50th Anniversary

Alberta Soil Science Workshop

Professional Development for Alberta Soil Scientists

Workshop Theme:

Futuresol: A New World Order

February 19 to 21, 2013

The Coast Lethbridge Hotel and Conference Centre

526 Mayor Magrath Drive S.
Lethbridge, AB T1J 3M5

www.soilsworkshop.ab.ca

Organizing Committee for the 2013 Alberta Soil Science Workshop

Past Chair:	Miles Dyck Dept. Renewable Resources, Univ. of Alberta, Edmonton, AB
Chair:	Newton Lupwayi Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB
Treasurer:	Jay Woosaree Alberta Innovates – Technology Futures, Vegreville, AB
Secretary:	M. Derek MacKenzie Dept. Renewable Resources, Univ. of Alberta, Edmonton, AB

Chairpersons for Technical Groups:

Soil Fertility:	Len Kryzanowski Alberta Agriculture & Rural Development, Edmonton, AB
Land Use:	Karen Raven and Rob Dunn Alberta Agriculture and Rural Development, Edmonton,AB Alberta Agriculture and Rural Development, Lethbridge, AB
Land Reclamation:	Deo A. Heeraman and Jay Woosaree AMEC Environment and Infrastructure, Calgary, AB Alberta Innovates – Technology Futures, Vegreville, AB
Forest, Riparian & Wetland Soils:	Maria Strack and Bin Xu Dept. Geography, University of Calgary, Calgary, AB NAIT Boreal Research Institute, Peace River, AB

50th Anniversary Commemoration

The Organizing Committee thanks the following people, who organized the activities marking the 50th anniversary of the Alberta Soil Science Workshop:

1. Sheilah Nolan, Alberta Agriculture and Rural Development
2. Jilene Sauve, Matrix Solutions
3. James Robertson, U of A
4. Tony Brierley, Agriculture and Agri-Food Canada
5. Tom Jensen, International Plant Nutrition Institute
6. Gordon Dinwoodie, Alberta Environment and Sustainable Resource Development

Sponsors of the 2013 Alberta Soil Science Workshop

We are grateful to the sponsors who have contributed to the 2013 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 2013 Workshop we acknowledge the generosity of the following sponsors:

1) **Agriculture and Agri-Food Canada**
2) **Agrium , Inc.**
3) **Alberta Innovates – Technology Futures**
4) **Amec Environment and Infrastructure**
5) **PenServ Corp.**
6) **EBA Engineering Consultants**
7) **Paragon – Soil and Environmental Consulting Inc.**
8) **Department of Renewable Resources, University of Alberta**
9) **Government of Alberta, Alberta Agriculture and Rural Development**
10) **University of Calgary**

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 that comprises 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).

Program - 2013 Alberta Soil Science Workshop

Overview

Tuesday, February 19, 2013

7:00 – 10:00 PM Foothills Room	Reception and Registration, Coast Lethbridge Hotel, Lethbridge

Wednesday, February 20, 2013

7**:00 AM – 5:30 PM** Grand Ballroom	Registration
7:00 – 8:15 AM Grand Ballroom	Breakfast
8:15 – 11:55 AM Grand Ballroom	Plenary Session Futuresol: A New World Order
10:00 – 10:25 AM	Coffee and Refreshments: 9:45 – 10:10 AM
11:55 – 1:15 PM Grand Ballroom	Lunch
1:15 – 3:50 PM	Concurrent Sessions (Oral Presentations):
Grand Ballroom	Volunteer Session 1
Continental Ballroom	Volunteer Session 2
Foothills Room	Reclamation Technical Session 1
Grand Ballroom	Coffee and Refreshments: 2:40 – 3:10 PM
4:00 – 6:00 PM Grand Ballroom	Poster Session
5:00 – 9:00 PM Continental Ballroom	Cash Bar
6:50 – 9:00 PM Continental Ballroom	Banquet and Entertainment

Thursday, February 21, 2013

7:00 – 8:00 AM Breakfast / Day Registration
Grand Ballroom

8:00 – 9:45 AM Technical Sessions:
Grand Ballroom Land Reclamation Technical Session 2
Foothills Room Land Use Technical Session

9:45 – 10:00 AM Coffee and Refreshments
Grand Ballroom

10:00 – 11:45 AM Technical Sessions:
Grand Ballroom Soil Fertility Technical Session
Foothills Room Wetland and Riparian Soils Technical Session

11:45 – 1:30 PM Lunch and ASSW Business Meeting
Grand Ballroom

Detailed Program

Wednesday, February 20, 2013 - Morning Plenary Session
Futuresol: A New World Order
Grand Ballroom

8:15 – 8:30 AM Welcome and Introduction Chair: Newton Lupwayi, AAFC, Lethbridge.

8:30 – 9:15 AM **Soil science in Alberta – History and direction**
Dr. Ross McKenzie, Alberta Agriculture and Rural Development, Lethbridge

9:15 – 10:00 AM **Quo Vadis: the living soil and society?**
Dr. Bill McGill, University of Northern British Columbia

10:00 – 10:25 AM Coffee and refreshments

10:25 – 11:10 AM **Soil science needs to get dirtier**
Dr. Dan Pennock, University of Saskatchewan

11:10 – 11:55 AM Q & A/Panel Discussion; All speakers

Wednesday, February 20, 2013 – Afternoon
Concurrent Sessions

*Graduate Student Presentations

PM	Volunteer Session 1 Grand Ballroom	Volunteer Session 2 Continental Ballroom	Land Reclamation Session 1 Foothills Room
1:15 – 1:20	Introduction **Chair: Miles Dyck** Dept. Renewable Resources, U of A, Edmonton AB	Introduction **Chair: Derek MacKenzie** Dept. Renewable Resources, U of A, Edmonton AB	Introduction **Chair: Deo A. Heeraman** AMEC Environment and Infrastructure, Calgary AB
1:20 – 1:40	*Assessment of arsenic-rich poultry litter as manure in barley (Hordeum vulgare L.) in an Orthic Black Chernozemic soil of Canadian Prairies **Sanjay Gupta[1],** Department of Renewable Resources, University of Alberta, Edmonton **Gary Kachanosky,** Memorial University of Newfoundland, St. John's, NL **Tariq Siddique** Department of Renewable Resources, University of Alberta, Edmonton [1] sanjay1@ualberta.ca	Ion Dynamics on synthetic resin membranes (PRS^{TM} probes): implications for environmental studies **E. Bremer[1], T. Radtke,** Western Ag Innovations, Saskatoon **G. Birkhauser and D.Huggins** Dept. of Crop and Soil Science, Washington State University, Pullman, WA [1] ericbremer@westernag.ca	*Organic amendment type affected N cycling and activities of associated enzymes in oil sands reclaimed soils **G.M. Jamro[1]** Department of Renewable Resources, University of Alberta, Edmonton; and Department of Soil Science, Sindh Agriculture University, Tandojam, Pakistan **S.X. Chang and M.A. Naeth** Department of Renewable Resources, University of Alberta, Edmonton, Alberta [1] jamro@ualberta.ca
1:40 – 2:00	Effect of cattle manure compost on greenhouse gas emissions and soil properties **S. Ren and S. Chang[1]** Dept. of Renewable Resources, University of Alberta, Edmonton	Nitrogen availability along a fire chronosequence in Lodgepole pine stands near Hinton, AB **M.D. MacKenzie** Renewable Resources, University of Alberta Edmonton, AB	* Use of forest floor protection or salvage in the reclamation of temporary drilling pads **S. Bachmann[1], V.J. Lieffers and S.M. Landhäusser** Dept. of Renewable Resources, University of Alberta [1] sbachman@ualberta.ca

2:00 – 2:20	Improving barley utilization of N and P nutrients from soil amended with bio-digested cattle manure **Xiying Hao[1], Brett Hill, Pam Caffyn**, AAFC Lethbridge Research Centre, Lethbridge, AB **Virginia Nelson** Alberta Agriculture and Rural Development, 3000 College Dr. Lethbridge, AB. Canada. T1K 1L6. **Xiaomei Li** XY-Green Carbon Inc., Edmonton, AB [1] Xiying.hao@agr.gc.ca	Effects of conservation management practices and rotations on soil organic matter fractions and aggregtation of irrigated land in southern Alberta. **Lingling Li[1]** Gansu Provincial Key Laboratory of Arid Land Crop Sciences/Faculty of Agronomy, Gansu Agricultural University, Lanzhou, P.R. China **Denis Angers** Agriculture and Agri-Food Canada, Québec **Francis J. Larney** Agriculture and Agri-Food Canada, Lethbridge, AB [1] lill@gsau.edu.cn	*Water stress reduced tree growth in some reclaimed Lodgepole Pine stands in the Athabasca Oil Sands Regions, Alberta, Canada **J.D. House[1], M. Duan, and S.X. Chang** Department of Renewable Resources, University of Alberta [1] jdhouse@ualberta.ca
2:20 – 2:40	Greenhouse gas emission from soil amended with DDGS manure and compost: A laboratory study **Ikechukwu Agomoh** Agriculture and Agri-Food Canada, Lethbridge Research Centre; University of Manitoba **Xiying Hao[1], Chunli Li** Agriculture and Agri-Food Canada, Lethbridge Research Centre **Guangrong Yang** Agriculture and Agri-Food Canada, Lethbridge Research Centre; Yunnan Agricultural University **Jeff Schoenau** Department of Soil Science, University of Saskatchewan **Tim McAllister** Agriculture and Agri-Food Canada, Lethbridge Research Centre [1] Xiying.hao@agr.gc.ca	Temperature sensing in plants and its fundamental role in understanding some puzzles in soil science **Tinghui Jiang** Department of Biological Sciences, University of Alberta [1]tjiang@ualberta.ca .	*Reclamation monitoring – eye in sky **R. Doherty[1],** Dept. of Geography, University of Lethbridge [1] becky.leppington@uleth.ca
2:40 – 3:10	**Coffee and Refreshments – Grand Ballroom**		

3:10 – 3:30	Characterization of bacterial endophytes from potato (*Solanum tuberosum* L.) reveals growth-promoting and antagonistic properties *in vitro* **B. B. Pageni, Z. Akter, N. Z. Lupwayi*, F. J. Larney, and L. M. Kawchuk** Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge, AB [1] **newton.lupwayi@agr.gc.ca**	Diffusive release of uranium from contaminated sediments: The influence of micro-environments on fate and transport **Kenton Rod[1]** Environment Practice, EBA a Tetra Tech Company, Calgary, AB [1] krod@eba.ca	* Restoring native grassland function in urban environment; Implications for Soil-Plant Relations **S. Arezoo Amini[1] and M. Derek MacKenzie** Department of Renewable Resources, University of Alberta [1] seyedeha@ualberta.ca .
3:30 – 3:50		Salinity and trace elements in Hetao Basin groundwater and Wuliangsuhai Lake, Inner Mongolia, China **Dongnan Zhu** 306, Zhaowuda Road, Water Conservancy and Civil Engineering College, Inner Mongolia agricultural University, Hohhot, P.R.China **M. Cathryn Ryan[1]** Hydrogeology Group, Department of Geoscience, University of Calgary 2500 University Drive NW Calgary, AB **Biao Sun and Changyou Li** 306, Zhaowuda Road, Water Conservancy and Civil Engineering College, Inner Mongolia agricultural University, Hohhot, P.R.China [1] cryan@ucalgary.ca	
4:00 – 6:00	**Poster Session (cash bar after 5:00 PM – Continental Ballroom)**		

Wednesday, February 20, 2013 – Afternoon Poster Session, 4:00 – 6:00 PM
Grand Ballroom

***Graduate Student Posters**

1	Current research on sandy Spodosols for kenaf production in Malaysia **Khalil Ahmed[1], A.R. Anuar, Y.M. Khanif, A.W. Samsuri** Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia [1] khalilahmed281@gmail.com
2	Variability in symbiotic nitrogen fixation among dry bean genotypes **Z. Akter, N. Z. Lupwayi[1] and P. M. Balasubramanian** Agriculture and Agri-Food Canada, Lethbridge Research Centre [1] newton.lupwayi@agr.gc.ca
3	Soil properties below the compost windrow **X. Hao[1], C. Li, S. Xu and B. Ellert** AAFC, Lethbridge Research Centre [1] xiying.hao@agr.gc.ca
4	Ciliate dependent production of microbial anthranilic acid occurring in aspen litter **M. J. B. Swallow[1], S. A. Quideau, C. E. Norris** Department of Renewable Resources, University of Alberta, Edmonton, AB [1] swallow@ualberta.ca
5	Long-term Effect of Fresh and Composted Cattle Manure on the Size and Nutrient Composition of Dry-Sieved Soil Aggregates **J.J. Miller[1], B.W. Beasley, F.J. Larney** Agriculture and Agri-Food Canada Lethbridge, AB **C. Drury,** Agriculture and Agri-Food Canada, Harrow, Ontario **B. Zebarth,** Agriculture and Agri-Food Canada, Fredericton, New Brunswick **E. Bremer,** Symbio Ag Consulting, Lethbridge, Alberta [1] jim.miller@agr.gc.ca

6	Adapting 4R nutrient management principles to an individual field **Tom Jensen[1]** International Plant Nutrition Institute, Calgary, AB [1] tjensen@ipni.net
7	Potential effects of climate change on Methane dynamics of a Boreal Alberta Peatland **T. M. Munir[1] and M. Strack** Department of Geography, University of Calgary [1] tmmunir@ucalgary.ca
8	Properties of simulated rain runoff from compost windrows **Andrew F. Olson, Francis J. Larney[1], Jim J. Miller and Bonnie C. Tovell** Agriculture & Agri-Food Canada, Lethbridge [1] francis.larney@agr.gc.ca
9	Soil carbon changes over 12 years on the Vauxhall irrigated rotation study **Drusilla C. Pearson, Francis J. Larney[1], Robert E. Blackshaw and Newton Z. Lupwayi** Agriculture & Agri-Food Canada, Lethbridge, AB [1] francis.larney@agr.gc.ca
10	Measurements and field observations of compaction in reclaimed borrow pits **Fred Mensah[1] and D.A. Heeraman** AMEC Environment and Infrastructure, Calgary, AB [1] fred.mensah@amec.com
11	A new analytical method for estimating soil moisture characteristic curve using horizontal infiltration data in soil column **Ali Asghar Zolfaghari[1], Mehdi Shorafa, Mohammad** Department of soil science, University of Tehran, Iran **Hossein Mohammadi** Department of soil science, University of Zanjan, Zanjan, Iran **Miles Dyck** Department of Renewable Resources. University of Alberta, Edmonton AB [1] aliasgha@ualberta.ca

12	Comparison of K-nearest neighbor and artificial neural network methods for predicting cation exchange capacity of soil **Ali Asghar Zolfaghari[1], Mohamad Taghi Tirgar Soltani** PhD student of soil science, Department of soil science, University of Tehran,Iran **Miles Dyck, Amanuel Weldeyohannes** Department of Renewable Resources. University of Alberta. Edmonton. Canada [1] aliasgha@ualberta.ca
13	* Spatial variations in soil respiration in a Boral aspen forest fire chronosequence **S. Das Gupta[1], M. D. MacKenzie, S. A. Quideau** Department of Renewable Resources, University of Alberta, Edmonton AB, Canada [1] sanatan@ualberta.ca
14	Characterization of soil quality in a reclaimed sand pit and potential barriers to reclamation success **A. D. Reinhardt[1], F. Mensah and D. A. Heeraman** AMEC Environment and Infrastructure, Calgary, AB [1] ashley.reinhardt@amec.com
15	Overview of Alberta's agricultural carbon offset trading system, 2007 to 2011 **Sheilah Nolan[1], Tom Goddard, Angela Bentley, Paul Jungnitsch** Alberta Agriculture and Rural Development, Edmonton, AB [1] sheilah.nolan@gov.ab.ca
16	* Analysis of *E.coli* and Bromide transport from at-grade line sources to shallow groundwater **Amanuel Oqbit Weldeyohannes[1]** Dept. Renewable ResourcesUniversity of Alberta, Edmonton, AB **R.G. Kachanoski,** Office of the President, Memorial University of Newfoundland, St. John's, NL **M. Dyck,** Dept. Renewable Resources, Edmonton, AB [1] aweldeyo@ualberta.ca
17	50 years of research at the Ellerslie Research Farm **Dick Puurveen[1] and James Robertson** Department of Renewable Resources, University of Alberta [1] puurveen@ualberta.ca
18	*Green-Seeker-measured NDVI predicts grain yield and soil nutrient supply **Leah, Predy, Dick Puurveen and Miles Dyck[1]** Department of Renewable Resources, University of Alberta [1] miles.dyck@ualberta.ca

