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# PROGRAM AT A GLANCE - CANADIAN WORKSHOP

## JUNE 12 – 14, 2011

### SUNDAY, JUNE 12, 2011

16:00 – 20:30	Canadian Workshop Registration	Lobby
18:30 – 20:30	Ice Breaker	Galerie sur le parc

### MONDAY, JUNE 13, 2011

7:00 – 8:30	Welcome & Canadian Workshop Registration	Foyer
8:30 – 9:00	Welcome Words	Suzor-Côté
9:00 – 10:30	Communications <ul style="list-style-type: none"> <li>• International Mire Conservation Group</li> <li>• Newfoundland &amp; Labrador</li> <li>• Prince Edward Island</li> </ul>	Suzor-Côté
10:30 – 11:00	Break	Borduas / Foyer
11:00 – 12:15	Plenary Sessions <ul style="list-style-type: none"> <li>• Nova Scotia</li> <li>• New Brunswick</li> <li>• Minister of Natural Resources and Wildlife, Québec</li> </ul>	Suzor-Côté
12:15 – 13:30	Lunch	Borduas / Foyer
13:30 – 15:00	Communications <ul style="list-style-type: none"> <li>• Ontario</li> <li>• Manitoba</li> <li>• Saskatchewan</li> </ul>	Suzor-Côté
15:00 – 15:30	Break	Borduas / Foyer
15:30 – 16:15	Communications <ul style="list-style-type: none"> <li>• Québec</li> </ul>	Suzor-Côté
16:15 – 16:30	Guidelines for Tuesday Excursion	Suzor-Côté

### TUESDAY, JUNE 14, 2011

8:00 – 13:30	Excursion – Grande plée Bleue Peatland	Front of the hotel
13:30 – 15:00	Communications <ul style="list-style-type: none"> <li>• Alberta</li> <li>• British Columbia</li> <li>• Yukon</li> <li>• North Western Territories and Nunavut</li> </ul>	Suzor-Côté
15:00 – 15:30	Break	Borduas / Foyer
15:30 – 16:15	Communications <ul style="list-style-type: none"> <li>• Canadian Wildlife Federation</li> <li>• Canada Peatland Reporting</li> <li>• Wetlands International</li> </ul>	Suzor-Côté
16:15 – 17:00	Discussion Panel	Suzor-Côté
17:00 – 17:15	Planification for the Publication	Suzor-Côté

# PROGRAM AT A GLANCE – INTERNATIONAL SYMPOSIUM

## JUNE 14 – 16, 2011

### TUESDAY, JUNE 14, 2011

16:00 – 18:30	International Symposium Registration	Foyer
18:30 – 21:30	Welcome Cocktail	Foyer

### WEDNESDAY, JUNE 15, 2011

7:00 – 8:30	Welcome & Registration	Foyer
8:30 – 9:55	Plenary Session – <i>simultaneous translation</i>	Suzor-Côté-Krieghoff
9:55 – 10:15	<b>BREAK</b> - Throught the Exhibitors	Borduas / Foyer
10:15 – 12:00	<b>Scientific Sessions</b> Session 8 – Carbon and Climate Change Session 10 – Compost and Alternative Substrates Session 7 – Production of Berries in Bogs	Suzor-Côté Krieghoff Pilot
12:00 – 13:15	<b>LUNCH</b> - Throught the Exhibitors	Borduas / Foyer
13:15 – 15:45	<b>Scientific Sessions</b> Session 8 – Carbon and Climate Change Session 9 – Future of Regulations and Certification of Growing Media Based on Peat and Other Materials Session 11 – Properties of Organic Soils and Growing Media Session 1 – Fen Restoration	Suzor-Côté Krieghoff  Pilot 410
15:45 – 18:15	Poster Session and Refreshments	Place Montcalm
18:15 – 22:00	Banquet & Cultural Event	Chapelle du musée de l'Amérique française

### THURSDAY, JUNE 16, 2011

7:00 – 8:30	Welcome & Registration	Foyer
8:30 – 9:55	Plenary Session - <i>simultaneous translation</i>	Suzor-Côté-Krieghoff
9:55 – 10:15	<b>BREAK</b> - Throught the Exhibitors	Borduas / Foyer
10:15 – 12:00	<b>Scientific Sessions</b> Session 3 – Boreal Peatlands: Use, Management, and Conservation Session 2 – Restoration and Rehabilitation of Bog Peatlands Session 12 – Technology and Innovation Session 4 – Peatland Management in the Energy Sector	Suzor-Côté Krieghoff Pilot 410
12:00 – 13:15	<b>LUNCH</b> - Throught the Exhibitors	Borduas / Foyer
13:15 – 15:00	<b>Scientific Sessions</b> Session 3 - Boreal Peatlands: Use, Management, and Conservation Session 2 - Restoration and Rehabilitation of Bog Peatlands Session 6 – Cultivation of Sphagnum and Biomass Production Session 12 - Technology and Innovation Session 4 - Peatland Management in the Energy Sector Session 5 – Rewetting of Peatlands	Susor-Côté Krieghoff Krieghoff Pilot 410 410
15:00 – 15:15	<b>BREAK</b> - Throught the Exhibitors	Borduas / Foyer
15:15 – 16:15	<b>Scientific Sessions</b> Session 6 – Cultivation of Sphagnum and Biomass Production Session 13 – Management of Tropical Peatlands Session 5 - Rewetting of Peatlands	Krieghoff Pilot 410
16:15 – 17:15	Round Table	Suzor-Côté
17:15 – 20:30	Commercial Exhibit and BBQ	Van den Hende Garden