19	Effect of phosphatic biofertilizer on the yield of rice and wheat at different AEZ of Bangladesh **M. A. Haque[1],** Soil Microbiology Lab., Soil Science Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh **M. A. Sattar** Director General, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh **M. R. Islam and M. A. Hashem** Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh [1] azizul732@yahoo.com
20	The New Look of the Alberta Soil Information Viewer **David Speiss[1] , David V. Hildebrand** Environmental Stewardship Div., Alberta Agriculture and Rural Development., Edmonton, AB **T. Brierley and M. Bock** Science and Technology Branch., Agriculture and Agri-food Canada., Edmonton, AB [1] david.spiess@gov.ab.ca
21	*Modeling complex water table effects on net CO2 exchange of Western Canadian peatlands **M. Mezbahuddin[1], R.F. Grant** Department of Renewable Resources, University of Alberta, Edmonton, AB **and L.B. Flanagan** Department of Biological Sciences, University of Lethbridge [1] mezbahud@ualberta.ca
22	Soil-Plant relations: A new capping study at Aurora mine **M.D. MacKenzie[1]** Department of Renewable Resources, University of Alberta [1] m.derek.mackenzie@ualberta.ca
23	An investigation of the effects of differing grazing systems on the hydrology of landscapes **Alan Stewart[1],** Agriculture and Agri-Food Canada, Science and Technology Branch, Edmonton AB **Darren Bruhjell,** Agriculture and Agri-Food Canada, Science and Technology Branch, Edmonton AB [1] alan.stewart@agr.gc.ca

Banquet and Entertainment, 6:50 – 9:00 PM
Continental Ballroom

Thursday, February 21, 2013 – Morning
Concurrent Technical Sessions

*Graduate Student Presentations

AM	**Land Reclamation Technical Session 2** **Grand Ballroom**	**Land Use Technical Session** **Foothills Room**
8:00 – 8:05	Introduction **Chair: Jay Woosaree** Alberta Innovates – Technology Futures, Vegreville, AB	Introduction **Chair: Rob Dunn** Alberta Agriculture and Rural Development, Lethbridge, AB
8:05 – 8:25	*Textural interface impacted the distribution of root, water and nutriens in reclaimed forest soils in the Athabasca Oil Sands Region **Kangho Jung, Min Duan[1], Jason House, and Scott X. Chang** Department of Renewable Resources, University of Alberta [1] mduan1@ualberta.ca	HOLOS – a GHG calculator growing up Roland Kroebel [1] Agriculture and Agri-Food Canada, Lethbridge, Alberta [1] **roland.kroebel@agr.gc.ca**
8:25 – 8:45	*Understory plant community was changed by seven years of simulated N and S deposition in the Athabasca Oil Sands region in Alberta **K.H. Jung, J.H. Kwak[1] and S.X. Chang** Dept. of Renewable Resources, University of Alberta [1] jinhyeob@ualberta.ca	Southeast Alberta voluntary conservation offset pilot: agriculture offset for industrial native prairie habitat impacts **Rob Dunn[1], Karen Raven and Tom Goddard** Alberta Agriculture and Rural Development, Agriculture Land Management Specialist, Lethbridge, Alberta [1] rob.dunn@gov.ab.ca
8:45 – 9:05	*Wildfire nitrogen dynamics in the Alberta boreal forest soils: A comparison for anthropogenic disturbance **J. Martin[1], M. Derek MacKenzie** Department of Renewable Resources, University of Alberta [1] jillianm@uaberta.ca	Soil and crop management practices in Akmola, Kazakhstan and Alberta, Canada: Compare and contrast **Francis J. Larney[1]** Agriculture & Agri-Food Canada, Lethbridge **Mehklis Suleimenov** A.I. Barayev Scientific and Production Centre of Grain Farming, Shortandy, Akmola, Kazakhstan [1] francis.larney@agr.gc.ca
9:05 – 9:25	Characterization of soil physical properties in compacted and decompacted soils on reclaimed mine tailings at Genesee Prairie Mine **P. Sabbagh[1] and M. Dyck** Dept. of Renewable Resources, University of Alberta [1] psabbagh@ualberta.ca	Overview of the land classification for irrigation process in Alberta **G. Ontkean[1],** Basin Water Management Branch, Alberta Agriculture and Rural Development, Lethbridge, AB [1]gerald.ontkean@gov.ab.ca

9:25 – 9:45	Chemical Considerations in the Thermal Desorption Remediation of Soils **D. R. Nelson, J. W. Sehlstrom, and S. N. Platts**[1] Nelson Environmental Remediation Ltd., Spruce Grove, AB [1] nick@nerglobal.com	Soil, water, and phosphorus: Observations from the BMP project **Barry Olson, Janna Casson, Jollin Charest, Andrea Kalischuk**[1]**, Lynda Miedema** Alberta Agriculture and Rural Development, Lethbridge **Wiebe Buruma** Alberta Agriculture and Rural Development, Lacombe [1] andrea.kalischuk@gov.ab.ca

9:45 – 10:00 AM Coffee and Refreshments
Grand Ballroom

	Soil Fertility Technical Session Grand Ballroom	**Forest, Riparian and Wetland Soils Foothills Room**
10:00 – 10:05	Introduction **Chair: Len Kryzanowski** Alberta Agriculture and Rural Development, Edmonton, AB	Introduction **Chair: Bin Xu** NAIT Boreal Research Institute
10:05 – 10:25	Narrow-row dry bean agronomy research: Row spacing, seeding rate and nitrogen fertilizer management **Pat Pfiffner** [1] Alberta Agriculture and Rural Development, Lethbridge, AB [1]pat.pfiffner@gov.ab.ca	A case study of forest development following industrial disturbance **Amanda Schoonmaker**[1] NAIT Boreal Research Institute **Mark Dewey** NAIT Forest Technology **Milo Mihajlovich** Incremental Forest Technologies Ltd. [1] ASCHOONMAKER@nait.ca
10:25 – 10:45	Optimizing variable rate fertilizer application in fields with spatial variability **Doon Pauly** [1] Alberta Agriculture and Rural Development, Lethbridge AB [1]doon.pauly@gov.ab.ca	*Soil carbon pool in three agroforestry systems across different soil-climatic zones in Alberta **Mark Baah-Acheamfour**[1] Department of Renewable Resources, University of Alberta, Edmonton AB
10:45 – 11:05	Using soil and plant analysis to fine tune crop nutrient management, an Alberta case study **Tom Jensen**[1] International Plant Nutrition Institute, Calgary AB [1] tjensen@ipni.net	Evaluation of streambank fencing on environmental quality of Lower Little Bow River and riparian zone **J.J. Miller**[1]**, T.W. Curtis, T. Entz, and W.D. Willms** Agriculture and Agri-Food Canada, Lethbridge AB **D. Chanasyk,**

		Department of Renewable Resources, University of Alberta, Edmonton AB [1] jim.miller@agr.gc.ca
11:05 – 11:25	Greenhouse gas emissions following tillage reversal on a Black Chernozem and a Gray Luvisol in Alberta **B.M.R. Shahidi[1], M. Dyck** Department of Renewable Resources, University of Alberta, AB **And S. Malhi** Agriculture and Agri-Food Canada, Melfort, SK [1] manjila@ualberta.ca	*Carbon dioxide dynamics of undisturbed natural reference fen ecosystems in the oil sands region of Alberta **Md. Sharif Mahmood[1], Maria Strack** University of Calgary [1] msmahmoo@ucalgary.ca
11:25 – 11:45	Manure management on N2O and ammonia fluxes in barley for silage **Guillermo Hernandez Ramirez[1]** Department of Renewable Resources, University of Alberta, Edmonton AB [1]ghernand@ualberta.ca	*Effect of drainage on microbial community of a boreal Alberta bog **J. Graham[1], P. Dunfield** Dept. of Biological Sciences, University of Calgary **M. Strack** Dept. of Geography, University of Calgary [1] jmgraham@ucalgary.ca

11:45 – 1:30 PM Lunch and ASSW Business Meeting
Grand Ballroom

Plenary Session

Wednesday, February 20, 2013 – Morning

Soil science in Alberta – History and direction

Ross H. McKenzie

Research and Innovation Division, Alberta Agriculture and Rural Development, Lethbridge, AB.

Corresponding author: ross.mckenzie@gov.ab.ca

ABSTRACT

History and future direction of Soil Science in Alberta will be discussed. The last glacial period in Alberta ended about 10,000 years ago. Chernozemic, Luvisolic, Solonetzic and other soil types have formed and developed across Alberta depending on soil parent material, climatic factors and topographic influence. Mapping of Alberta soils started in the early 1920's. All soil survey information is now available on-line in AGRASID (Agricultural Region of Alberta Soil Inventory Database). Alberta has no Class 1 land suitable for annual grain crop production (Land Suitability Rating System). Depending on the region, Alberta's agricultural lands have various limitations and only 16% of Alberta's total land base is use used of annual crop production. Key soil science research advances and accomplishments in soil conservation, soil fertility and fertilizers, cropping system effects on soils, management of Luvisolic soils and Solonetzic soils will be discussed. Important negative impacts of cropping systems such as the wheat-fallow rotation will be reviewed. Positive soil impacts of continuous cropping and zero-till direct seeding will be explained. The negative impacts of urban expansion, land fragmentation, oil and gas development and other types of rural development on Alberta's soil resources and landscape will be reviewed and discussed.

Quo Vadis: the living soil and society?

W. B. McGill

Ecosystem Science & Management Program, University of Northern British Columbia, Prince George, BC

Corresponding author: bill.mcgill@unbc.ca

ABSTRACT

In exploring "from where and to where?" this talk raises the question: "will the multifaceted importance of soils fragment the disciplined understanding of soils?" Soils are highly integrative natural bodies. A vast array of professions and disciplines use soils or soils knowledge. Therein rests its strength and its vulnerability. Are these connections like spreading rings with a core of unified knowledge at the center, or forces of fragmentation?

Soils are foundations for production of food, fuel and fiber; they are the starting points and ending points for materials. Consequently soils and soil organisms are increasingly important to food supply, waste treatment & resource recovery, remediation of disturbed ecosystems and urban agriculture. Fundamental questions are emerging about bioavailability, prediction & management of soil microbial activity, soils as sources of novel genes and novel organisms; integration over many orders of magnitude in size scales, revitalized connections between soil biology & soil physics, carbon storage, and microbial community adaptation to climate change and shifting plant communities. Industries, professions, and disciplines engaging in use of soils and soil information will include but not be restricted to: Agronomy; Biology and Ecology; Biotechnology, metagenomics, epigenomics; Civil Engineering, Ecological Engineering, Ecotoxicology, Exo-biology and Geoscience. Will there be a unified understanding of soils or will it fragment into the disciplines mentioned above?

The future is what we invent. By returning to our roots in the pedon, and by assuring that we integrate knowledge just as soils integrate processes we can invent a vibrant future.

Soil science needs to get dirtier

Dan Pennock

Professor of Soil Science, University of Saskatchewan, Saskatoon, SK

Corresponding author: dan.pennock@usask.ca

ABSTRACT

Soil science is not the most reflective of disciplines, and the (very limited) available literature on its future often focuses on a series of contradictions – more soils research is being published than ever before, but there is a dwindling number of researchers and faculty in soil science departments (or their remnants); excellent employment prospects exist for soil scientists yet we cannot attract students into soil science programs (if, indeed, such programs even still exist); soil information is critical to solve the big challenges facing humanity, yet policy makers and politicians remain oblivious of the fine work we produce. My own work as a teacher and academic administrator would suggest another fundamental contradiction – the literature on soil science's future focuses on very real but very high-level concerns (e.g. food security, climate change mitigation and adaptation, biodiversity), yet students entering university consistently state they want a career-focused education leading to employment. More simply, students (and, I suspect, employers) are interested in soil science as an applied science ("getting their hands dirty"), yet the discipline of soil science (and many of its practitioners) remains focused on loftier goals. Soil science has no future if we do not attract bright, enthusiastic students into the soil science pipeline; to do this we need better alignment between the applied and fundamental aspects of our science. Achieving this alignment is made more challenging by the near-complete retreat of the federal government from many aspects of soil science, but several promising approaches currently exist and need to be fully supported by the soil science community.

Volunteer Session 1

Wednesday, February 15, 2012 – Afternoon

Assessment of Arsenic-Rich Poultry Litter as Manure in Barley (*Hordeum vulgare* L.) in an Eluviated Black Chernozemic Soil of the Canadian Prairies.

Sanjay Gupta[1],

Department of Renewable Resources, University of Alberta, Edmonton T6G 2E3

Gary Kachanosky,

Memorial University of Newfoundland, St. John's, NL A1C 5S7

Tariq Siddique

Department of Renewable Resources, University of Alberta, Edmonton T6G 2E3

[1]Corresponding author: sanjay1@ualberta.ca

ABSTRACT

Arsenic-rich poultry litter is produced as a waste in poultry industry because of the use of antibiotic - Roxarsone (3-nitro-4-hydroxyphenylarsonic acid) which is included in poultry feed to improve weight gain, feed efficiency and coloration, and manage coccidial parasites. Roxarsone is a legal compound in Canada under the jurisdiction of Canada Feeds Act. Though poultry litter will continue to be applied to croplands because of its nutritional value, it is important to understand the root, shoot, and grain assimilation of arsenic in barley which is grown extensively in the three Prairie Provinces. A higher concentration of arsenic in grains may become the greatest source of inorganic arsenic intake for the Canadian population via beer, whisky and a variety of foods made from barley.

In this study, arsenic-rich poultry litter was applied @25 tons per hectare to barley in an Eluviated Black Chernozemic Soil. Grain, straw and total above-ground biomass yield increased significantly with the addition of litter. The increase was 82, 112 and 97 % in the first year, and 42, 56 and 49 % during the subsequent year when the same crop was raised on residual soil nutrients. However, barley plants did not show any phyto-toxicity symptoms of arsenic. Soil arsenic content increased from 6.51 mg kg^{-1} in control (back-ground concentration) to 6.91 in treated plots. Barley root, shoot and grain concentration of arsenic also increased with litter application. In grains, arsenic content increased from 0.37 to 0.61 mg kg^{-1} in the first year. In the subsequent year, the grain, shoot and root contents of arsenic were 0.52, 0.56 and 1.37 mg kg^{-1}, respectively. It was concluded that arsenic-rich poultry litter is a good source of nutrients to the barley plants as it increased the yield significantly but repeated application of this type of litter to croplands may increase the arsenic content of soil and barley grains beyond critical limits.

EFFECTS OF CATTLE MANURE COMPOST ON GREENHOUSE GAS EMISSIONS AND SOIL PROPERTIES

S. Ren and S. Chang[1]

Dept. of Renewable Resources, University of Alberta, ESB 442, Edmonton, AB, T6G 2R3

[1]Corresponding author: scott.chang@ualberta.ca

ABSTRACT

Composting has become an increasingly important treatment before land application of large amounts of cattle manure. However, the effect of composted manure application on greenhouse gas (GHG) emissions is not well understood. This study investigated the effects of cattle manure compost application rate on soil properties and the flux of three GHGs - CO_2, CH_4, and N_2O. Two application rates of the compost (3 and 10 tons/ac) with inorganic fertilizer application as control (CK) were applied on an agricultural land seeded with fall rye near High River in Alberta. The average fluxes of CO_2 were 79.3 mg m^{-2} h^{-1} (CK), 82.8 mg m^{-2} h^{-1} (Compost 3t) and 87.2 mg m^{-2} h^{-1} (Compost 10t), respectively, representing a 4.4 and 10.0 % increase in the 3t and 10t treatments over the control. The average fluxes of N_2O showed a similar trend: 13.4 μg m^{-2} h^{-1} (CK), 16.1 μg m^{-2} h^{-1} (Compost 3t) and 18.4 μg m^{-2} h^{-1} (Compost 10t), representing a 20.1 and 10.0 % increase in the 3t and 10t treatments, respectively. The average fluxes of CH_4 after treatment were -13.2 μg m^{-2} h^{-1} (CK), -12 μg m^{-2} h^{-1} (Compost 3t) and -15 μg m^{-2} h^{-1} (Compost 10t), respectively, indicating a 7.5% reduction (Compost 3t) and a 16.7 % increase (Compost 10t) of uptake comparing to the control. The results demonstrated that the higher application rate of the compost enhanced GHG emissions. The compost application also increased soil pH, EC, and available ammonium/nitrate concentration which indicted improved soil properties.

Improving barley utilization of N and P nutrients from soil amended with bio-digested cattle manure

Xiying Hao, Brett Hill, Pam Caffyn,

AAFC Lethbridge Research Centre 5403 1st Ave. S., Lethbridge, AB T1J 4B1

Virginia Nelson

Alberta Agriculture and Rural Development, 3000 College Dr. Lethbridge, AB. Canada. T1K 1L6.

Xiaomei Li

XY-Green Carbon Inc. 1124 111A St. Edmonton, AB T6J 6R9

[1]Corresponding author: Xiying.hao@agr.gc.ca

ABSTRACT

Anaerobic digestion (AD) of animal manure has become an environmentally attractive technology to meet the world's increasing demand for energy. Anaerobically digested manure (ADM), often referred as digestate, is one of the final by-products of the biogas energy industry. The ADM is a nitrogen-rich material and its application increases crop yields. The objectives of this study were to investigate barley utilization of N and P nutrients from soil amended with bio-digested cattle manure. Two field sites were selected, one near Lethbridge, Southern Alberta, and another near St. Albert, Central Alberta. A complete randomized block design with six treatments, two application rates and four replications was used. The six treatments were: (1) control: no amendment (CK), (2) fresh manure (M), (3) ADM, (4) liquid removed from ADM to produce separated solids (SS), (5) SS processed into pellets (PE), and (6) urea-enriched SS processed into N:P balanced pellets (PEU). All amendments were applied at rates of 100 and 200 kg N ha^{-1} yr^{-1}. Barley was grown and harvested at the soft dough stage as forage for making silage feed. Barley yield and N and P uptake varied significantly over the year, affected by weather conditions and seeding dates, and were higher with ADM liquid application than all other treatments. The higher yield and N and P uptake from ADM than other amended soil reflect the greater fraction of N and P in available forms associated in the ADM applied.

Greenhouse Gas Emissions from Soil Amended with DDGS Manure and Compost: A Laboratory Study

Ikechukwu Agomoh

Agriculture and Agri-Food Canada, Lethbridge Research Centre

University of Manitoba;

Xiying Hao[1], **Chunli Li**

Agriculture and Agri-Food Canada, Lethbridge Research Centre

Guangrong Yang

Agriculture and Agri-Food Canada, Lethbridge Research Centre

Yunnan Agricultural University

Jeff Schoenau

University of Saskatchewan

Tim McAllister

Agriculture and Agri-Food Canada, Lethbridge Research Centre

[1]Corresponding author: Xiying.hao@agr.gc.ca

ABSTRACT

Utilization of dried distiller grain with solubles (DDGS) in cattle feedlot operation has increased over years due to the steady growth of the bio-ethanol industry. Application of manure from cattle fed DDGS to agricultural land may result in greater greenhouse gas (GHG) emission due to its higher nutrient composition. This incubation study investigated GHG emissions from soil (Dark Brown Chernozem) amended with manure from cattle on two different DDGS diets (with or without *Acacia mearnsii* tannin) and the corresponding composts. The ratio of soil:manure/compost:tannin is 120:20:1 with an amended control for comparison. Soils were maintained at 60% water holding capacity moisture content and incubated for 105-d at 22±1°C. Gas samples were collected and analyzed weekly. The rate of CO_2 and N_2O emission were highest on the first day and decreased over time. Cumulative CO_2 emissions was higher ($P<0.05$) in manure and compost amended soil (4.35 to 13.6g C/Kg) than the control (1.19g C/Kg). CO_2 emission was lower ($P<0.05$) from compost than manure amended soil, reflecting the lower degradability of C in the compost than manure. Cumulative N_2O emissions was higher ($P<0.05$) in manure and compost amended soil than the control and reflecting increased available N in the amended soil. Including tannin decreased N_2O and CO_2 emissions from manured amended soil but were unaffected with compost. These results suggest that greenhouse emissions from manure amended soil could be minimized with the use of tannin.

Characterization of Bacterial Endopytes from Potato (*Solanum tubersum* L.) Reveals Growth-Promoting and Antagonistic Properties *In Vitro*.

B. B. Pageni, Z. Akter, N. Z. Lupwayi[1], F. J. Larney, and L. M. Kawchuk

Agriculture and Agri-Food Canada, Lethbridge Research Centre, P.O. Box 3000, Lethbridge, AB, T1J 4B1, Canada

[1]Corresponding author: email: newton.lupwayi@agr.gc.ca

ABSTRACT

Endophytes are microorganisms that live within a plant in a mutualistic relationship. An irrigated cropping system study was initiated in 2000 at Vauxhall, Alberta, to compare the effects of 3- and 4-yr rotations under conventional or conservation management, and 5- and 6-yr conservation rotations on yields of dry bean, potato, sugar beet and spring wheat. Conservation management included, where possible, reduced tillage, fall-seeded cover crops, and composted cattle manure application. Bacterial endophytes were isolated from potato and characterized for nitrogen fixation, plant growth hormone production and plant disease control properties. The nitrogen-fixing nitrogenase (*nif*H) gene was detected in potato roots by polymerase chain reaction. Sequence analysis revealed that the *nif*H genes were homologous to those of *Burkholderia, Azospirillum*, *Ideonella*, *Pseudacidovorax* and *Bradyrhizobium* species. Indole acetic acid (IAA) growth hormone production was greater in conservation soil management practices than conventional practices, and tended to be greater in longer rotations than shorter rotations. The growth-promoting effects of 12 endophytes were tested by inoculating them on two dry bean (*Phaseolus vulgaris* L.) cultivars grown in nutrient solution. Eight of them increased the shoot biomass of each bean cultivar, and six of them increased shoot biomass of both cultivars. Six endophytes exhibited antagonistic properties against *Pectobacterium atrosepticum, Fusarium sambucinum* and *Clavibacter michiganensis subsp. sepedonicus* pathogens by inhibiting their growth by 13 to 58%.

Volunteer Session 2

Wednesday, February 20, 2013 – Afternoon

Ion Dynamics on synthetic resin membranes (PRS^{TM} probes): implications for environmental studies

E. Bremer[1], T. Radtke,

Western Ag Innovations, 104-110 Research Drive, Saskatoon, SK S7N 3R3

G. Birkhauser and D.Huggins

Dept. of Crop and Soil Science, Washington State University, Pullman, WA

[1]Corresponding author: ericbremer@westernag.ca

ABSTRACT

Plant Root Simulator (PRS^{TM}) probes consist of synthetic ion-exchange resin membranes in plastic supports that have been extensively used to monitor nutrient bioavailability in soils. An understanding of the dynamics of ion exchange is critical for designing and interpreting monitoring evaluations with these tools. Ion adsorption is most rapid initially after burial in soil, at rates that are sensitive to the soil characteristics controlling ion diffusion. If soil conditions are unchanged, the quantity of ions adsorbed will reach an equilibrium or steady state level that depends on the same factors controlling exchangeable ion levels on soil colloids. For example, the maximum quantity of ions adsorbed and the time required for this to be achieved is lower for K^+ than Ca^{+2} due to both lower activity and affinity. Ions that are less strongly retained by soils, such as NO_3-N, will increase to a higher level and over a longer time period than ions that are strongly retained by soils, such as HPO_4^{2-}. Changes in soil conditions also have diverse impacts on ion adsorption: increases in the activity of ions held with a high affinity are rapid and sustained; while increases in ions held with low affinity will be small and ephemeral. The implications of these dynamics for the evaluation of stubble burning practices and soil moisture fluctuations will be presented.

Nitrogen availability along a fire chronosequence in Lodgepole pine stands near Hinton, AB

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

Abstract

Fire is the main natural disturbance in ecosystems of western Canada, including Lodgepole pine (*Pinus contorta var. latifolia* Engelm.) forests of the Rocky Mountain front range near Hinton, AB. Fire results in tree mortality and partial combustion of organic matter on site, but also causes shifts in plant community composition, microbial community dynamics and nutrient availability. Part of these affects are mediated by the thermal pulse of a fire, but some are related to charcoal, the main long-term residue of fire. Charcoal has been shown to have large non-polar surface area, thereby affecting rhizosphere biogeochemistry in other pyrogenic ecosystems, but little work has been done in this ecosystem. We established a chronosequence of replicated stands with ages of 12, 21, 53 and 100 years since fire in 2010. At each of 3 replicates we installed 10 resin capsules along a transect to measure nitrogen availability for 1 year. When probes where collected, we also sampled through the organic layer and into mineral soil for a total depth of 15 cm, and recorded the dominant plant species cover. In the lab, we analyzed total carbon and nitrogen, microbial biomass and respiration, and charcoal content. We found significant shifts in plant species composition and forest floor depth with increasing time since fire. N availability also changed with time since fire, but charcoal content did not.

Effects of conservation management practices and rotations on soil organic matter fractions and aggregation of irrigated land in southern Alberta.

Lingling Li[1]

Gansu Provincial Key Laboratory of Arid Land Crop Sciences/Faculty of Agronomy, Gansu Agricultural University, Lanzhou 730070, P.R. China

Denis Angers

Agriculture and Agri-Food Canada, 2560 Hochelaga Blvd., Québec, QC G1V 2J3

Francis J. Larney

Agriculture and Agri-Food Canada, Lethbridge, AB, Canada T1J4B1

[1]Corresponding author: lill@gsau.edu.cn

ABSTRACT

An irrigated rotation study was initiated in 2000 to examine the impact of conventional and conservation management practices for 3 to 6 yr crop rotations. Crops included potatoes, dry beans, sugar beets, soft wheat and timothy. The conservation management practices comprised a package of (1) direct seeding where possible; (2) fall seeded cover cropping; (3) composted cattle manure application (28 or 42 Mg ha^{-1} every 3rd yr); and (4) narrow-row (20 cm) solid-seeded beans vs, traditional wide-row (60 cm). Our objective was to gain a better understanding of soil quality responses to rotation, management practices and carbon (C) input, and their underlying mechanisms. Soils were sampled in September 2011 at the end of 12 yr. Carbon inputs were determined from crop yield data using published coefficients and total C analysis of compost. Results showed that the 5-yr (potatoes-wheat-sugar beet-wheat-beans) conservation rotation had the highest total C input over 12 yr at 59 Mg ha^{-1}, almost double that of the 3-yr conventional rotation (potatoes-beans-wheat) at 31 Mg ha^{-1}. The 5-yr conservation rotation also showed improved soil quality indicators such as alkaline phosphatase activity (APA), microbial biomass carbon, total C and nitrogen, particulate (POM) and fine organic matter (FOM) carbon and nitrogen and aggregation. Of these parameters, APA, and POM fractions were most sensitive to rotation treatments. All organic matter fractions were linearly related to both compost C and total C inputs. The study shows that a conservation management package as described above can improve soil quality parameters and ensure sustainable irrigated cropping.

Temperature Sensing in Plants and Its Fundamental Role in Understanding Some Puzzles in Soil Science

Tinghui Jiang

Department of Biological Sciences, University of Alberta

Corresponding author: tjiang@ualberta.ca

ABSTRACT

Calcium permeable channels were suggested to be the original sensors of cells in response to temperature variation. The underlying mechanism is unclear. Herein it is proposed that cytosolic pH variation is the first signal in temperature sensing that causes membrane polarization or depolarization, resulting in the opening of calcium channels and the rise in cytosolic free calcium ion. Cytosolic pH variation and its regulation are the driving force for nutrient uptake by plants and nutrient homeostasis in cells. It helps explain some phenomena that are not well understood in some areas related to soil science. Such as Fe deficiency in plants in early summer and fall cannot explained well by soil properties. Why do plants damage more seriously on sunny slope upon frost damage? Why do young shoots other than old leaves die first in response to cold stress? Why do the old leaves die first in response to heat stress? Why are the optimum pH of plasma membrane ATPase and that of tonoplast ATPase different? Why does H^+ secretion from roots show the same pattern as daily temperature variation? Why do root tips take up K^+ together with H^+? Why does large temperature variation promote sugar accumulation in fruits and help plants tolerate salt stress? All above puzzles can be or at least partially explained by temperature sensing processes in plants.

Diffusive release of uranium from contaminated sediments: The influence of micro-environments on fate and transport

K.A. Rod[1]

Environment Practice, EBA a Tetra Tech Company

115, 200 Rivercrest Drive SE Calgary, AB, T2C 2X5

[1]Corresponding author: **krod@eba.ca**

ABSTRACT

The fate and transport of radionuclides from contaminated sediments represents a major long-term risk at department of energy (DOE) sites. Waste disposal units at DOE sites have undergone source zone removal, however, a number of persistent subsurface plumes remain. Sediment analysis from these sites suggests the residual contamination has migrated into sediment fractures, pores and pore-throats and is influenced by coupled nanometer scale reactions. These pore scale reactions affect pore-scale contaminant concentrations and control the presence of persistent subsurface plumes. Flooding of contaminated capillary fringe sediments due to seasonal changes in the Columbia River stage has been identified as a source for U supply to ground water. We investigated U release from Hanford capillary fringe sediments by packing sediments into reservoirs of centrifugal filter devices and saturate with Columbia River water for 3 to 84 days at varying solution-to-solid ratios. After specified times, samples were centrifuged. Within the first three days, there was an initial rapid release of 6-9% of total U, independent of the solution-to-solid ratio. After 14 days of reaction, however, the experiments with the narrowest solution-to-solid ratios showed a decline in dissolved U concentrations. The removal of U from the solution phase was accompanied by removal of Ca and HCO^{3-}. After the rapid initial release in the first three days for the wide solution-to-solid ratio experiments, there was sustained release of U into the pore water. This sustained release of over 90% of total U from the sediments had diffusion-limited kinetics.