# ORAL PRESENTATIONS SCHEDULE – INTERNATIONAL SYMPOSIUM

## WEDNESDAY, JUNE 15, 2011

Room		Suzor-Côté	Krieghoff	Pilot	410
08:30	<b>Plenary Session</b> (simultaneous translation)	<ul style="list-style-type: none"> <li>Jean CARON</li> <li>Nigel ROULET</li> </ul>			
09:55	<b>BREAK</b> (Borduas / Foyer)				
10:15	<b>Scientific Sessions</b>	<b>S8 – Carbon and Climate Change</b> (simultaneous translation)	<b>S10 – Compost and Alternative Substrates</b>	<b>S7 – Production of Berries in Bogs</b>	
		<b>S8</b> Mats Nilsson*	<b>S10</b> Hans Verhagen*	<b>S7</b> Taimi Paal*	
10:45		<b>S8</b> Jim McLaughlin	<b>S10</b> Paul Alexander	<b>S7</b> Lakshaman Ranasinghe	
11:00		<b>S8</b> Andrey Sirin	<b>S10</b> Armin Blievernicht	<b>S7</b> Line Lapointe	
11:15		<b>S8</b> Angela Kross	<b>S10</b> Youbin Zheng	<b>S7</b> Sara Kristine Naess	
11:30		<b>S8</b> Tim Moore	<b>S10</b> Maria Dombrowski	<b>S7</b> Hilary Sandler	
11:45		<b>S8</b> Simon van Bellen	<b>S10</b> Jared Barnes		
12:00	<b>LUNCH</b> (Borduas)				
13:15	<b>Scientific Sessions</b>		<b>S9 – Future of Regulations and Certification of Growing Media Based on Peat and Other Materials</b>		<b>S1 – Fen Restoration</b>
13:30		<b>S8</b> Dan Charman*	<b>S9</b> Jack Rieley*	<b>S11 – Properties of Organic Soils and Growing Media</b>	<b>S1</b> Rodney Chimner*
13:45			<b>S9</b> Herbert Diemont*	<b>S11</b> Walter Wohanka*	<b>S1</b> Vicky Bérubé
14:00		<b>S8</b> Anne Quillet	<b>S9</b> Jaakko Silpola	<b>S11</b> Jean-Charles Michel*	<b>S1</b> Marie-Claire LeBlanc
14:15		<b>S8</b> Julie Talbot	<b>S9</b> Michael Keyes	<b>S11</b> Reza Nemati	<b>S1</b> Shannon Malloy
14:30		<b>S8</b> Derrick Lai	<b>S9</b> Marie-Luc Arpin	<b>S11</b> Jean-Pierre Fortin	<b>S1</b> James Bess
14:45		<b>S8</b> Florence R.-Wilson	<b>S9</b> Ed Bloodnick	<b>S11</b> Lakshman Ranasinghe	<b>S1</b> Flor Salvador
15:00		<b>S8</b> Juan Benavides	<b>S9</b> Laurent Largent	<b>S11</b> Guillaume Létourneau	<b>S1</b> Annemieke Kooijman*
15:15		<b>S8</b> Maria Strack*	<b>S9</b> Jerome Carr	<b>S11</b> Juichi Omote	
15:30					
15:45			<b>Poster Session and Refreshments</b> (Place Montcalm)		<b>Commission V Meeting</b>
16:00					
16:15					
16:30					
17:00					
17:30					
18:15			<b>Banquet</b> (with transportation to the Musée de l'Amérique française)		

\*Guest Speaker

# ORAL PRESENTATIONS SCHEDULE – INTERNATIONAL SYMPOSIUM

## THURSDAY, JUNE 16, 2011

Room	Suzor-Côté	Krieghoff	Pilot	410
08:30	<b>Plenary Session</b> (simultaneous translation)	<ul style="list-style-type: none"> <li>Michael RAVIV</li> <li>Jean-Pierre REVÉRET</li> </ul>		
09:55	<b>BREAK</b> (Borduas / Foyer)			
10:15	<b>Scientific Sessions</b>	<b>S3 – Boreal Peatlands: Use, Management, and Conservation</b> (simultaneous translation)	<b>S2 – Restoration and Rehabilitation of Bog Peatlands</b>	<b>S12 – Technology and Innovation</b>
		S3 Marcel Darveau	S2 Catherine Farrell*	S12 Paul Short*
10:30		S3 Tatiana Minayeva*		S4 Christine Daly*
10:45			S2 Triin Triisberg	S12 Rémi Bourgault
11:00		S3 Kevin Smith	S2 Roxane Andersen	S12 Rémi Bourgault
11:15		S3 Stéphanie Boudreau	S2 Rémy Pouliot	S12 Kathleen Blanchard
11:30		S3 Sylvain Jutras	S2 Lasse Aro	S12 Denis Pettigrew
11:45		S3 Clayton Rubec*	S2 Jacques Gagnon	S12 Jocelyn Boudreau
12:00	<b>LUNCH</b> (Borduas)			
13:15	<b>Scientific Sessions</b>	S3 Marcel Darveau	S2 - BDB**	S12 Julie Major*
13:30		S3 Frederic Reid	S2 - BDB**	S12 Yves Machraf
13:45		S3 Étienne Paradis	S2 - BDB**	S12 Younes Machraf
14:00		S3 Nicole Fenton	S2 - BDB**	S12 Claudia Lafreniere
14:15		S3 Marie Clément	S2 Edgar Karofeld*	S12 Sophie Rochefort
14:30		S3 Bin Xu		S12 Rémi Naasz
14:45		S3 Céline Macabiau	<b>S6 – Cultivation of Sphagnum and Biomass Production</b>	S12 Sophie Rochefort
			S6 Greta Gaudig	S5 Olivia Bragg
15:00	<b>BREAK</b> (Borduas / Foyer)			
15:15	<b>Scientific Sessions</b>		S6 Matthias Krebs	S13 – Management of Tropical Peatlands
				S13 Jack Rieley
15:30			S6 Anga Prager	S13 Lulie Melling
15:45			S6 Josée Landry	S13 Marcel Silvius*
16:00			S6 Sabine Whichmann	S5 Alona Armstrong*
16:15	<b>Round Table</b> (Suzor-Côté)	<b>ROUND TABLE</b> <b>"Towards improved responsible management of peatlands"</b> <ul style="list-style-type: none"> <li>What have we learned that we did not know 48 hrs before?</li> <li>What are the next steps?</li> <li>Recommendations, questions and solutions from participants</li> </ul>		
17:15	<b>Commercial Exhibit BBQ</b>	<b>Commercial Exhibit and BBQ</b> with transportation to the Van den Hende garden, Université Laval		

\*Guest Speaker

\*\* BDB: 1 hour on the Bois-des-Bel Project

## WELCOME WORDS OF THE CHAIRPERSONS

Dear participants,

On behalf of the *International Peat Society*, the *International Society for Horticultural Science*, *Université Laval* and the *Canadian symposium organizing committee*, we would like to welcome you to Québec city for this international venue on responsible peatland management and growing media production.

The symposium will focus on the latest information on the restoration of wetlands (fen, bog peatlands), with sessions on their use, management, and proper rewetting. Innovative work on *Sphagnum* and biomass production will also be presented. All this research work is the cornerstone for responsible usage and restoration of peatlands for the benefit of future societies. Hence, a strong emphasis will be on the final use of peat and how it can be efficiently incorporated in growing media and substrates.