Salinity and trace elements in Hetao Basin groundwater and Wuliangsuhai Lake, Inner Mongolia, China

Dongnan Zhu

306, Zhaowuda Road, Water Conservancy and Civil Engineering College, Inner Mongolia agricultural University, Hohhot, P.R.China; postcode: 010018

Hydrogeology Group, Department of Geoscience, University of Calgary 2500 University Drive NW Calgary, AB, Canada; postcode: T2N 1N4

M. Cathryn Ryan[1]

Hydrogeology Group, Department of Geoscience, University of Calgary 2500 University Drive NW Calgary, AB, Canada; postcode: T2N 1N4

Biao Sun and Changyou Li

306, Zhaowuda Road, Water Conservancy and Civil Engineering College, Inner Mongolia agricultural University, Hohhot, P.R.China; postcode: 010018

[1]Corresponding author: cryan@ucalgary.ca

Abstract

Wuliangsuhai Lake and groundwater quality in the eastern part of the Hetao Basin was investigated using stable isotopes and geochemistry. The groundwater and lake geochemistry are consistent with silicate weathering and some evaporite influence. Eleven of thirteen water wells were contaminated by at least one health-based parameter (including As, B, F, Na, NO_3, and/or U) and all of the wells failed to reach aesthetic guidelines (including Cl, SO_4, and/or total dissolved solids concentrations). The isotopic and geochemical compositions suggest groundwater is largely derived from the Yellow River, and also from local recharge. Groundwater and surface water undergo varying degrees of evapotranspiration in both the irrigation area and the Wuliangsuhai Lake, with commensurate concentration increases of two to three orders of magnitude in conservative parameters (e.g. chloride). In addition to concentration increases due to evapotranspiration, major and trace mineral precipitation and redox processes also affect ion distributions. Notably high uranium concentrations in the Yellow River (relative to world rivers) suggest the groundwater uranium and other trace elements (e.g. As, B, F) may originate in the Yellow River-derived irrigation water. Although a lake water balance (conducted using average annual values) suggests there is little net groundwater inflow or outflow, a chloride mass balance results in a net unexplained accumulation of chloride in the lake that is too high to be accounted for in reed harvest.

Land Reclamation Technical Session 1

Wednesday, February 20, 2013 – Afternoon

Organic amendment type affected nitrogen cycling and associated enzyme activities in oil sands reclaimed soils

G.M. Jamro[1]

Department of Renewable Resources, University of Alberta, Edmonton, Canada, T6G 2E3 and Department of Soil Science, Sindh Agriculture University, Tandojam, Pakistan, 70060

S.X. Chang and M.A. Naeth

Department of Renewable Resources, University of Alberta, Edmonton,Alberta, Canada, T6G 2E3

[1]Corresponding author:jamro@ualberta.ca

ABSTRACT

LFH and peat are commonly used organic amendments in oil sands reclamation.These amendments have contrasting biological properties and nutrient availabilities, with organic matter in LFH material more decomposed than that in peat.The objective of this study was to assess whether soil enzyme activities and available nitrogenare greater in LFH than in peat amendment. Monthly soil sampling was conducted at two soil depths (0-10 and 10- 20 cm) from June to October 2011 and May to October 2012 at reclaimed sites on the Suncor leasein Fort McMurray, Canada.In-situ nitrogen availability was determined using plant root simulator (PRS^{TM}) probes for three time periods (June-September 2011, September 2011-May 2012, May-October 2012). Soil samples were used for analysis of microbial biomass carbon (MBC) and nitrogen (MBN), glucosaminidase, arylamidase and urease activities and available ammonium nitrogen (NH_4^+) andnitrate nitrogen (NO_3^-). In this two-years tudy soil enzyme activities and nitrogen availability were largely affected by the type of amendment. LFH had greater glucosaminidase and arylamidase activities and higher MBC and MBN than the peat amendment. Glucosaminidase was positively correlated with NH_4^+, $NO_3^-$and MBN, and arylamidase was positively correlated with NH_4^+ and NO_3^-.Glucosaminidase, arylamidase and urease activities, and MBC, MBN, $NH_4^+$and NO_3^-concentrations were higher in the 0-10 cm than the 10-20 cm depth increment. Mineral nitrogen supply rate was higher in LFH than in peat throughout the study. Thus nitrogen mineralization rates are greater in LFH than in peat amendment. Overall, LFH is a better amendment than peat for developing nitrogen cycle and biological functions in oil sands reclaimed soils.

Use of forest floor protection or salvage in the reclamation of temporary drilling pads

S. Bachmann[1], V.J. Lieffers and S.M. Landhäusser

Dept. of Renewable Resources, University of Alberta, 429 Earth Sciences Building, Edmonton, Alberta T6G 2E3, Canada

[1]Corresponding author: sbachman@ualberta.ca

ABSTRACT

The increasing exploration of oil sands reservoirs in the Athabasca deposit results in forest fragmentation from numerous temporary drilling pads and calls for more effective and rapid reclamation techniques. Forest floor (FF) protection could be effectively used to promote the natural regeneration of aspen (*Populus tremuloides*) dominated mixedwoods. This could be achieved by covering parts of undisturbed FF during construction and operation of the drilling pad. Using subsoil from standard leveling operations prior to rig-setup could create an efficient buffer protecting the FF. It can be uncovered once the rig is deconstructed (<1month). Since FF contains many viable propagules and aspen has the ability to resprout from roots, stand establishment can be expected within the first growing season. A substantial problem implementing this procedure are government regulations which demand the complete stripping and salvaging of FF prior to, and the roll-back of the heavily mixed FF onto the pad after drilling. In a field study we compared 3 different treatments, which allowed separating the original FF from the deposited subsoil, with the standard method of stripping and salvaging the FF. The treatments included the covering of subsoil on geotextile, frozen snow and with no barrier. An undisturbed soil treatment was established as a control. Understory vegetation and aspen suckering response indicate that all 3 protection treatments are by far superior to stripping and rollback and also surpassed the control. With skilled machine operators, FF protection can produce at least 8 times as many aspen sprouts compared to salvaging and will significantly improve forest restoration.

Water stress reduced tree growth in some reclaimed lodgepole pine stands in the athabasca oil sands region, alberta, canada

J.D. House[1], M. Duan, and S.X. Chang

Department of Renewable Resources, University of Alberta, 442 Earth Sciences Building, Edmonton, Alberta, T6G 2E3

[1]Corresponding author: jdhouse@ualberta.ca

ABSTRACT

Stand productivity varies greatly in reclaimed lodgepole pine (*Pinus contorta* subsp. *latifolia*) (PL) stands in the oil sands region. Stands with low productivity often display visual symptoms such as stunted growth, foliar discolouration, and needle dropping. Low stand productivity needs to be addressed because commercial forestry is commonly an end land-use goal in oil sands reclamation. We predicted that water availability may be a key factor that acts alone, or in combination with other factors, to limit tree growth. To test this prediction, we established 9 PL sites on peat-mineral mix (PMM) over tailings sand (TS) on Suncor lease 86/17 in June 2011. Sites chosen represented a gradient of stand productivity based on visual symptoms noted above. Tree height and diameter at breast height (DBH) were measured in June 2011 and October 2012. Water content at 10 cm below the surface and 10 cm below the PMM-TS interface were continuously measured with soil moisture probes and datalogged. Pre-dawn shoot water potential (PSWP) was determined with a pressure chamber in mid-August 2011 and at 4 week intervals from June to August in 2012. Relative soil water content (RSWC) was calculated as the proportion of plant available water to soil water holding capacity. In summer 2011, a summer drier than usual, PSWP was positively correlated with height increment ($p = 0.04$) and DBH increment ($p = 0.04$). RSWC was positively correlated with PMM layer thickness ($p = 0.03$). These results indicate that sites that experienced greater water stress had poorer growth and sites with thicker PMM layers (>20 cm) had more plant available water and thus better tree growth.

Reclamation monitoring - Eye in the sky

R. Doherty[1],

Dept. of Geography, University of Lethbridge, 4401 University Drive, Lethbridge, Alberta, T1K 3M4

[1]Corresponding author: becky.leppington@uleth.ca

ABSTRACT

Long-term reclamation monitoring is often perceived as mindless and unrelated to scientific research, mainly due to poorly designed and managed programs. If properly designed, reclamation monitoring programs allow us to observe and measure the progress of the transformation of disturbed lands to its former equivalent capability. Using remote sensing as a tool to aid in monitoring reclamation progress may provide cost and time saving benefits. Through the use of remote sensing, areas of concern may be identified prior to site visits, which would allow regulators and operators alike to focus on identified problematic areas. In order to effectively use remote sensing as a tool for monitoring reclamation progress, three main components need to be assessed. These components are: baseline mapping, assessment of vegetation health and change detection. The baseline map would consist of multispectral satellite data collected prior to disturbance, which can be used to categorize the existing vegetation into classes. These categorized images then serve as a reference or benchmark to which to the reclaimed vegetation can be compared. The overall vegetation health, including vegetation height, biomass and percent cover, of the site can be assessed using multispectral and Light Detection And Ranging (LiDAR) data. Health characteristics of plants can then be summarized and used to assign a rating on the overall success of vegetation establishment on the area. Change detection integrates and analyses imagery from several years throughout the reclamation-time period. The time-series images can be compared against one another to highlight fluctuations during the selected time period.

Restoring native grassland function in urban environment; implications for soil-plant relations

S. Arezoo Amini[1] and M. Derek MacKenzie

Department of Renewable Resources, University of Alberta, Edmonton, AB, Canada

[1] Corresponding author: seyedeha@ualberta.ca

ABSTRACT

The area of rough fescue prairie has been reduced in Western Canada because of human activities including housing development and land clearing. Urban development can impact natural ecosystems by eliminating native species and their habitat. Larch Park is an Edmonton residential development area to which land reclamation and restoration ecology have been applied in order to rebuild natural grasslands instead of turf grasses. By using salvaged soil, planting native communities and adding biochar as a fire surrogate to the soil we expected ecosystem function and services in reclaimed site to be more similar to natural grassland site. A greenhouse study was also conducted to examine the effects of biochar and native species on soil processes. We examined ecosystem function in reclaimed and natural grassland sites by measuring soil nitrogen availability using resin capsules, soil microbial biomass C and N by chloroform fumigation-extraction method, microbial respiration by alkali trap method and microbial community structure with phospholipid fatty acid (PLFA) analysis. Disturbance followed by land reclamation at Larch Park caused drastic changes in soil processes. We found significant differences in soil properties including higher nitrogen availability, lower microbial biomass, and lower microbial diversity in reclaimed site compared to natural grassland site. The results indicated that biochar had some significant interaction effect on soil-plant processes. Greenhouse results showed stimulatory effects of native species on microbial biomass and respiration, and decreasing impact on nitrogen availability.

Poster Session

Wednesday, February 20, 2013 – Afternoon

Current research on sandy Spodosols for kenaf production in Malaysia

Khalil Ahmed[1], A.R. Anuar, Y.M. Khanif, A.W. Samsuri

Department of Land Management, Faculty of Agriculture, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

Nasima Junejo

Laboratory of Sustainable Bioresource Management, Institute of Tropical Forestry and Forest Products, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia

[1]Corresponding author: khalilahmed281@gmail.com

ABSTRACT

Demand for pulp and paper, leads to deforestation in the entire world; including Malaysia. Another challenge, faced by this tropical country is the land scarcity; especially for the use of agricultural purposes. Therefore, research efforts have been taken to utilize sandy spodosols soils for kenaf production to produce pulp and paper. The presented sets of studies were conducted from 2008 to 2011. Geostatistical and GIS techniques were used to quantify the variability of soil properties in disturbed spodosols area of 20.04 ha. Response of kenaf was studied at four depths (20, 48, 77 and 118 cm) and four types of spodic horizons (3.88, 5.03, 5.82 and 8.05 kg cm^{-2}). Data was subjected to homogeneity of variance among four depths of spodic horizon at various locations followed by the ANOVA and regression. Distribution maps indicate low nutrient status of soil however, 50 % of the area was higher in P and Mn content. The depth of spodic horizon had a significant effect on plant height, diameter and dry matter yield of kenaf as the negative linear relationship. Kenaf roots were deformed at spodic strength of 8.05 kg cm^{-2}. It is concluded that the disturbance of spodic horizon caused variability in the soil properties and yield of kenaf. Depth and types of spodic horizons had significant effect on growth, root morphology and yield of kenaf and need to be considered in the planting of kenaf on sandy spodosols soils.

Variability in symbiotic nitrogen fixation among dry bean genotypes

Z. Akter, N. Z. Lupwayi[1] and P. M. Balasubramanian

Agriculture and Agri-Food Canada, Lethbridge Research Centre, Lethbridge

[1]Corresponding author: newton.lupwayi@agr.gc.ca

ABSTRACT

Dry bean (*Phaseolus vulgaris* L.) genotypes in symbiosis with *Rhizobium leguminosarum* bv. *Phaseoli* are believed to have low biological nitrogen fixation (BNF) potential, and hence application of N fertilizer is often recommended in dry bean production. A field experiment was conducted with 16 diverse dry bean genotypes that had previously been selected for their contrasting nodulation ability and/or N_2-fixing potential under controlled conditions. The experiment had four treatments: (1) un-inoculated, (2) inoculated with commercial *Rhizobium leguminosarum* bv. *phaseoli* inoculant TagTeam®, (3) inoculated with commercial *Rhizobium* inoculant Nodulator®, and (4) high-N soil. The treatments were arranged in a split plot design with four replications. At R1 growth stage (flowering), nodulation and shoot N_2 fixation of dry bean genotypes were significantly affected by the inoculation, N fertilization and by the genotypes. At physiological maturity, inoculation resulted in greater shoot dry mass, seed yield, 1000 seed weight and N_2 fixation as compared with the un-inoculated control. Genotype PI 136692 had the highest grain yield (3248 kg ha^{-1}) and N_2 fixation (85 kg ha^{-1}), whereas inoculated genotype LEF 2RB had the highest shoot dry weight. This study identified genetic variation among dry bean genotypes in N_2 fixation, and bean genotypes that can fix large amounts of N_2.

Soil properties below the compost windrow

X. Hao[1], C. Li, S. Xu and B. Ellert

AAFC Lethbridge Research Centre, Lethbridge

[1]Corresponding author: xiying.hao@agr.gc.ca

ABSTRACT

Proper disposal of dead livestock is a major concern for the beef industry. Instead of rendering, on-farm composting is increasingly used as a cost-effective method to dispose of cattle carcasses while minimizing risks of disease transmission (e.g. BSE) and of scavenger attraction (e.g. bears, cougars, canids). However, the possible environmental effects of mortality composting on soil below the windrows are largely unknown. We examined soil chemical properties underneath windrows of beef feedlot manure with and without dead cattle or calves. We also sampled an adjacent area that had not been covered by compost windrows. Soil samples were collected in five increments to a total depth of 120 cm under windrows at end of the composting process. Soils were analyzed for organic carbon (SOC), total N (TN), total P (TP), KCl-extractable N (NO_3 and NH_4), Olsen-P, pH and electrical conductivity (EC). Windrow type had no detectable effect ($P > 0.05$) on SOC, TN, TP, Olsen-P and EC, but soil under windrows with dead stock had greater ($P < 0.05$) pH and NH_4 at all depths. In contrast, under windrows with dead stock soil NO_3 was lower near the surface (0-60 cm), but greater at 90 – 120 cm, compared to soil under regular windrows. The greater amounts of KCl-extractable N (NH_4 plus NO_3) under windrows with dead stock likely are attributable to greater and more decomposable N (protein-rich) in these windrows. During the composting process this N was converted to inorganic N that leached into the soil below the windrows.