The symposium will provide insights into future regulations and, current and pending certification, so that scientists are informed of upcoming constraints and will be able to fully participate in an efficient evolution of a growing debate.

As conveners, we wish you a fruitful symposium and beneficial exchanges on the multiple aspects of peatlands' use, restoration and regulations.

Bienvenue!

Jean Caron and Line Rochefort  
Co-chairs



## INTRODUCTION

The International Peat Society, the International Society for Horticultural Science, and the Canadian Symposium Organizing Committee are honored to welcome those interested in responsible peatland management and growing media production to attend this international symposium, which is held at the Loews Le Concorde Hotel, in Québec City, Canada.

The symposium includes a Canadian National Workshop entitled **Towards Sustainable Peatland Management in Canada**, organized by Dr. Michelle Garneau (Université du Québec à Montréal) and Dr. Line Rochefort (Université Laval). This workshop aims to facilitate the exchange of information, statistics and know-how on Canadian peatland management. Université Laval is the institution hosting these events.

## SCOPE OF THE INTERNATIONAL SYMPOSIUM

To address the increasing pressures of productivity, efficiency and responsibility, peat producers, and government agencies are embracing business models to achieve long-term viability and sustainability of the resources and products. The goals of this event are therefore to provide an opportunity to learn more about responsible peatland management, including environmental, social and economic values, peat usage and growing media practices.

The symposium aims to address public, grower and retail demand for objective science based information that addresses reduced peat use, peat alternative products and compost. It is intended to provide a forum for presentation of state-of-the-art results of experiments on growing performances of various media in greenhouse and nursery studies. Additionally, it aims to provide information on life-cycle of peat, reduced peat and peat free products.

Peatland management covers all forms of peatland uses ranging from peatland protection, plant and biomass production (*Sphagnum* culture), construction development, peat harvesting, all forms of after-use as well as non-use. Responsible peatland management respects the balanced stewardship of the environmental, social and economic values of peatlands involving local, regional and global aspirations. Thus all stakeholders having an interest in responsible peatland management are welcome to participate in this event.

## VENUE

### **Loews le Concorde Hotel**

1225, cours du Général-de-Montcalm  
Québec (Québec) G1R 4W6 Canada  
Telephone: 1 800 463-5256 (toll free)  
Fax: (1) 418-647-4710

Located near the Plains of Abraham and the Parliament, the Loews le Concorde Hotel offers all the comfort and technology needed to make this event a success. Delegates are only a few minute walk from Old Quebec and the many museums, restaurants and other attractions that are available in Québec City.

The Loews Le Concorde Hotel is committed to protect the environment through wide-ranging policies and practices. The hotel has received 4 Green Key Rating of the Official Green Key ECO-Rated Hotel.



Loews le Concorde Hotel

# COMMITTEES AND ORGANIZATIONS

## ORGANIZING COMMITTEE

- Chairmen: Dr. Line Rochefort and Dr. Jean Caron (Université Laval, Canada)
- Berger Peat Moss Ltd. (Canada)
- Martin Fafard (Association des producteurs de tourbe du Québec & Fafard et frères, Canada)
- Michelle Garneau (Université du Québec à Montréal, Canada)
- Martin Joly (Ministère du Développement durable, de l'Environnement et des Parcs du Québec)
- Sylvain Jutras (Université Laval, Canada)
- Geneviève Potvin (Association des producteurs de tourbe horticole du Québec, Canada)
- Premier Tech Horticulture (Canada)
- Paul Short (Canadian Sphagnum Peat Moss Association, Canada)
- Sun Gro Horticulture inc. (Canada)
- Jacques Thibault (Ministère des Ressources naturelles, Nouveau-Brunswick, Canada)
- Secretary: Claire Boismenu (Université Laval, Canada)

## SCIENTIFIC COMMITTEE

- Jean Caron (Canada, U. Laval, ISHS, IPS)
- Marcel Darveau (Canada, DU)
- Catherine Farrell (Ireland, Chair of IPS Commission V)
- Michelle Garneau (Canada, UQAM, SWS)
- Philippe Le Prestre (Canada, Institut EDS, U. Laval)
- Jean-Charles Michel (France, INH UMR, ISHS, IPS)
- Rémi Naasz (Canada, Premier Tech Horticulture, ISHS)
- Reza Nematì (Canada, Fafard et Frères Itée, ISHS, IPS)
- Jonathan S. Price (Canada, U. Waterloo, PERG)
- Michael Raviv (Israel, ISHS)
- Line Rochefort (Canada, IPS, SWS, IMCG, PERG)
- Nigel Roulet (Canada, McGill U., GEC3, PeatNet)
- Gerald Schmilewski (Germany, Chair of IPS Commission II)
- Wilfried Schnitzler (Germany, ISHS)
- Dale Vitt (USA, Southern Illinois U., PeatNet)





## SUPPORTING ORGANIZATIONS

### FOR THE INTERNATIONAL SYMPOSIUM:

- International Peat Society – IPS (<http://www.peatociety.org>)
- International Society for Horticultural Science – ISHS (<http://www.ishs.org/>)
- Society of Wetland Scientists – SWS (<http://www.sws.org/>)
- Canadian Sphagnum Peat Moss Association – CSPMA (<http://www.peatmoss.com/index.php>)
- Canadian Geophysical Union - Hydrology Section (<http://www.cgu-hs.ca/>)
- Canadian Society of Peat and Peatlands – CSPP
- Ducks Unlimited Canada (<http://www.ducks.ca/>)
- Université Laval (Québec, Canada) (<http://www.ulaval.ca/al2/web/index.html>)
- Association des producteurs de tourbe horticole du Québec – APTHQ ([www.horticulturalpeatmoss.com](http://www.horticulturalpeatmoss.com))
- New Brunswick Peat Producers Association – NBPPA
- Peatland Ecology Research Group – PERG (<http://www.gret-perg.ulaval.ca/>)
- PeatNet (<http://www.peatnet.siu.edu/>)
- Cercle des ambassadeurs de Québec (<http://www.cercledesambassadeurs.com/pages/apropos.htm>)
- Office de tourisme de Québec (<http://www.quebecregion.com/en>)

### FOR THE CANADIAN NATIONAL WORKSHOP:

- International Mire Conservation Group – IMCG (<http://www.imcg.net/>)
- Society of Wetland Scientists – Canada SWS (<http://www.sws.org/>)
- Université Laval (Québec, Canada) (<http://www.ulaval.ca/al2/web/index.html>)
- Peatland Ecology Research Group – PERG (<http://www.gret-perg.ulaval.ca/>)
- Centre d'études nordiques – CEN (<http://www.cen.ulaval.ca/>)
- Cercle des ambassadeurs de Québec (<http://www.cercledesambassadeurs.com/pages/apropos.htm>)
- Office de tourisme de Québec (<http://www.quebecregion.com/en>)

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## INTERNATIONAL PEAT SOCIETY

The **International Peat Society** (IPS) is a non-governmental, non-profit multidisciplinary organisation of scientific, industrial and regulatory members. Currently it has 1,450 individual and institutional members from 36 countries. The mission of the IPS is to bring people and organisations together to foster the advancement, exchange and communication of scientific, technical and social knowledge and understanding for the wise use of peatlands and peat. The vision of the IPS is to be the authoritative international organisation on all aspects of peatlands and peat.

To achieve its goals, the IPS via its Commissions and National Committees regularly organises conferences, symposia and workshops, publishes research results from science and industry and serves in general as a forum to bring together experts from different fields of business, science, culture and regulatory bodies dealing with peat and peatlands. The main activities of the International Peat Society are conducted through its nine Commissions that act as subject groups within specific fields. The International Symposium on Responsible Peatland Management and Growing Media Production is organised with the participation of **Commissions II (Industrial utilization of peat and peatlands)** and **V (After-use of cut-over peatlands)**.

For more information about the IPS: <http://www.peatsociety.org/>

## INTERNATIONAL SOCIETY FOR HORTICULTURAL SCIENCE

The **International Society for Horticultural Science** (ISHS), dating from 1864 and formally constituted in 1959, has more than 7000 members representing some 150 countries. It is a major source of up-to-date information on global horticultural research. The aim of the ISHS is "...to promote and encourage research and education in all branches of horticultural science and to facilitate cooperation and knowledge transfer on a global scale through its symposia and congresses, publications and scientific structure." It encourages the development of international co-operation, bringing together scientific and technical professionals to stimulate, facilitate and co-ordinate research and scientific activities on a global scale. It is the world's leading independent organization of horticultural scientists.

For more information about the ISHS: <http://www.ishs.org/>

# THE CANADIAN WORKSHOP

## JUNE 13 - 14, 2011

### TOWARDS SUSTAINABLE PEATLAND MANAGEMENT IN CANADA

#### CHAIRPERSONS

**Line Rochefort**, director of the Peatland Ecology Research Group, and **Michelle Garneau**, director of a Hydro-Québec chair, are hosting a Canadian workshop, entitled: **Towards Sustainable Peatland Management in Canada**.

This workshop will facilitate the exchange of information, statistics and know-how on Canadian peatland management. All stakeholders interested in the responsible management of Canadian peatlands are welcome and encourage participating in the discussions. Invited speakers from each Canadian provinces and territories and from the International Mire Conservation Group will give oral communications. Discussion periods are scheduled at the end of each talk to allow good integration of the information and networking.

#### WHY A CANADIAN WORKSHOP ON PEATLAND MANAGEMENT?

In recent years, the goods and ecological services of peatlands have gained much in recognition. Along with that, several fields of economic activities are moving north or in remote areas of Canada where peatland ecosystems are prominent. In the light of current and future developments, Canadians have a responsibility towards the protection and wise use of this productive habitat.

One-third of the boreal peatlands of the planet are concentrated on the Canadian territory. Hence, Canada has a global responsibility to protect this huge carbon sink and source of freshwater in a similar fashion that the global community is looking onto Brazil to protect rainforest and its rich biodiversity. But in reality “how much peatlands is there in Canada?”, “how much is protected or impacted by human?” etc. Several available statistics are just plain old, although some other are very detailed but accounting for a specific region. We are aware that a lot of work has been done since the seventies by the different provinces or territories, but we think it has become fundamental to exchange our latest data surveys. This is an invitation to share updates on peatland national inventory will help modellers and management to better predict or plan potential outcome in light of climate change. Sharing our different approaches on territorial or provincial management policies will also facilitate awareness on how to achieve responsible management of peatlands in the Canadian landscape.

A **field excursion** at an ecological peatland reserve (IUCN category I - Grande plée Bleue), near Québec City, is planned on **Tuesday, June 14, 2011** in the morning.

#### NATURAL PEATLAND ON THE SOUTH SHORE (GRANDE PLÉE BLEUE)

(organizer: Réal Carpentier, Ministère du Développement durable, de l'Environnement et des Parcs du Québec)

**Schedule:** Tuesday, June 14: departure at 8:00, arrival at 13:00.

**Description:** This peatland excursion will be hosted by the ministry of environment of the province of Québec as a show-case of the process of establishing an ecological reserve (level of protection 1 under the classification scheme of IUCN). The Grande plée Bleue peatland takes its name *Grande* from being a 15 km<sup>2</sup> peatland and *Bleue* for harbouring more than 400 natural pools. Historic of the land acquisition process will be presented as well as the current rewetting management actions to restore part of the former hydrological integrity of the peatland. Your assessment about the nomination of this site as a Ramsar site will be appreciated.

# DETAILED CANADIAN WORKSHOP PROGRAM

## JUNE 13 - 14, 2011

MONDAY JUNE 13, 2011

### Welcome Words

SUZOR-CÔTÉ

08:30 – 09:00	<p>Welcome and Introduction of the minister</p> <p><b>LINE ROCHEFORT</b> - Director of the Peatland Ecology Research Group and Co-Chair of the Symposium</p> <p><b>MICHELLE GARNEAU</b> – Director of Hydro-Quebec Research Chair and Peatland Ecosystems Dynamics and Climatic Change</p> <p><b>JEAN-SYLVAIN LEBEL</b> – Associate Deputy Minister in Mines, Québec</p> <p>Goal and functioning of the workshop – <b>LINE ROCHEFORT</b>, Director of the Peatland Ecology Research Group</p>
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### Canadian Workshop Communications