Ciliate dependant production of microbial anthranilic acid occuring in aspen litter

M. J. B. Swallow[1], S. A. Quideau, C. E. Norris

[1]Department of Renewable Resources, University of Alberta, Edmonton, AB T6G 2R3, Canada

[1]Corresponding author: swallow@ualberta.ca

ABSTRACT

Terrestrial protozoa and their role in the soil microbial loop are intricately linked to the functioning of forest soils. Yet, in spite of their recognition as vital components of soil ecosystems, protozoa remain understudied when compared to other soil microorganisms. In addition to directly stimulating soil nutrient levels by releasing bacterial nutrients, soil protozoa may affect plant growth indirectly by promoting bacteria that produce plant auxins. We conducted a four week incubation study using defaunated trembling aspen leaves that were selectively inoculated with ciliates. Ciliates modified microbial community structure, as assessed with phospholipid fatty acid (PLFA) analysis. Using High Performance Liquid Chromatography (HPLC), we found that the presence of ciliates did not favor bacteria that produce the plant auxin, indole-3-acetic acid (IAA). Instead, ciliates were associated with the production of anthranilic acid, which indicates that they were responsible for maintaining populations of *r*-selected bacteria within a relatively stable and nutrient poor environment. Additionally, while ciliates were observed using phase contrast microscopy, the commonly used PLFA indicator for soil protozoa (20:4) was not detected therefore it was shown to be a poor and potentially invalid biomarker.

Long-term effect of fresh and composted cattle manure on the size and nutrient composition of dry-sieved soil aggregates

J.J. Miller[1], B.W. Beasley, F.J. Larney

Agriculture and Agri-Food Canada, 5403-1st Ave. South,

Lethbridge, AB, T1J 4B1

C. Drury

Agriculture and Agri-Food Canada, Harrow, ON

B. Zebarth,

Agriculture and Agri-Food Canada, Fredericton, NB

E. Bremer,

Symbio Ag Consulting, Lethbridge, AB

[1]Corresponding author: jim.miller@agr.gc.ca

ABSTRACT

The objective was to determine the effects of fresh or composted feedlot manure containing straw or wood-chip bedding on dry-sieved aggregate size distribution and nutrient contents. Surface (0-15 cm) soil samples were obtained from a long-term field experiment where treatments were fresh (FM) or composted manure (CM) containing straw or wood-chips applied annually at 0 (control) or 77 Mg ha^{-1} yr^{-1} for 11 yr. Air-dried soil samples were separated using a rotary sieve into six aggregate size fractions ranging from <0.47 mm to >12.7 mm. Total C, total N, C:N ratio, soil mineralizable N (41-day incubation), total P, soil test P, and P saturation index were determined on the six aggregate fractions. The amendments significantly ($p \leq 0.05$) increased the proportion of smaller (<0.47 mm) aggregates and decreased the proportion of the larger (>12.7 mm) aggregates relative to the unamended control. The geometric mean diameter (GMD) was also lower and wind erodible fraction (WEF) was greater for the amended treatments than unamended control. We attributed this manure effect to increased organic matter content in the soil making the aggregates more friable and susceptible to breakdown by tillage. Carbon, N, and P concentrations were not shifted to smaller aggregate sizes where root growth and nutrient uptake are generally greater. Long-term manure application may shift soil aggregates from larger to finer fractions because of greater friability and suggests that these soils should be managed to avoid the greater risk of wind erosion.

Adapting 4R Nutrient Management principles to an individual field

Tom Jensen, International Plant Nutrition Institute (IPNI), Saskatoon, SK

[1]Corresponding author: tjensen@ipni.net

ABSTRACT

The 4R Nutrient Management Principles of applying the Right Source of Nutrient at the Right Rate, Time and Place, are seen as a way of improving the efficiency of applied nutrients and reducing any adverse environmental impacts. This presentation will outline how the 4R principles can be applied in selected fields around the globe.

Potential effects of climate change on methane dynamics of a boreal Alberta peatland

T. M. Munir[1] and M. Strack

Department of Geography, University of Calgary, 2500 University Dr. NW Calgary, Alberta. T2N 1N4

[1]Corresponding author: tmmunir@ucalgary.ca

ABSTRACT

Peatlands are one of the largest natural sources of atmospheric methane (CH_4). The most severe climatic warming in the future is predicted to occur at northern peatlands. The warming will likely cause lowered water table and reduced efflux of CH_4 to the atmosphere. However, the extent of reduction in CH_4 emission at the ecosystem and microtopographic scales is unclear. We monitored peatland CH_4 fluxes over the growing season of 2011. The CH_4 fluxes were measured across the factors of warming (control vs. warming using open-top chambers) and microforms (hummocks and hollows) nested in the water table levels of control, recently drained and 10 years old-drained sites located near the town of Wandering River, Alberta (55.354646,-112.518302). The largest CH_4 fluxes occurred at warmed hollows at control site having highest daily mean water table position, followed by the fluxes at warmed hollows at recently drained site, while the lowest emissions occurred from warmed hummocks at old-drained site where daily mean water table position was deepest. The CH_4 fluxes at control and recently drained sites were significantly higher at warmed hollows than the fluxes at warmed hummocks at old-drained site. The water table position and microform alone were strongest predictors of CH_4 flux and their interaction explained 92% of the variation in the CH_4 flux. Therefore, while climatic warming is expected to lower the water table of peatlands followed by reduced flux of CH_4, different microforms may respond differently with accelerated emissions at wetter (hollows) and reduced emissions at drier (hummocks) microforms.

Properties of simulated rain runoff from compost windrows

Andrew F. Olson, Francis J. Larney[1], Jim J. Miller and Bonnie C. Tovell

Agriculture & Agri-Food Canada, 5403 1st Ave. S., Lethbridge, AB T1J 4B1

[1]Corresponding author: francis.larney@agr.gc.ca

ABSTRACT

Composting is being increasingly adopted by the beef cattle feedlot industry in southern Alberta. However, little is known about the quantity and quality characteristics of runoff emanating from windrows subjected to heavy rainfall at different stages of composting. A rainfall simulator, with an intensity of 126.5 mm hr^{-1}, was used to generate windrow runoff on Days 18, 26, 40, 54, 81, 109 and 224 of composting. Runoff potential increased from 24% of incoming rainfall on Day 0 to 69% by Day 90. Some properties showed differences with time during runoff event, *e.g.* on Day 18, NH_4-N increased from 46 mg L^{-1} for the 0-5 L runoff increment to 172 mg L^{-1} for the 25-30 L increment, while total dissolved phosphorus increased from 36 to 61 mg L^{-1} between the same volume increments. Nitrate-N had a runoff export coefficient of 19.5 mg m^2 min^{-1} on Day 224 which was significantly higher than 1.8-6.3 mg m^2 min^{-1} on Days 18-54. Even though some constituents were present in higher concentrations during the latter stages of composting, their transport potential in runoff was curtailed as organic matter stabilized. The study showed that runoff quantity and quality are influenced by the age of compost which has implications for (1) the timing of rainfall events in relation to the compost maturity spectrum; (2) losses of nutrients and organic matter that could be land-applied in for improved soil quality and crop production, and (3) the potential risk to surface water quality if runoff is not contained.

Soil carbon changes over 12 years on the Vauxhall irrigated rotation study

Drusilla C. Pearson, Francis J. Larney[1], Robert E. Blackshaw and Newton Z. Lupwayi

Agriculture & Agri-Food Canada, 5403 1st Ave. S., Lethbridge, AB T1J 4B1

[1]Corresponding author: francis.larney@agr.gc.ca

ABSTRACT

Irrigated row crops in southern Alberta, such as potatoes, dry beans and sugar beets return little crop residue after harvest for maintenance of soil organic matter. An irrigated rotation study was initiated in 2000 to examine the impact of conventional and conservation management practices for 3 to 6 yr crop rotations. The conservation management practices comprised a package of (1) direct seeding where possible; (2) fall seeded cover cropping; (3) composted cattle manure application (28 or 42 Mg ha^{-1} every 3rd yr); and (4) narrow-row (20 cm) solid-seeded beans vs, traditional wide-row (60 cm). In 1999 (baseline year), plots were sampled as if rotations were in place and there was an 8% difference between the highest and lowest soil organic carbon (SOC) values for the 0-15 cm soil depth. By 2011, after 12 yr of divergent soil management practices, there was a 50% difference (P = <0.001) between highest and lowest values with the 5-yr conservation rotation (potatoes-wheat-sugar beet-wheat-beans) containing 36.9 Mg ha^{-1} C compared to only 24.6 Mg ha^{-1} C for the 4-yr conventional rotation (wheat-sugar beet-beans-potatoes). For the 4-yr sister rotations, SOC accrual over time (12 yr) under conservation management was 0.42 Mg ha^{-1} yr^{-1} (R^2 = 0.97, P = 0.002) while SOC loss over time with conventional management was 0.19 Mg ha^{-1} yr^{-1} (R^2 = 0.80, P = 0.04). Our results demonstrate the importance of soil organic matter inputs in the form of compost in building and maintaining soil quality in intensive irrigated cropping systems.

Measurements and field observations of compaction in reclaimed borrow pits

F. Mensah[1] and D.A. Heeraman

AMEC Environment & Infrastructure, 140 Quarry Park Blvd. SE, Calgary, AB. T2C 3G3

[1]Corresponding author: fred.mensah@amec.com

ABSTRACT

Material excavated from borrow pits are used to construct roads in municipal districts and counties in southern Alberta. Pre-disturbance and post-disturbance (post-reclamation) topsoil assessments and soil quality characteristics including soil profile restriction to plant growth are requirements of Alberta Transportation's guidelines for reclaiming borrow excavations used for road construction. Soil profile restriction is one of the criteria required for reclamation certification. This study involved field observations of the root growth patterns of volunteer canola seedlings at various landscape positions in 4 newly reclaimed borrow sites. Root growth patterns and soil compaction measurements were recorded between the reclaimed borrow and adjacent areas. Soil compaction in both the topsoil and subsoils was measured with the aid of a Dickey-John™ soil compaction meter (penetrometer). Canola seedlings were randomly uprooted and described at several soil inspection locations containing profile restriction readings between 0 to ≥ 300 psi. The taproot growth patterns within the soil profiles were described as vertical, semi-vertical, semi lateral and lateral. A curvilinear relationship between root growth patterns was found to exist from the vertical to lateral and profile restriction ratings. The vertical taproot growth correlated to inspection locations with low profile restriction ratings, whereas the lateral taproot growth is related to locations with high profile restriction ratings. The differences in rooting pattern are attributed to increased bulk density and soil compaction from post-reclamation machinery tracks. Other soil conditions and characteristics such as volumetric water content, soil structure, texture, profile cracks, and total soil porosity were also found to play a role in affecting root development, after soil replacement and re-vegetation These factors are discussed in the presentation.

A new analytical method for estimating soil moisture characteristic curve using horizontal infiltration data in soil column

Ali Asghar Zolfaghari[1], Mehdi Shorafa, Mohammad

Department of soil science, University of Tehran, Iran

Hossein Mohammadi

Department of soil science, University of Zanjan, Zanjan, Iran

Miles Dyck

Department of Renewable Resources. University of Alberta. Edmonton. Canada

[1]Corresponding author: aliasgha@ualberta.ca

ABSTRACT

Quantitative knowledge of soil hydraulic properties such as the soil moisture characteristics curve (SMC) is crucial for flow and transport modeling supporting hydrologic and agricultural engineering. However, many laboratory and field methods are currently available for direct measurement of the soil hydraulic properties, but most or all of the direct methods are time consuming and costly. Thus developing simple and quick physically-based methods for predicting SMC is desirable. In this study, an analytical method was developed to estimate Brooks-Cory model parameters (n and air entry value, h_d) using horizontal infiltration data. Soil sorptivity (S), wetting front distance (x_f) and the relationship between cumulative infiltration and wetting front distance were obtained for prediction of the n and h_d parameters. The new method was compared with the method presented by Wang et al (2002). Sixteen soils with seven soil texture classes with a wide range of hydraulic properties were used to test the new method. The results showed that the new method estimates n and air entry value (h_d) smaller than those fitted by Brooks-Cory model on experimental data. However, the comparison of measured and predicted SMC showed that the new method can predicted SMC with high accuracy. (R^2=0.93 and RMSE =0.03) confirmed the accurate predictability of new method. Sensitivity analysis indicated that the accurately estimation of SMC depends mainly on sorptivity parameter.

Comparison of K-nearest neighbor and artificial neural network methods for predicting cation exchange capacity of soil

Ali Asghar Zolfaghari, Mohamad Taghi Tirgar Soltani

Department of soil science, University of Tehran, Iran

Miles Dyck, Amanuel Weldeyohannes

Department of Renewable Resources, University of Alberta. Edmonton, AB

ABSTRACT

Cation exchange capacity (CEC) measurement is a very expensive and time-consuming method. It may be appropriate to develop nonparametric models using readily available soil properties such as particle size distribution and soil organic matter to predict CEC. In the present study, a nonparametric, nearest neighbor approach (K-NN) was used for estimating CEC. It was further compared with the most common nonparametric models, which are based on artificial neural networks (ANN). We adapted the algorithm that was introduced by Nemes et al. for the prediction of soil hydraulic properties. Similar to pedoteransfer functions (PTFs), K-NN approach uses two data sets: the reference data set (RF) and target data set (TR). A total of 683 soils (RF=563 and TR=120) were used from central Iran. The soil properties, clay, silt, sand and organic carbon were used as independent input variables and CEC as the dependent output variable. Results showed that the maximum error (MaxE) with K-NN and ANN techniques were 4.81 and 5.26 $cmol^{+}/kg$, respectively. The root mean squared error (RMSE) for the K-NN and ANN were 1.51 and 1.53, respectively. This indicated that both methods were equally appropriate to predict CEC. The positive values of mean error (ME) showed that both models tend to underestimate CEC values in soil samples. From the high efficiency of the models (EF=0.88), it was evident that both models are good to estimate CEC values in target soils. In conclusion, the K-NN technique was comparable to the artificial neural networks model that is popular in the current most advanced and accurate PTF techniques.

Spatial variations in soil respiration in a boreal aspen forest fire chronosequence

S. Das Gupta[1], M. D. MacKenzie, S. A. Quideau

Department of Renewable Resources, University of Alberta, Edmonton AB, Canada T6G 2E3

[1]Corresponding author: **sanatan@ualberta.ca**

ABSTRACT

Fire can alter ecosystem respiration by changing spatial distribution of resources such as organic C, moisture, temperature, etc. There is limited information on how fire affects the spatio-temporal heterogeneity of soil respiration in boreal aspen forest. This study compared spring and summer season soil respiration in a boreal aspen fire chronosequence (1, 9 and 72 year after fire) in 2012. An intensive spatial sampling protocol with a minimum detectable lag distance of 2m was used for the measurements. Significant (p<0.05) spatial and seasonal trend was observed in soil respiration and environmental variables in all the three sites. Highest soil respiration rate was found in the oldest aspen site (1.4 g m^{-2} $hour^{-1}$) followed by 9 year (1.0 g m^{-2} $hour^{-1}$) and 1 year old site (0.8 g m^{-2} $hour^{-1}$). Spatial range gradually increased from spring to summer in the oldest stand (2.9 m to 5.1 m) whereas gradually decreased in 9 year old stand (6.8 m to 2.7 m) and did not follow any specific trend in the 1 year old site. Forest floor depth was the main controlling factor for soil respiration in the 1 year old site whereas both forest floor depth and soil moisture were significant in the 9 year and 72 year old sites. Temperature sensitivity of soil respiration was the highest (Q_{10} = 3) in the 9 year old site followed by 72 year (Q_{10} = 0.79) and 1 year old site (Q_{10} = 0.54).