SUZOR-CÔTÉ

09:00 – 09:30	INTERNATIONAL MIRE CONSERVATION GROUP – <b>FRANCIS MULLER</b> , POLE-RELAIS TOURBIERES, FRANCE
09:30 – 10:00	NEWFOUNDLAND & LABRADOR – <b>ILKA BAUER</b> , MEMORIAL UNIVERSITY OF NEWFOUNDLAND
10:00 – 10:30	PRINCE EDWARD ISLAND – <b>RANDY DIBBLEE</b> , PEI DEPARTMENT OF ENVIRONMENT, ENERGY & FORESTRY

### BREAK

10:30 – 11:00	Borduas / Foyer
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### Canadian Workshop Communications

SUZOR-CÔTÉ

11:00 – 11:30	NOVA SCOTIA – <b>RANDY MILTON</b> , NOVA SCOTIA DEPARTMENT NATURAL RESOURCES
11:30 – 12:00	NEW BRUNSWICK – <b>JACQUES THIBAUT</b> , NB DEPARTMENT OF NATURAL RESOURCES
12:00 – 12:15	ORIENTATIONS MIN. NAT. RES (PEAT) – <b>PIERRE VERPAESLT</b> , MINISTRY OF NATURAL RESOURCES AND WILDLIFE, QUÉBEC

### LUNCH

12:15 – 13:30	Borduas / Foyer
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### Canadian Workshop Communications

SUZOR-CÔTÉ

13:30 – 14:00	ONTARIO – <b>JOHN RILEY</b> , NATURE CONSERVANCY CANADA
14:00 – 14:30	MANITOBA – <b>JAMES BAMBURAK</b> , MANITOBA GEOLOGICAL SURVEY
14:30 – 15:00	SASKATCHEWAN – <b>MICHAEL MCLAUGHLAN</b> , SASKATCHEWAN MINISTRY OF ENVIRONMENT, AND <b>JACQUES GAGNON</b> , PREMIER TECH HORTICULTURE

### BREAK

15:00 – 15:30	Borduas / Foyer
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### Canadian Workshop Communications

SUZOR-CÔTÉ

15:30 – 16:15	<p>QUÉBEC – <b>MARTIN JOLY</b>, MINISTRY OF SUSTAINABLE DEVELOPMENT, ENVIRONMENT AND PARKS, AND <b>LINE ROCHEFORT ET AL.</b>, PEATLAND ECOLOGY RESEARCH GROUP</p>
16:15 – 16:30	GUIDELINES FOR TUESDAY EXCURSION

TUESDAY JUNE 14, 2011

**FIELD EXCURSION - Grande plée Bleue Peatland**

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- 8:00 – 13:00      THE MANAGEMENT OF IUCN LEVEL 1 PROTECTED AREAS IN QUÉBEC
- YOU MUST BE PREREGISTERED TO ATTEND THIS FIELD TOUR
  - PLEASE MEET IN THE LOBBY AT 8 AM. BORDING AT 8:10 AM
  - ON THE WAY BACK, A LUNCH BOX WILL BE SERVED ON BOARD

**Free time and free lunch for those who did not registered to the excursion.**

**Canadian Workshop Communications**

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SUZOR-CÔTÉ

- 13:30 – 14:00      ALBERTA – **GERRY HEAKEL**, ALBERTA SUSTAINABLE RESOURCE DEVELOPMENT
- 14:00 – 14:30      BRITISH COLUMBIA – **TONY BUTTON**, BC MINISTRY OF ENVIRONMENT
- 14:30 – 15:00      YUKON – **KAREN MCKENNA**, CRYOGEOGRAPHIC CONSULTING  
NORTH WESTERN TERRITORIES AND NUNAVUT

**BREAK**

- 15:00 – 15:30      Borduas / Foyer

**Canadian Workshop Communications**

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SUZOR-CÔTÉ

- 15:30 – 15:45      CANADIAN WILDLIFE FEDERATION – **ROB JANZEN** -  
*PROGRESS AND CHALLENGES IN APPLYING PEATLAND SCIENCE TO DEVELOPMENT OF A CARBON OFFSET PROTOCOL*
- 15:45 – 16:00      CANADA PEATLAND REPORTING – **DOMINIQUE BLAIN**, ENVIRONMENT CANADA (TBC)
- 16:00 – 16:15      WETLANDS INTERNATIONAL – **TATIANA MINAEVA**, Wetlands International, Arctic Officer

SUZOR-CÔTÉ

**DISCUSSION PANEL**

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MODERATOR: M<sup>E</sup> ROBERT DAIGNEAULT

- 16:15 – 17:00

**PLANIFICATION FOR THE PUBLICATION**

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SUZOR-CÔTÉ

- 17:00 – 17:15

# THE INTERNATIONAL SYMPOSIUM

## KEYNOTE SPEAKERS – PLENARY SESSIONS

**WEDNESDAY, June 15, 2011, 8:30 to 9:55**

*(simultaneous translation English-French)*

Suzor-Côté - Krieghoff

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### TOWARDS RESPONSIBLE GROWING MEDIA MANUFACTURING IN NORTH AMERICA

**Jean Caron**, Ph. D.

Dept. of Soil Science and Agrifood Engineering, Horticultural Research Center, Université Laval, Québec, Québec, Canada  
([jean.caron@fsaa.ulaval.ca](mailto:jean.caron@fsaa.ulaval.ca))

Jean Caron is a Professor of Soil Physics at Université Laval since 1992. He earned a B. Sc in agronomy (1983), a M. Sc. in soil science (fertilisation of greenhouse tomatoes) in 1987 and a Ph.D. in soil physics at the University of Guelph in 1991. He has published more than 70 scientific papers and given more 190 conferences mostly on various aspects of water, solute and gas transport in growing media used in nurseries and greenhouses. He is actively involved in consulting and research with growing media manufacturing and with the greenhouse, nursery and fruit industry. Members of his team and himself have received more than 20 prizes and awards in provincial, national and international competitions for their contribution to knowledge and innovation.

**Abstract:** The growing media of industry is evolving in North America towards a responsible use of peat resources and peatland, an increased proportion of composted byproducts and other biomass, and an increased proportion of substrates containing biological agents. These changes are partly based on the introduction of new physical criteria for substrates design, having important consequences on the choice of materials and having different environmental impact on their use. This paper will compare different substrates of high quality, the basis behind their comparisons and the potential impact on C cycle, the cost of their manufacturing and the availability of the basic components associated with their manufacturing for the North American market.