Characterization of soil quality in a reclaimed sand pit and potential barriers to reclamation success

A. D. Reinhardt[1], F. Mensah and D. A. Heeraman

AMEC Environment and Infrastructure, 140 Quarry Park Blvd. Calgary, AB

[1]Corresponding author: ashley.reinhardt@amec.com

ABSTRACT

Soil physical and chemical characteristics can impede the successful reclamation of a disturbed site to a similar adjacent land use. The objectives of this study were to determine soil limiting characteristics for a reclaimed sand pit near Standard, Alberta, and determine which of these characteristics may impede reclamation of the site to agricultural cropland. Soil physical and chemical characteristics were characterised at 8 control locations adjacent to the gravel pit and 33 locations within the disturbed reclaimed area. Soil physical parameters measured in the field were texture, profile restriction, and topsoil depth. Laboratory analysis included measurements of soil electrical conductivity, soil pH for topsoil and subsoil samples, and available nitrate, phosphate, sulphate, and potassium for topsoil samples. Physical characteristics for the disturbed and control locations were compared against appropriate regulatory guidelines including the 2010 Reclamation Criteria for Wellsites and Associated Facilitiesand the soil quality criteria guidelines relative to disturbance and reclamation. Compared to the adjacent land, the reclaimed area had greater topsoil and subsoil profile restrictions, shallower topsoil depths, and higher pH in the topsoil. There were no differences in available nutrients, electrical conductivity, subsoil pH, and soil textures observed between the adjacent and reclaimed areas. Successful re-vegetation of the site is expected to be negatively impacted from soil compaction, topsoil replacement depths, and topsoil pH. These potential barriers and their overall effects on reclamation success are discussed in the presentation.

Overview of Alberta's Agricultural Carbon Offset Trading System, 2007 to 2011

Sheilah Nolan[1], Tom Goddard, Angela Bentley, and Paul Jungnitsch

Alberta Agriculture and Rural Development, Edmonton, AB

[1]Corresponding author: sheilah.nolan@gov.ab.ca

ABSTRACT

Alberta was first in North America to regulate greenhouse gas (GHG) emissions. Alberta's *Specified Gas Emitters Regulation (SGER, 2007)* created a market between regulated companies and others who can lower emissions on a voluntary basis, such as by agricultural management improvements. Government of Alberta approved offset quantification protocols provide the basis for this carbon trade. Protocols follow the International Organization for Standardization (ISO) 14064-2 process. This includes linking science-based emission reductions to management improvements that can be verified by independent third parties. Close to one-third of all Alberta offset protocols are agricultural, representing emission reductions from improved cropping, livestock and energy management. Agricultural offset protocols have been used to create 40% of all offsets and 20% of emission reductions used by regulators to meet compliance obligations since 2007. This has generated close to $ 105 M of income for farmers and aggregators in Alberta. Carbon offsets represent important opportunities to gain incentives for management improvements that lower GHG emissions, while improving record keeping capacity and increasing production efficiencies.

Analysis of *E.coli* and bromide transport from at-grade line sources to shallow groundwater

Amanuel Oqbit Weldeyohannes[1],

Dept. Renewable Resources, 751 GSB, University of Alberta, Edmonton, AB, T6G 2H1

R.G. Kachanoski,

Office of the President, Memorial University of Newfoundland, St. John's, NL A1C 5S7

M. Dyck,

Dept. Renewable Resources, 751 GSB, University of Alberta, Edmonton, AB, T6G 2H1

[1]Corresponding author: aweldeyo@ualberta.ca

ABSTRACT

The fate and transport of pathogens under variably saturated and unsaturated conditions typical of on-site wastewater treatment systems (OWTS) requires a better understanding to assess the environmental risks associated with these systems. In-situ spatial and temporal transport of *Escherichia coli* (*E.coli)* and Br^- from at-grade line sources to shallow groundwater were investigated at Wetaskiwin Rest Stop, Alberta. The site was receiving an ultraviolet (UV) disinfected wastewater for four years via a pressurized at-grade line sources. Following a field characterization and wastewater plume delineation, a nest of piezometers (N=30 in 10 nests) were installed along the wastewater plume center of mass parallel to the direction of groundwater flow. The UV system breakdown was simulated for 90 days and a pulse of Br^- was applied to the source tank to track wastewater flow path and contaminant transport over time. Observed breakthrough curves of *E.coli* and Br^- and implications will be presented. The research output will benefit future research on pathogens fate and transport; in designing environmentally sustainable OWTS and groundwater risk assessment plans.

50 years of research at the Ellerslie Research Farm

Dick Puurveen[1] and James Robertson

Department of Renewable Resources, University of Alberta

[1]Corresponding author: **puurveen@ualberta.ca**

ABSTRACT

On July 1, 1961, the University of Alberta signed a 50-year lease with the Government of Alberta, Department of Public Works, on three quarter sections of land located south of Edmonton in an area known as Ellerslie. At that time, the concurrent loss of the "Soils Farm" lands under Michener Park to urban development by the City of Edmonton necessitated a replacement of lands suited for soils research. With Dr. J. Toogood as Chair of the Department of Soil Science, and Dr. C.F. Bentley as Dean of the Agriculture Faculty, activities in the initial years of the Ellerslie Research Station included a detailed soil survey, crop uniformity map and initiation of the first soil fertility research trials at Ellerslie. The thick black chernozemic soil at Ellerslie was very uniform and ideal for small plot research, and a perfect contrasting soil type to the thin gray-wooded soil at the Breton Plots. Since 1961, the Ellerslie Research Station has provided facilities and land for cooperative research between University, Government and Industry partners. Success at the Ellerslie Research Station is evident by numerous MSc and PhD dissertations, and academic publications that resulted from research at Ellerslie. The Alberta Agriculture Diagnostic Field School, held at Ellerslie from 1991 to 2005, was world renown, and received the 2003 Premier's Award of Excellence. Industry partnership was also encouraged, with companies such as Westco Fertilizers placing over 160 sites years of research trials at Ellerslie. On July 1, 2011, the 50-year lease with the Government of Alberta expired, without renewal. This poster reviews some of the soils research at the Ellerslie Research Station.

Green-Seeker-measured NDVI predicts grain yield and soil nutrient supply

Leah, Predy, Dick Puurveen and Miles Dyck[1]

Department of Renewable Resources, University of Alberta

[1]Corresponding author: **miles.dyck@ualberta.ca**

ABSTRACT

The Breton Classical Rotation was initiated in 1929 near Breton, Alberta on Gray Luvisolic soil. The Classical Rotation is a five-year rotation (Wheat – Oats – Barley – Hay 1 – Hay 2) with 11 fertility treatments. As such, these Plots are an ideal setting for assessing a crops response to nutrients. One method commonly used to assess nutrient status is simply visual. Most "experienced" farmers can tell you from their truck windows if a crop appears deficient in nitrogen. Plants get their green colour from the presence and relative abundance of the pigment chlorophyll, which is responsible for photosynthesis. Chlorophyll contains nitrogen. Therefore, plants deficient in nitrogen are less green than those with adequate nitrogen. The "drive-by" visual nutrient status determination is rather subjective. A better methodology to make this comparison is to have a colour reference. The Breton Plots allow for a side-by-side comparison of a crop receiving nitrogen fertilizer to that receiving no nitrogen. In 2011 and 2012, treatments were compared by collecting data using a GreenseekerTM sensor, which measures red and NIR light reflected from the plants and is expressed as a NDVI index. In 2012, we deployed PRS probes in selected treatments to assess yield-NDVI-nutrient supply relationships. Our results show a consistent NDVI-yield relationship over two years and NDVI and wheat grain yield are correlated to PRS-measured soil nitrogen supply.

Effects of phosphatic biofertilizer on the yield of rice and wheat at different AEZ of bangladesh

M. A. Haque[1],

Soil Microbiology Lab., Soil Science Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh

M. A. Sattar

Director General, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh

M. R. Islam and M. A. Hashem

Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh

Corresponding author: azizul732@yahoo.com

ABSTRACT

Phosphate solubilizing bacteria (PSB) as phosphatic biofertilizer (PB) have potentiality to solubilize the unavailable P in rhizosphere soil. Therefore, the present study was aimed to investigate the effect of PB on the yield of transplanted *Aman* rice (*Oryza sativa*) and wheat (*Triticum aestivum*) in the diverse agroecological zones (AEZs) of Bangladesh. The field experiments were conducted in the soils of Old Brahmaputra Floodplain, Madhupur Tract and High Ganges River Floodplain at Mymensingh, Madhupur and Ishurdi, respectively during two consecutive years of 2008-09 and 2009-10. Fourteen treatments were comprised with two PSB inoculants (MR1 or MW1) and inorganic or organic sources of P for both the crops and the experiments were conducted following Randomized Complete Block design with four replications. Single or mixed PSB inoculants with 50% P from triple super phosphate (TSP) or cowdung (CD) increased the PSB population and phosphatase activity in rhizosphere soil of transplanted *Aman* (T. *aman*) rice and wheat. These two variables showed significant correlation ($P_{0.01}$) resulted in higher availabile P in soil. Consequences of higher availability of soil P due to PSB inoculation with 50% P from TSP or CD attributed to increase the P uptakes and grain yields of T. *Aman* rice (34.1, 21.4 and 15.2% yield increase) and wheat (92.4, 61.9 and 26.1% yield increase) over without P which were also comparable to 100% P from TSP alone at Mymensingh, Madhupur and Ishurdi, respectively. Thus, 50% P can be saved in the cultivation of T. *Aman* rice and wheat by the integrated use of phosphatic biofertilizer with inorganic or organic sources of P.

The New Look of the Alberta Soil Information Viewer

D. J. Spiess[1] and D.V. Hildebrand,

Environmental Stewardship Div., Alberta Agriculture and Rural Development, Edmonton, AB

A. Brierley and M. Bock

Science and Technology Branch., Agriculture and Agri-food Canada., Edmonton, AB

[1]Corresponding author: david.spiess@gov.ab.ca

ABSTRACT

The redeveloped Alberta Soil information Viewer, based on the Agricultural Region of Alberta Soil Inventory Database (AGRASID), is the next evolution of online tool that Alberta producers have had access to since 1998.

In the early 2000s, a project to migrate AGRASID onto the internet began. The migration project was broken into two parts. The second part was the development of an internet map viewer to provide the general public with a means to access an essential but limited sample of AGRASID soil landscape information for the agricultural region of Alberta.

A reasonably stable production version of the viewer was first deployed on the ARD website in October of 2005 and has accommodated some 3000 visits per month.

In 2011 when it was determined that the hardware and software framework needed to be replaced, the existing tools were re-evaluated and enhanced, and additional functionality was added."

The redevelopment project started in the early spring of 2012.

Project completion is expected prior to March 31, 2013.

Some intended uses include:

- Reference for pipeline surveys,
- Environmental impact studies
- Environmental farm planning and assessment by agricultural producers.

MODELING COMPLEX WATER TABLE EFFECTS ON NET CO_2 EXCHANGE OF WESTERN CANADIAN PEATLANDS

M. Mezbahuddin[1], R.F. Grant

Department of Renewable Resources, University of Alberta, Edmonton AB

L.B. Flanagan

Department of Biological Sciences, University of Lethbridge, Lethbridge, AB

[1]Corresponding author: mezbahud@ualberta.ca

ABSTRACT

Hydrology is one of the key controls governing peatland carbon balance under current and future climatic conditions. Seasonal variations in soil water content and water table depths can alter the balance between peatland primary production and respiration and so cause a peatland to change between a sink and a source of carbon. Seasonal and inter-annual variation in peat hydrology can affect primary production and respiration through its influence on evapotranspiration, plant water and nutrient uptake and on microbial decomposition. Simulating water table effects on current and future net ecosystem productivity (NEP) of peatlands thus demands models with coupled soil-plant-atmosphere schemes for gases, water, energy, carbon and nutrients (N, P). We combined a 3-dimensional water transport scheme and prognostic water table dynamics with an existing ecosystem model *ecosys* in order to examine the hydrological controls on seasonal and inter-annual variability in NEP of a moderately rich fen peatland in Alberta, Canada. Simulated hourly ecosystem energy and CO_2 fluxes along with hourly near surface soil water contents and water table depths correlated very well (R2 ~ 0.80) with measurements at the site from 2003 to 2009, during which the water table declined gradually. We compared modeled and measured fluxes at hourly and seasonal time scales in years with contrasting weather and water table depths in order to see how water table fluctuations altered the diurnal and seasonal patterns of NEP. In the model, shallow water tables limited root and soil aeration, slowing root and microbial growth, and hence nutrient uptake. This reduced gross primary productivity (GPP) but also ecosystem respiration (RE), so that the peatland remained a substantial net C sink. In the model, deeper water tables caused more rapid microbial and root growth, and hence more rapid mineralization and nutrient uptake, and hence greater GPP. Deeper water tables also caused near-surface drying which slightly reduced near surface peat decomposition. However this reduction was offset by more rapid decomposition in deeper peat layers so that total RE increased. Concurrent increases in GPP and RE caused simulated and measured NEP to change in complex ways with deeper water tables. These complex changes in seasonal and annual CO_2 exchange with changes in hydrology can be simulated with models that represent basic processes for soil-plant-atmosphere transfers of gases, particularly O2, as well as those of water and energy. Such models can provide a predictive capability for how peatland productivity might change with hydrology under future climates.

Soil-Plant relations: A new capping study at Aurora mine

M.D. MacKenzie

Renewable Resources, University of Alberta, Edmonton, AB

Corresponding author: m.derek.mackenzie@ualberta.ca

ABSTRACT

A new capping study has been built at Syncrude Canada's Aurora mine. The study is replicated at the operational scale and includes 10 treatments using different types of reclamation materials, depth of placement, and horizonation. The substrates are generally coarse textured making this study site very different from previous research at the Mildred Lake mine, as well as at Suncor's Millennium mine, which are dominated by fine textured materials. My lab will be examining the soil-plant-microbe continuum over the next 5 years with the goal of tracking ecosystem development in the reclaimed environment and comparing it to other types of natural and anthropogenic disturbance in the region, including fire and harvesting. We will use ionic resin analysis, foliar analysis and microbial community profiling to examine the rate at which the continuum reconnects. We will also spatial pattern analysis to determine if these reclaimed ecosystems are on a trajectory towards natural ecosystem function.

AN INVESTIGATION OF THE EFFECT OF DIFFERING GRAZING SYSTEMS ON LANDSCAPE HYDROLOGY

Alan Stewart[1] and Darren Bruhjell

Agriculture and Agri-Food Canada, Science and Technology Branch, Edmonton AB

[1]Corresponding author: alan.stewart@agr.gc.ca

ABSTRACT

Land use and management affect the balance between runoff, soil moisture storage and deep percolation of precipitation on the landscape. This is a preliminary investigation on the effects of pasture management on the retention of precipitation on the landscape and its release or discharge. The study has two sites, both on 'hydrologically active' landscapes. The Ponoka Site is a Gray Luvisol soil- landscape and Porcupine Hills site is a Black Chernozemic soil-landscape. At each site transects were set up on adjacent pastures under differing management systems. Soil profile characteristics, bulk density, infiltration and runoff were measured at key landscape positions (from crest to basin) on the transects; water table observation wells were installed in the lower slope to basin segments of the transects. For each site, soil profiles in the crest to mid-slope positions have only minor differences; profile characteristics in the lower-slope and basin positions were more variable and reflected landscape evolution processes and higher soil moisture regimes. Bulk density, infiltration and runoff were very variable on all transects. At the Ponoka and the Porcupine Hills site with summer-long-grazing the water table levels of the basins fluctuated with precipitation. However on the intensive-rotationally grazed pasture at Porcupine Hills the basin hydrograph had a short lag period in spring before rising and declining gradually over summer, unaffected by precipitation, indicating a different hydrological regime.