WEDNESDAY, June 15, 2011, 8:30 to 9:55

*(simultaneous translation English-French)*

Suzor-Côté - Krieghoff

## PEATLANDS, CLIMATE CHANGE AND CARBON: THINGS WE SHOULD BE THINKING ABOUT FOR THE MANAGEMENT OF PEATLANDS IN A CHANGING WORLD

**Nigel Roulet**, Ph. D.Department of Geography, McGill University, Montreal, Québec, Canada ([nigel.roulet@mcgill.ca](mailto:nigel.roulet@mcgill.ca))

Dr. Nigel T. Roulet is a James McGill Professor of Biogeosciences in the Department of Geography. He was the Director of the McGill School of Environment from 2003 to June 2008 and the Director of the Centre for Climate and Global Change Research at McGill University from 1996 until 2002. He is currently serving as the Group Chair of the Geosciences for the Natural Sciences and Engineering Research Council of Canada's Discovery Grants and Scholarships program. Nigel's research interests focus on the interactions among hydrology, climatology, and ecosystems processes in the temperate, boreal, and arctic regions. He has published over 140 scientific papers, book chapters and monographs and was a contributing author to the 2<sup>nd</sup> through 4<sup>th</sup> scientific assessments of climate change by the United Nation's Intergovernmental Panel on Climate Change. Nigel also recently served as a member of the Ontario Far North Act Science Advisory Panel (2008-2010).

**Abstract:** Peatlands store about 25% of the world's terrestrial carbon and they are present-day, small but persistent sinks for atmospheric CO<sub>2</sub> and globally significant sources of atmospheric CH<sub>4</sub>. Peatlands have played a global significant role in the carbon cycle and climate throughout the last 12,000 years resulting in a net radiative cooling that is equivalent to a ~ 20%, offset of the warming attributed to the anthropogenic emissions of greenhouse gases. Peatland carbon dynamics are intimately connected to hydrology, which in turn is a function of the exchanges of water and energy with the atmosphere and the laterally with the surrounding landscape. With climate change the exchanges of water and energy with the atmosphere will alter the storage of water, and changes in land use, whether on the peatland itself or within the watershed can alter the internal hydraulic properties and/or the lateral exchanges. These changes, will in turn, alter the rates and pathways of the carbon biogeochemistry and if the changes are persistent and/or destructive the vegetation structure will also change. However, peatlands are to some extent complex adaptive systems, meaning they possess a set of tightly coupled feedbacks mechanisms that result in a form of self-regulation. A central question for managers and planners to consider is whether external forces (e.g. climate change) or direct actions by human development alter the peatland enough to create a situation where the peatland move beyond the ability of the feedback mechanisms to self-regulate. The time period over which the self-regulation can re-establish the peatland to its natural trajectory is also critical to management questions. In terms of climate change the current relevant time periods are less than a century. Over the last decade the carbon stored and exchanges from natural ecosystems have become part of the discussions of the management of atmospheric greenhouse gas concentrations. Many developing countries are advocating compensation for the maintenance of their natural carbon stores – i.e. the cost of deferred development. In some jurisdictions the carbon stores and carbon function of peatlands is becoming one of the ecological processes and function in legislation, and/or land-use guidelines, policies and land-use planning practices. The emergence of these views in relation to carbon stores and ecosystem functions place an additional and different set of demands on the management of peatlands. Both a qualitative and quantitative assessment of the change in carbon and greenhouse function of peatlands are emerging as a new information need in the policy and planning process. Since the emergence of greenhouse gas emission registries and international protocols, carbon has gained a 'real' currency – i.e. carbon now has a price and is traded as a commodity. This means that both the indirect and direct anthropogenic changes to peatlands have real costs and hence the management of the carbon and greenhouse balance of peatlands takes on a new significance.

THURSDAY, June 16, 2011, 8:30 to 9:55

(simultaneous translation English-French)

Suzor-Côté - Krieghoff

THE FUTURE OF COMPOSTS AS INGREDIENTS OF GROWING MEDIA

**Michael Raviv**, Ph. D.

Dept. of Environmental Horticulture, Agricultural Research Organization, Neve Ya'ar Research Center, Israel  
([mraviv@volcani.agri.gov.il](mailto:mraviv@volcani.agri.gov.il))

Prof. Michael Raviv is affiliated to the Agricultural Research Organization, Ministry of Agriculture, Israel, and works in Neve Ya'ar Research Center, Northern Israel since 1979. For many years the focus of his work was plant production in various soilless media, which led him to initiate and to edit (together with Prof. J.H. Lieth, UC Davis), the book: **Soilless Culture – Theory and Practice** (2008, Elsevier, [http://www.elsevier.com/wps/find/bookaudience.cws\\_home/713460/description#audience](http://www.elsevier.com/wps/find/bookaudience.cws_home/713460/description#audience)). Since 1993 Prof. Raviv is dealing with research in Organic Agriculture. His main interest is in composting, the different uses of composts, and especially the use of composts as suppressive agents against soil-borne diseases. Since 1995 Prof. Raviv is teaching the only academic course on Organic Agriculture in Israel, in the Hebrew University, Faculty of Agriculture, Rehovot. Over the years he published 75 papers in peer-reviewed journals, 13 chapters in books, 25 articles in professional magazines in English and 59 articles in professional magazines in Hebrew. In addition, he edited 7 books.

**Abstract:** In the last several decades more and more food and cut flowers are grown in soilless media due to their inherent advantages. Recently, peat used in these substrates has been gradually replaced by composts. Limitations to the use of composts as ingredients of growing media are their physical properties, salinity, high pH and rate of residual degradation with time. As a result, normally the fraction of the compost in the mixture should not exceed 50%, although some exceptions exist. Advantages of composts as ingredients of growing media include their low cost, nutritional contribution and suppressiveness against soil-borne diseases. It can be concluded that the use of compost in growing media will continue to grow. Required future research, among others, should study the linkage between composting techniques and compost characteristics and predicted performance. The effect of compost storage on the shelf life of its desirable properties should also be studied.