Land Reclamation Technical Session 2

Thursday, February 16, 2012 – Morning

Textural interface impacted the distribution of root, water and nutrients in reclaimed forest soils in the athabasca oil sands region

Kangho Jung, Min Duan[1], Jason House, and Scott X. Chang

Department of Renewable Resources, Edmonton, AB

[1]Corresponding author: mduan1@ualberta.ca

ABSTRACT

Peat-mineral mix (PMM) is typically used to establish organic matter-rich surface soils as the growth media over tailings sand or fine-textured overburden to reclaim disturbed lands in the Athabasca oil sands region. However, abrupt changes in physico-chemical properties between PMM and substrates may alter water and nutrient distributions, limiting root growth. To assess impacts of the textural interface on root, water, and nutrient distribution, we collected soils from 0-2, 2-5, and 5-10 cm above and below the interface at six PMM-tailings sand (TS) and six PMM-overburden (OB) sites with various thickness of PMM. Root biomass decreased exponentially ($p<0.001$) with depth between 10 cm above and below the interface in both TS and OB. In TS, much of the variation in root biomass could be explained by pH and water content (v/v) ($p<0.01$) above the interface and water content ($p<0.05$) below the interface based on multiple regression, where root biomass was negatively related with pH and positively related with water content. Decreasing water content with depth in TS implied that capillary water moves downward, reducing water availability in PMM. On the other hand, root biomass in OB decreased with increasing EC above and below the interface and increased with NH_4-N ($p<0.001$) and DON ($p<0.01$) below the interface, indicating that N availability and salt stress influenced root growth in OB. In conclusion, the textural interface was the barrier to root growth, so the suitable PMM thickness should be applied to prevent limited root growth because of deficient available water in TS, and to avoid salt stress to roots because of high level of EC in OB.

***Oral presentation for the student competition**

Understory plant community was changed by seven years of simulated n and s deposition in the Athabasca oil sands region in Alberta

K.H. Jung, J.H. Kwak[1] and S.X. Chang

Dept. of Renewable Resources, University of Alberta

[1]Corresponding author: jinhyeob@ualberta.ca

ABSTRACT

Increased levels of nitrogen (N) and sulfur (S) depositions are becoming a concern in the oil sands region as oil production levels increase; however, we have little data on the responses of plant communities to N and S depositions in the oil sands in northern Alberta. We simulated N and S depositions in a 2 (0 vs. 30 kg N $ha^{-1}yr^{-1}$, as NH_4NO_3) x 2 (0 vs. 30 kg S $ha^{-1}yr^{-1}$, as Na_2SO_4) factorial experiment to evaluate changes in soil chemistry and understory plant community from 2006 to 2012. The N and/or S treatments influenced a number of chemical properties in the surface mineral soil but not in the forest floor. Nitrogen addition increased DOC and DON ($p<0.05$) and S addition decreased exchangeable cations ($p<0.05$) in the mineral soil. Shrub species richness was not affected by treatments while the diversity and evenness were decreased by N ($p<0.1$) and S additions ($p<0.01$). Total shrub cover was decreased by S addition ($p<0.1$). The nonmetric multidimensional scaling ordination showed a clear separation of the treatments and MANOVA results showed the effect of S addition ($p<0.05$) on the composition of plant species. No N and S addition effects were found on the richness, diversity, evenness and total cover of the herb layer. However, N addition affected the composition of plant species ($p<0.05$) due to contrasting effects of N addition on different species. In conclusion, seven years of simulated N and S depositions affected the chemistry of mineral soils and understory plant community composition, and decreased plant species diversity in the studied boreal forest in the Athabasca oil sands region.

***Oral presentation for the student competition**

Wildfire nitrogen dynamics in Alberta's boreal soils: a comparison for anthropogenic disturbance

J. Martin[1] and M. Derek MacKenzie

Department of Renewable Resources, University of Alberta, Edmonton, AB

[1]Corresponding author: jillianm@uaberta.ca

ABSTRACT

This study examined the nitrogen availability, soil microbial community, and understory vegetation in soil following natural wildfire disturbance and anthropogenic (reclamation) disturbance over time. Eleven natural (2-131 years) and 5 reclaimed sites (4-27 years) with increasing time since disturbance were selected from the Athabasca oil sands region, within 120 km of Fort McMurray. All sites were upland aspen/spruce stands. Soil available nitrogen was assessed in-situ with ionic resin capsules. Potentially mineralizable nitrogen was determined by anaerobic incubation. Microbial respiration was used to measure microbial activity by the closed chamber alkali trap method, and the microbial communities were fingerprinted and biomass determined using phospholipid fatty acid analysis (PLFA). Vegetation was characterized by canopy cover, and a plant functional group and genus composition survey. Average site nitrate levels for the youngest natural sites (aged 2 to 9) for winter/spring 2011 were slightly higher (11.72-68.44 ug/capsule) then consistently lower levels in the older sites (1.14-4.68 ug/capsule). For all sites ammonium levels were found to be higher than nitrate levels. No other trends for nitrate or ammonium were observed. An NMS ordination of the soil microbial community composition revealed reclaimed and unburned sites to have significantly different microbial communities, while the burned sites (aged 2 to 39) were more variable bridging of the difference between the other two.

***Oral presentation for the student competition**

Characterization of soil physical properties in compacted and de-compacted soils on reclaimed mine tailings at Genesee prairie mine, Alberta

P. Sabbagh[1] and M. Dyck

Dept. of Renewable Resources, University of Alberta, Edmonton, AB

[1]Corresponding author: psabbagh@ualberta.ca

ABSTRACT

Revegetation with perennial grasses or alfalfa has traditionally been a standard practice for site reclamation within Alberta's agricultural zone, but these species are not representative of the natural biodiversity. Therefore, aspen is being used in more recent reclamation projects in the Parkland Ecoregion of the agriculture zone. Initial aspen plantations showed poor growth and the likely cause was soil compaction from machinery during landscape reconstruction. To improve subsoil aeration and water transmission, subsoil ripping was carried out in a test plot at Genesee Prairie Mine. Within the site, 6 replicates with 2 treatments each (compacted and decompacted) were established with 5 m buffers between them. The main objective of this project is to characterize the effects of subsoil ripping on soil physical properties. In July and August 2011, soil samples were extracted from 9 locations in each ripped and non-ripped replication (total of 108 locations) with a GeoProbe hydraulic soil coring device. At each location, disturbed samples were taken from four depths (0-15, 15-30, 30-60 and 60-90 cm). In addition to the disturbed samples, an undisturbed core sample was also taken. Soil physical parameters measured on these samples include soil texture, bulk density, moisture retention curve and saturated hydraulic conductivity. Preliminary results indicate that the deep ripping treatment has improved the soil physical properties with respect to Aspen revegetation.

***Oral presentation for the student competition**

Chemical considerations in the thermal desorption remediation of soils

D. R. Nelson, J. W. Sehlstrom, and S. N. Platts[1]

Nelson Environmental Remediation Ltd., 26519-C Township Road 530,

Spruce Grove, AB T7X 3L5

[1]Corresponding author: nick@nerglobal.com

ABSTRACT

Thermal Desorption Units (TDUs) reliably treat soils contaminated with a wide variety of organic compounds, routinely remediating such environmental liabilities down to well-below the regulatory soil concentration criteria (*e.g.,* paraffinic and aromatic petroleum hydrocarbons (PHCs), commercial solvents, pesticides, *etc.*). From operational, emissions, and sustainability aspects, we're steadily considering some of the different kinds of chemistries that can reasonably be expected to be occurring inside our TDUs, along with effects on residuals entrained in the output soils. The kinds of chemical reaction types that we can envisage occurring inside the rotary desorber drums include functionalizations and derivatizations, such as: alkene generation (*e.g.,* via heterogeneous catalytic cracking reactions on clay mineral surfaces under the hot, dry, anoxic conditions prevailing); molecular structural dehydrations (*e.g.,* via thermal condensation of hydroxy groups); oxygenates generation (*e.g.,* via partial oxidations and hydrolyses); and mechanochemical / tribochemical reactions (*e.g.,* freshly-produced / exposed / excited inorganic surfaces, particularly in the case of quartz-rich materials, that can have high surface energies and be chemically reactive in their own right and/or be catalytically-active). Awareness of the different chemistries that can conceivably occur when thermally processing soils is useful for problem-solving on-the-job, when addressing a client's queries, regarding possible future regulatory requirements, and as sustainability issues become increasingly significant among the factors being actively considered in decision-making deliberations among landowners, environmental liability-holders, environmental engineering firms, consultancies, and other stakeholders.

Land Use Technical Session

Thursday, February 16, 2012 – Morning

HOLOS – a GHG calculator growing up

Roland Kroebel

Agriculture and Agri-Food Canada, Lethbridge, AB

Corresponding author: **roland.kroebel@agr.gc.ca**

ABSTRACT

Greenhouse gas emissions (GHG) remain an important field of agricultural research. Apart from measuring, simulations are frequently used to investigate management impacts on GHG emissions. The HOLOS model has been developed (using country specific emission factors) to explore potential mitigation practices with respect to GHG emission reduction or increased carbon storage. However, avoided GHG emissions can create nutrient surpluses, and thus other environmental hazards (e.g., for human and/or ecosystem health). We propose to expand the "Virtual Farm" concept by connecting the budgets of carbon, nitrogen, and energy flows, and thus estimate environmental impacts as a function of management choices, environment, and climate influence. An improved HOLOS version has been equipped with a flexible interface to allow for different levels of data input complexity, and management of livestock production systems is now described on a monthly basis. Furthermore, initial tests to combine HOLOS with the carbon model ICBM in Norway have been promising, and will be further developed for Canadian farming systems. Additionally, HOLOS will be expanded with the Versatile Soil Moisture Budget (VSMB) model, the indicator for Residual Soil Nitrogen (RSN) and the Indicator for the Risk Of Water Contamination with Nitrogen (IROWC-N). The latter two will be combined with the Ammonia indicator to form a complete nitrogen budget. In a second development pathway, efforts will focus on Life Cycle Analysis (LCA), with the goal to assess carbon-, energy-, and potentially water footprints. The resulting tool is intended for transfer of emerging scientific findings, for educational use, and for exploring future management decisions.

Southeast Alberta voluntary conservation offset pilot: agriculture offset for industrial impacts on native prairie

Rob Dunn[1], Karen Raven and Tom Goddard

Alberta Agriculture and Rural Development, Environmental Stewardship Division, AB

[1]Corresponding author: rob.dunn@gov.ab.ca

ABSTRACT

The Government of Alberta is championing a voluntary conservation offset pilot in south-east Alberta in collaboration with industry and landowners. The pilot is led by Alberta Agriculture and Rural Development in partnership with ACA, Alberta Innovates Technology Futures, University of Calgary, LandWise Inc. and Alberta Environment and Sustainable Resource Development. This pilot is based on a voluntary offset of new industry development impacts on private and publicly owned native prairie within the Dry Mixed Grass prairie region (Brown soil zone). This area is home to a significant number of species at risk. Participating companies will offset their impact by purchasing contracts with private landowners who are willing to convert annually cultivated land into mixed native grasses. The contracts with farmers, and establishment of the native perennial species, will be managed through a third party (NGO) as will verification and inspections to ensure success and quantify offset results. Representatives from several industries have engaged in initial pilot development workshops, with landowners to be engaged in winter 2012/13. Since this pilot is in the early stages, the presentation will focus on early experiences and needs of creating a pilot project and the key components that have been developed to date. The presentation will also highlight some of the issues and milestones ahead.

Soil and crop management practices in Akmola, Kazakhstan and Alberta, Canada: Compare and contrast

Francis J. Larney[1]

Agriculture & Agri-Food Canada, 5403 1st Ave. S., Lethbridge, AB T1J 4B1

Mehklis Suleimenov

A.I. Barayev Scientific and Production Centre of Grain Farming, Shortandy, Akmola, Kazakhstan

[1]Corresponding author: francis.larney@agr.gc.ca

ABSTRACT

The steppe region of northern Kazakhstan (50–54 °N), has much in common with the Canadian prairies in terms of soils, climate and agriculture, but there are also differences. Black soils, with 5-8% organic matter, developed under grassland, occupy a substantial portion of the region. While summer (April-September) air temperatures for Astana in Akmola province are similar to Lethbridge (mean of 14.0 *vs*. 13.8 °C), winters are much colder (October-March, –10.4 *vs*. –1.0 °C). Mean annual precipitation is 25% higher at Lethbridge (399 mm *vs*. 318 mm), the major difference occurring in summer (294 mm Lethbridge *vs*. 200 mm, Astana) rather than winter (105 mm Lethbridge; 118 mm Astana). The optimum sowing dates for spring wheat are 20-25 May, a few weeks later than southern Alberta, because of a drier May-June and wetter July. Snow plays an important role amounting to 33% of total annual precipitation in Akmola. Snow accumulation by snow ridging or tall stubble is an important source of moisture on stubble land which is a key factor in continuous cropping to reduce fallow. Under the former Soviet Union, approximately 25 million ha of virgin grassland in northern Kazakhstan was ploughed in the 1950s, some 40-60 yrs after the Canadian prairies were first broken. Spring wheat is still the major crop grown in Akmola, but efforts are underway to diversify rotations to include oilseeds and legumes. Adoption of no-till in the region showed no significant differences in wheat yield compared to traditional tillage on heavy-textured soils.

Overview of the land classification for irrigation process in Alberta

Gerald Ontkean

Basin Water Management Branch, Alberta Agriculture and Rural Development, Lethbridge, AB

gerald.ontkean@gov.ab.ca

ABSTRACT

Land classification for irrigation is the systematic examination, description, appraisal, and grouping of land into classes on the basis of physical and chemical characteristics affecting its suitability for sustained production under irrigated agriculture. The purpose of land classification is to determine the extent and degree of suitability of land for irrigation. This will assist in allocating scarce water resources in an effective manner. Some form of land classification related to irrigation has been present in Alberta since 1915. The current Standards for the Classification of Land for Irrigation in the Province of Alberta (2004) are included in the Irrigation Act and Regulations (2000) making land classification prior to the obtaining of water rights within irrigation districts law in Alberta.

The process for producing a land classification report is described in the Procedures Manual for the Classification of Land in Alberta (2004). The number of inspection sites and soil samples required for analysis will vary depending on the level of intensity of the investigation and the size and nature of the areas being investigated. A Level II intensity of investigation is required to obtain water rights and no more than 15% of the proposed irrigable area can be classed as non-irrigable. Level II land classification reports are also conducted under the Water Act (agricultural feasibility reports) and the Environmental Protection and Enhancement Act (wastewater irrigation projects).

Individuals producing land classification reports must be trained in soil science (specifically soil classification), have the ability to conduct soil and terrain mapping, have read and understood the methodology of the classification system in Alberta, and be a Professional Agrologist (P.Ag) or an Agrologist in Training (AIT) working under a P.Ag.