THURSDAY, June 16, 2011, 8:30 to 9:55

*(simultaneous translation English-French)*

Suzor-Côté - Krieghoff

## SOCIETY AND SUSTAINABLE MANAGEMENT OF PEATLANDS

**Jean-Pierre Revéret**, Ph. D.Département stratégie, responsabilité sociale et environnementale, Université du Québec à Montréal, Montréal, Québec, Canada  
([reveret.jean-pierre@uqam.ca](mailto:reveret.jean-pierre@uqam.ca))

Jean-Pierre Revéret holds a Master in development economics and a Ph.D. in Economics of the Environment and Natural Resources from the University of Clermont in France as well as a Postgraduate Degree in Applied Ecology. He is full professor at the University of Quebec in Montreal, in the department of Strategy, social and environmental responsibility. He has taught in universities in France, the UK, Switzerland and Egypt. He created and headed the department of Environmental management at Senghor University (Alexandria, Egypt) from 1991 to 1993. He is co-holder of the **International Chair in Life Cycle Analysis** at CIRAIQ a world leader research center in LCA based at the Montreal Polytechnic School. Jean-Pierre is also vice President of Group AGECO a consulting firm, initially a spin off from Laval University specialized in economic analysis of the food and agri-food sector, natural resources and the environment. His field of expertise includes environmental and natural resources management, impact and sustainability assessment, environmental evaluation and social lifecycle analysis. His research deals with the economic valuation of Ecological Goods and Services, particularly in the context of agro-ecosystems and with the development of methodologies for socio-economic lifecycle analysis of products. He is one of the co-authors of the UNEP-SETAC guidelines for social life cycle analysis published in 2009. He is a member of the Environment and sustainable Development committee of IDF Canada.

**Abstract:** During this session, we will discuss reopening the debate on responsible management and its relationship with sustainable development within the scientific community and review the basic definitions on these subjects. Since the Earth Summit in Rio, almost 20 years ago, the message that industrialized countries should change their production and consumption patterns has been heard worldwide but not implemented at an even pace. However it is through practice in different countries and sectors that sustainable development is acquiring some substantial meaning. We shall explore how some key concepts were debated and put at work while a number of new Tools were developed besides some traditional ones in the management of human affairs. We shall cover the recent evolution of Corporate Social Responsibility, the emergence of the triple bottom line concept in performance evaluation, the increasing role of stakeholders, the still new concept of ecological goods and services, all calling for responsible management of resources. A series of new Tools like Life Cycle Analysis, both environmental and social, reporting Tools, new economic instruments, make it possible to implement the willingness to change and do it efficiently. Some sectors are acting collectively faster than others, we shall point the leaders, but most are “en route” to a new way of making decisions and producing goods and services.

# DESCRIPTION OF THE SCIENTIFIC SESSIONS

## SESSION 1 – FEN RESTORATION

Guest Speakers: **Dr. Rodney A. Chimner** (Michigan Technological University, USA) and **Dr. Annemieke Kooijman** (University of Amsterdam, The Netherlands)

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Organised and chaired by: Line Rochefort (Industrial NSERC Research Chair in Peatland Management, Université Laval, Canada) and Jonathan S. Price (University of Waterloo, Canada)

Disturbed fens do not spontaneously develop back their characteristic ecological functions because of changes in hydrology, peat physical and chemical properties, frost heaving, invasive competition, etc., and often because of changes in the surrounding landscape that recharges fens. We invite papers that address the biotic and abiotic changes associated with fen function, particularly as it relates to their restoration.

## SESSION 2 – RESTORATION AND REHABILITATION OF BOG PEATLANDS

Guest Speaker: **Dr. Edgar Karofeld** (Tallinn Pedagogical University, Estonia) and **Catherine Farrell** (Bord na Móna, Ireland)

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Organised and chaired by: Catherine Farrell (Bord na Mona, Ireland, and Chair of IPS Commission V)

Peatlands that have been degraded generally require some form of 'positive management' to either restore the peatland to its former condition; and/or to rehabilitate the degraded peatland to enhance ecosystem services in terms of for example: biodiversity, water management and/or carbon sequestration. This session will focus on practical applications of restoration and rehabilitation, with the success of different measures evaluated. It is hoped to compare different approaches and how these relate to: legislative instruments at regional and national levels; cause and degree of degradation; practical management (short and long term) and value for investment (in terms of real and likely successes or failures of restoration and/or rehabilitation measures). Value is to be considered as social, environmental or economic.

## SESSION 3 – BOREAL PEATLANDS: USE, MANAGEMENT, AND CONSERVATION

Guest Speakers: **Dr. Tatiana Minayeva** (Wetlands International, Russia) and **Clayton Rubec** (Centre for Environmental Stewardship and Conservation, Canada)

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Organised and chaired by: Marcel Darveau (Ducks Unlimited, Canada)

Boreal peatland distribution, characteristics, human use and alteration are likely to vary across the hemisphere. The session will start with a series of invited papers that will contrast wetland inventories with a special focus on peatlands, historical uses of peatlands, and threats to these ecosystems in boreal Eurasia and North America. We will also explore approaches for land use planning and conservation targets determination for the boreal region. Contributed papers will complement the boreal session.

## SESSION 4 – PEATLAND MANAGEMENT IN THE ENERGY SECTOR

Guest speakers: **Christine Daly** (Suncor Energy Inc., Canada) and **Carla Wytrykush** (Syncrude Canada Ltd., Canada)

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Organised and chaired by: Dale Vitt (Southern Illinois University, USA)

Peatlands are one of the dominant habitat in the oil sands region in Northern Alberta. Their abundance makes it inevitable for them to be impacted during the petrol extraction process. Management of peatlands within a high salinity environment is challenging. We invite papers that explore solution to reclaim or recreate peatlands on post-tar sand extraction sites. Subjects related to reclamation planning and overall management of peatlands in Northern Alberta are welcome.

## SESSION 5 – REWETTING OF PEATLANDS

Guest Speakers: **Martin Evans** (University of Manchester, UK) and **Alona Armstrong** (University of Glasgow, UK)

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Organised and chaired by: Jonathan S. Price (University of Waterloo, Canada)

Rewetting of disturbed peatlands is usually the first step in restoration since their hydrology dictates their biogeochemical and ecological function. We invite papers that examine the cause and effect of disturbances and particularly the planning, implementation and assessment of rewetting.

## SESSION 6 – CULTIVATION OF SPHAGNUM AND BIOMASS PRODUCTION

Organised by: Line Rochefort (Industrial NSERC Research Chair in Peatland Management, Université Laval, Canada)

Chaired by: Greta Gaudig (University of Greifswald, Germany)

The production and processing of peat-based media has become a precondition for horticulture. It is apparent there will be a continued demand on the peat resource for the future. However, peat extraction is damaging natural mire ecosystems that play a vital role in global C cycling. Thus, responsible management commands to seek the production of *Sphagnum* biomass on a renewable basis. Papers on the subject of promoting *Sphagnum* growth in a context of harvesting biomass are invited to participate in this session.