Soil, water, and phosphorus: observations from the BMP project

Barry Olson[1], Janna Casson, Jollin Charest, Andrea Kalischuk, Lynda Miedema

Alberta Agriculture and Rural Development, Lethbridge, AB T1J 4V6

Wiebe Buruma

Alberta Agriculture and Rural Development, AB

[1]Corresponding author: barry.olson@gov.ab.ca

ABSTRACT

A 6-yr (2006-2012) study was carried out to evaluate the environmental effectiveness of beneficial management practices (BMPs) in Alberta. Study sites included two main agricultural watersheds: Indianfarm Creek (IFC) Watershed near Pincher Creek and Whelp Creek (WHC) Sub-watershed near Lacombe. In addition, two irrigated fields with a history of manure application were selected north of Lethbridge: Battersea Drain Field (BDF) site and Lower Little Bow River Field (LLB) site. Several BMP sites were selected in the IFC and WHC watersheds. At these BMP sites, and at the BDF and LLB sites, water quality was monitored for 2 to 4 yr. Then BMPs were implemented and water quality was monitored for another 2 to 4 yr. Water samples were analyzed for several parameters including total P and total dissolved P (TDP). Soil samples were analyzed for soil-test P (STP) in the top 15 cm. Biannual (spring and fall) average STP concentration ranged from 16 to 509 mg kg^{-1} among the BMP sites with cultivated fields. Fields with recent manure application tended to have elevated STP concentrations compared to fields without manure application. The two manured, irrigated fields had the highest STP concentration in excess of 200 mg kg^{-1} STP, and 3 yr without manure application resulted in no decrease in STP concentration. The majority of total P in runoff water at edge-of-field sites was in the form of TDP. The two irrigated sites with the highest STP concentrations also tended to have the highest TDP in runoff water.

Soil Fertility Technical Session

Thursday, February 21, 2013 – Morning

Narrow-row dry bean agronomy research: Row spacing, seeding rate and nitrogen fertilizer management.

Pat Pfiffner

Alberta Agriculture and Rural Development

Corresponding author: pat.pfiffner@gov.ab.ca

ABSTRACT

Dry bean is a very profitable irrigated crop grown in southern Alberta. Annual acreage averages 45 000 acres and contributes approximately 60 million dollars into the southern Alberta economy. Majority of acreage is grown in wide-row spacing ranging from 22” to 30”. Dry bean producers are interested in shifting to narrow-row spacing (7”-14”). This shift may potentially increase returns, improve soil quality and increase acreage. Irrigated field experiments are being conducted at three locations each year over 4 years (2010 – 2013). The research project is evaluating the impact of row spacing, seeding rate and N fertilizer management (N rates, N product and rhizobia benefit) on productivity. Results to date indicate that narrow-row treatments generally yield higher than wide-row treatments at higher seeding rates. Nitrogen fertilizer management results have indicated a strong nitrogen fertilizer rate response and a strong rhizobia benefit. Polymer coated urea (ESN) treatments have shown significant yield response in three out of nine site-years.

Optimizing variable rate fertilizer application in fields with spatial variability.

Doon Pauly[1], Ross McKenzie, and Chris Hietamaa

Alberta Agriculture and Rural Development, Lethbridge, AB

[1]Corresponding author: doon.pauly@gov.ab.ca

ABSTRACT

Equipment and engineering aspects of variable rate technology (VRT) are highly advanced, but a science-based approach to develop variable rate fertilizer "prescriptions" is lacking. A multi-year, multi-site study was initiated in 2010 to develop an understanding of the soil factors controlling yield potential, crop response to nitrogen fertility treatments applied across a variable landscape, and the consistency of treatment effects/crop responses within fields, between sites, and from year to year. Experimental sites with variable topography were selected at Coaldale, Raymond, Magrath, Claresholm and Vegreville. We assumed that landform and the effect of slope position on soil moisture would be a dominant factor in the development of variable rate prescriptions and collected data at upper, mid, and lower slope positions at every site. Surprisingly, soil NO_3^- levels were low at most slope positions at all sites in all years. Soil organic matter, P, K, and S levels tended to be low at upper slope positions and high at lower slope positions. In many cases, these nutrient level differences between upper and lower slope positions were quite large. Soil pH also varied consistently with landform and was high on upper slopes and low on lower slopes. Fertilizer treatments were applied in 2 m wide strips across the full length of each field (approximately 800 m). Treatments included sidebanded urea at 0, 30, 60, 90, 120, and 150 kg N ha^{-1} all with 25 kg P_2O_5 ha^{-1}, 60 kg N ha^{-1} sidebanded with 0 phosphate, sidebanded ESN at 60 kg N ha^{-1} with 25 kg P_2O_5 ha^{-1}, sidebanded 90 kg N ha^{-1} with phosphate and 50 kg K_2O ha^{-1}, sidebanded 90 kg N ha^{-1} with phosphate, potash, and 20 kg S ha^{-1}, and sidebanded 90 kg N ha^{-1} with phosphate, potash, sulphate, and micronutrients (3 kg B ha^{-1} and 5 kg Zn ha^{-1}). The experimental area was seeded to the same crop as the co-operator was growing on the surrounding area of the field. "Benchmarks" that included all fertilizer treatments were selected along the transects to give 3 to 5 representative areas for each slope position in each field. Benchmarks were cut to 10 m prior to harvesting. We often observed a significant slope effect, and usually had a step-wise response to increasing N fertility rates. In most cases the yield response curves for each slope position had the same shape and slope. To date we have not observed yield responses to ESN, P, K, S, or micronutrients. The project will continue in the field for the 2013 growing season.

Using soil and plant analysis to fine tune crop nutrient management, an Alberta case study

Tom Jensen[1], International Plant Nutrition Institute (IPNI), Saskatoon, SK

[1]Corresponding author: tjensen@ipni.net

ABSTRACT

Scouting of fields during a growing season can be a useful exercise to assess how well crops are being supplied with needed nutrients. It is important to be concerned about poor growth areas and try to determine what the yield limiting factors are. It can be helpful to take both soil samples and plant samples from poor growth and good growth areas for comparison. This presentation will discuss an actual field investigation to determine what can be done to improve growth of winter wheat on a farm in the Stavely area of southern Alberta. One of the important aspects of this study shows that using both soil test and plant analysis results is more informative than just one of these activities on it's own.

Greenhouse gas emissions following tillage reversal on a Black Chernozem and a Gray Luvisol in Alberta

B.M.R. Shahidi[1], M. Dyck

Department of Renewable Resources, University of Alberta, AB, Canada

S. Malhi

Agriculture and Agri-Food Canada, Melfort, SK, Canada

[1]Corresponding author: manjila@ualberta.ca

ABSTRACT

Agricultural soils under long-term no till management have been well known to sequester atmospheric carbon in soil organic matter and to reduce emissions of greenhouse gases. Our study aimed at quantifying CO2 and N2O emissions from Black Chernozems and Gray Luvisols managed under long-term (~ 30 years) no till after tillage reversal. Our study revealed that both CO2 and N2O emissions were stimulated by tillage reversal. Comparative studies showed that the short-term rates of CO2 and N2O emissions after tillage reversal were higher than the historical rates of sequestration after the adoption of long term no till. Since the time scales for comparing the sequestration and emission rates were so different, these results are expected and reasonable. These results indicate that increased soil carbon storage resulting from changes in agricultural management practices is reversible and that the potential for carbon sequestration is dependent on the long-term trends of management practices.

Manure management effects on nitrous oxide and ammonia fluxes in barley for silage

Guillermo Hernandez Ramirez[1]

Department of Renewable Resources, University of Alberta, Edmonton, AB

Len Kryzanowski

Alberta Agriculture and Rural Development, Edmonton, AB

Robert F. Grant

Department of Renewable Resources, University of Alberta, Edmonton, AB

[1]Corresponding author: ghernand@ualberta.ca

ABSTRACT

Nitrous oxide emissions and ammonia volatilization from cropland contribute to both economic nitrogen losses and adverse environmental consequences such as greenhouse effect and associated climate change. These outcomes can be exacerbated in fields where animal manure is recurrently applied. This study examines the effects of application rate and placement (i.e., injection vs. surface band) of spring-added liquid dairy manure on nitrous oxide and ammonia fluxes in barley grown for silage. From June to September 2012, highly frequent flux measurements (71 fluxes per day) were done using a closed-dynamic automatic chamber system and a Fourier transform infrared analyzer. Biweekly or weekly manual chamber measurements for nitrous oxide and daily acid-trap open-chamber measurements for ammonia were also undertaken. As expected, gaseous N losses in general increased with manure-N input rate. However, the most striking effects were driven by the choice of manure placement. Whereas manure injection in the soil increased nitrous oxide emissions, surface banding increased ammonia volatilization. This observed tradeoff between nitrous oxide emissions and ammonia volatilization as a function of manure placement practice indicates the contrasting soil conditions and processes leading to increased production and transport of these two different N gaseous species. Based on the holistic need of identifying best management practices, these results suggest that future studies should simultaneously examine multiple environmental effects relevant to the predominant climate and land use systems in order to provide well-balance mitigation strategies.

Forest, Riparian and Wetland Soils Technical Session

Thursday, February 21, 2013 – Morning

A case study of forest soil development following industrial disturbances

Amanda Schoonmaker[1]

NAIT Boreal Research Institute

Mark Dewey,

NAIT Forest Technology

Milo Mihailovich

Incremental Forest Technologies Ltd.

[1]Corresponding author: ASCHOONMAKER@nait.ca

ABSTRACT

Soil compaction of forest soils is a common consequence of many types of industrial disturbances. Fine-textured soils are particularly susceptible. In NW Alberta, fine-textured soils of marginal air-filled porosity are common and therefore there is a large proportion of area at high risk of compaction and/or soil massing, leading to the suggestion that it is important to improve understanding of this issue. Soil de-compaction tools are utilized in order to attempt to restore the functional characteristics pre-disturbance.

We present preliminary findings of a retrospective case study examining changes in soil properties within the effective rooting profile (0-30 cm). Our objectives were to: (1) quantify soil bulk density following use of common de-compaction treatments and compare these to both untreated and undisturbed soils and (2) quantify differences in soil physical properties between the types of disturbances.

In the summer and fall of 2012, bulk density of de-compacted chip decks (forestry related activity) and bulk density and soil resistance of reclaimed well sites were assessed. Sites were located in the Boreal mixedwood ecological area within 200 kilometers of Peace River, Alberta. Samples are currently being processed and results will be presented.

Soil carbon pool in three agroforestry systems across different soil-climatic zones in Alberta

M. Baah-Acheamfour[1], Scott X. Chang

Dept. of Renewable Resources, University of Alberta, Edmonton, AB

Edward. Bork

Dept. of Agricultural, Food and Nutritional Science, Edmonton, AB

[1]Corresponding author: mbaahach@ualberta.ca

ABSTRACT

In Alberta, the potential of agroforestry (AF) systems as a carbon (C) sink has not been adequately recognized, let alone exploited. Data on C sequestration in AF systems are scarce, resulting in gaps that need to be filled in order to promote agroforestry practices among landowners. The objective of this study was therefore to: (i) determine the soil organic C stored in the bulk soils of three AF systems (shelterbelt, natural hedgerow, and grazed aspen woodland) and their adjacent agricultural counterparts; (ii) investigate the distribution of soil organic C in soil size-fractions (i.e., 250-2000, 53-250, and <53 µm), in relation to the impact of agroforestry systems on soil organic C storage and distribution. Thirty-five sites (2 plots at each site with one of agroforestry system and one agricultural for a total of 70 plots), forming a north-south transect, were selected for this study. Soil samples (0-10 cm layer) were fractionated into the three size classes using a modified wet-sieving technique. We found that average soil C content within the shelterbelt (5.92 g kg^{-1}) and hedgerow (8.92 g kg^{-1}) were significantly greater than in their respective cultivated fields (4.31 and 4.43 g kg^{-1}). This increase is attributed in part to the accumulation of plant residue in the less frequently disturbed AF systems. Soil organic C content in the pastoral system (6.68 g kg^{-1}) as compared to the cultivated fields; this is consistent with the influence of the extensive fibrous root system of the grasses that characterize such system. In general, our result supports the hypothesis that AF systems contain more C in bulk and smaller soil size- fractions as compared with agricultural fields under similar ecological settings. Further research is needed to also quantify the C stored in deeper soil layers.

Evaluation of streambank fencing on environmental quality of lower Little Bow River and riparian zone

J.J. Miller[1], T.W. Curtis, T. Entz, and W.D. Willms

Agriculture and Agri-Food Canada, Lethbridge, AB

D. Chanasyk

Department of Renewable Resources, University of Alberta, Edmonton, AB

[1]Corresponding author: jim.miller@agr.gc.ca

ABSTRACT

The WEBs (Watershed Evaluation of BMPs) program is a national program funded by Agriculture and Agri-Food Canada, and was initiated in 2004. Various BMPs are being evaluated at nine watersheds across Canada, including the Lower Little Bow River watershed in southern Alberta. Streambank fencing is one of the BMPs that has been studied. A 800-m reach of the LLB River was fenced in 2011 and off-stream watering installed. We evaluated water quality, aquatic insects, and fish in the river, streambank erosion, and riparian health. We also studied vegetation, soil, and hydrologic properties of the cattle-excluded pasture associated with streambank fencing; as well as soil properties of the fenced and unfenced reaches. The findings from this BMP evaluation will be discussed.

Carbon dioxide dynamics of undisturbed natural reference fen ecosystems in the oil sands region of Alberta

Md. Sharif Mahmood[1] and Maria Strack

Dept. of Geography, University of Calgary, Calgary, AB

[1]Corresponding author: msmahmoo@ucalgary.ca

ABSTRACT

Peatlands play an important role in the global carbon cycle as a carbon sink ecosystem. It is estimated that peatlands are storing about one third of the global soil carbon. In Alberta where most of the oil sands are located, peatland covers about 65% of the landscape. As part of the lease agreement all oil sands operators must restore/reclaim the land as similar ecosystem after extraction activities. Baseline reference data is an important consideration in order to examine the success of reclaimed ecosystems. As carbon dynamics is one of the important ecosystem functions, this study investigated the carbon dioxide exchange of surface level vegetation in three different undisturbed natural peatlands near Fort McMurray, Alberta. These included poor fen (open poor fen, treed poor fen), rich fen and saline fen. We used chamber techniques to measure the carbon flux in the pre-installed collars. We investigated six replicate plots for each ecosystem types, three of which were hummock plots and three were hollow plots. The result showed that the measured net ecosystem exchange (NEE) was the largest sink at saline fen followed by open poor, treed poor and rich fen. In poor and rich fen hollow plots were most carbon dioxide accumulating plots but in saline fen it was reverse. Over the season NEE was low at the beginning of season for all plots but started to increase over the summer. NEE of these monitored plots was mostly controlled by vegetation biomass. Other important controlling factors included position of water table, and soil and air temperature.

Effect of drainage on microbiological communities in northern Alberta bogs

J. Graham[1], P. Dunfield and

Dept. of Biological Sciences, University of Calgary, CALGARY, AB

M. Strack

Dept. of Geography, University of Calgary, CALGARY, AB

[1]Corresponding author: jmgraham@ucalgary.ca

ABSTRACT

This study investigated the response of carbon cycling in a natural peatland and a peatland affected by water table drawdown to determine whether drought affects peat substrate quality and microbial diversity and how this response varies along a microtopographic and depth gradient.

Overall bacterial and archaeal communities were described by targeting the 16S rRNA gene using Pyrotag sequencing. The differences in pH, peat temperature and humification status were analyzed among both the microtopographic position and drainage treatments. As well, the concentrations of major anions such as acetate and formate were determined through High-Performance Liquid Chromatography (HPLC).

For functional bacteria, the most relatively abundant methanotroph (methane consuming bacteria) is *Methylocella* followed by *Methylosinus/Methylocystis*. For functional archaea, the overwhelming relatively abundant methanogen (methane producing archaea) is the *Methanomicrobiales* Rice Cluster II at 91% of all methanogens detected. Chao1, Shannon and Simpson diversity indices show temperature, humification and position to the water table as the significant drivers affecting microbial diversity, evenness and richness. Interestingly, we found an effect of pH in only one site as both the Chao1 and the Shannon indices decreased as pH increased in the drained site only. Overall, the diversity, evenness and richness of the microbial community were all found to be higher at the drained site over the control site. This may be partially explained by the changing vegetation community increasing the pH and the decreased water table at the drained site allowing for more diversified aerobic microorganisms.