## SESSION 7 – PRODUCTION OF BERRIES IN BOGS

Guest Speaker: **Dr. Taimi Paal** (Estonian University of Life Sciences, Estonia)

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Organised and chaired by: Line Lapointe (Université Laval, Canada)

Cultivation of berries in cutover peatlands has grown over the last 10 years in Canada, but also in Northern Europe and Russia. Many species, either wild or recently domesticated, are being cultivated including *Vaccinium* species, *Rubus chamaemorus* and *Photinia melanocarpa*. However, much research and development are needed to optimise their yield in cutover peatlands.

## SESSION 8 – CARBON AND CLIMATE CHANGE

Guest Speakers: **Dr. Mats Nilsson** (Swedish University of Agricultural Sciences, Sweden), **Dr. Maria Strack** (University of Calgary, Canada), and **Prof. Dan Charman** (University of Exeter, UK)

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Organised and chaired by: Nigel Roulet (McGill University, Canada) and Michelle Garneau (Université du Québec à Montréal, Canada)

Peatlands are one of the largest stores of terrestrial carbon. Many peatlands continue to accumulate carbon, therefore remove CO<sub>2</sub> from the atmosphere, but they are also a source of atmospheric methane (CH<sub>4</sub>). Observations and experiments indicate there are many factors that control the sink and source strength for CO<sub>2</sub> and CH<sub>4</sub>, including the importance of climate related factors of the input and outputs of moisture and the thermal regime of a peatland. Most peatlands are located at latitudes that are projected to see greater than average increases in temperature over the next century and recent modelling effort suggest these changes could lead to a reduction of the carbon sink in peatlands, and even a reversal - i.e. peatland become a source of CO<sub>2</sub>, in some scenarios. In addition to climate change, as 10-20% of total peatlands have been drained for agriculture and forestry since 1800, direct and indirect human pressure on these ecosystems can affect the controls on their carbon balance and hence, an important obstacle to meeting the aim of stabilizing greenhouse gas emissions. With the push to include ecosystem carbon dynamics in global carbon models and the discussions of natural carbon stores in future carbon trading schemes make it imperative that peatland management has a sound basis in an ecological understanding of their structure and function in relation to carbon exchanges.

## **SESSION 9 – FUTURE OF REGULATIONS AND CERTIFICATION OF GROWING MEDIA BASED ON PEAT AND OTHER MATERIALS**

*Guest Speakers: **Prof. Dr. Jack Rieley** (International Peat Society, UK) and **Dr. Herbert Diemont** (Alterra, The Netherlands)*

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Organised and chaired by: Gerald Schmilewski (Klasmann-Deilmann GmbH, Germany, and Chair of IPS Commission II)

Still fifty years ago peat extraction was less affected by regulations as fen and bog development was effectively supported by governments. Today peat extraction and the production of growing media and constituents thereof are subject to numerous regulations and increasing numbers of environmentally or market driven certification systems that require certain standards. This session will outline present and future impacts that regulations and certification systems have and will have in decades to come. The question of sustainable/responsible growing media production and horticultural crop production will be discussed by dealing with the pros and cons of national, regional and international regulations, life cycle assessments and certification systems.

The session will include topics such as: existing regulations for peat extraction (and after-use); schemes for sustainable growing media production; strategies for responsible peatland management; regulations on growing media (and growing media constituents); European Committee for Standardization (CEN) standards as the basis for a European Regulation for growing media; growing media certification according to quality assurance systems; Life Cycle Assessment of growing media and constituents thereof; regulations for import of growing media; how do growing media producers see their role in sustaining their production in a responsible way; sustainable horticultural crop production; organic farming.

## **SESSION 10 – COMPOST AND ALTERNATIVE SUBSTRATES**

*Guest Speaker: **Hans Verhagen** (Foundation RHP, The Netherlands)*

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Organised by: Jean Caron (Université Laval, Canada); chaired by Hans Verhagen (Foundation RHP, The Netherlands)

This session will focus on:

- Quality demands for application of constituents in growing media;
- Interaction of constituents in growing media in case of physical, nutritional and biological behavior;
- Analytical approach of new constituents for growing media.

## **SESSION 11 – PROPERTIES OF ORGANIC SOILS AND GROWING MEDIA**

*Guest Speakers: **Dr. Jean-Charles Michel** (Institut National d'Horticulture UMR, France) and **Prof. Dr. Walter Wohanka** (Forschungsanstalt Geisenheim, Germany)*

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Organised and chaired by: Jean-Charles Michel (Institut National d'Horticulture UMR, France)

The session aims to present, on the basis of recent methodological developments, relevant indicators of the physico-hydrological, bio-chemical and microbiological quality of soils or culture mediums containing organic matter.

## **SESSION 12 – TECHNOLOGY AND INNOVATION**

*Guest Speakers: **Julie Major** (independant consultant, Canada) and **Paul Short** (Canadian Sphagnum Peat Moss Association, Canada)*

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Organised and chaired by: Rémi Naasz (Premier Tech Horticulture, Canada) and Reza Nemati (Fafard et Frères Itée, Canada)

This session focuses on all technology and innovation associated with peat and substrates mainly destined to use for greenhouse and nursery production. More emphasis will put on the latest innovation and technology related to peat harvesting, manufacturing processing, peat transformation, handling and shipping dealing with a sustainable/responsible approach. This session will also highlight the latest innovation and technology concerning biological control and biostimulants agents used as sustainable alternative in greenhouse production. Innovative peat utilization, other than growing media, will be also considered with a particular attention.

## **SESSION 13 – MANAGEMENT OF TROPICAL PEATLANDS**

*Guest Speaker: **Marcel Silvius** (Wetlands International, The Netherlands)*

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Chaired by: Dr. Jack Rieley (UK Peat Society)

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# DETAILED INTERNATIONAL SYMPOSIUM PROGRAM

## JUNE 14 - 16, 2011

### TUESDAY, JUNE 14, 2011

International Symposium Registration  
16:00 – 18:30

Foyer

Welcome Cocktail  
18:30 – 21:30

Foyer

### WEDNESDAY, JUNE 15, 2011

#### PLENARY SESSION

#### KEYNOTE SPEAKERS (*Simultaneous Translation*)

Suzor-Côté-Krieghoff

8:30 – 9:55 TOWARDS RESPONSIBLE GROWING MEDIA MANUFACTURING IN NORTH AMERICA  
**Jean Caron, Ph. D.**

PEATLANDS, CLIMATE CHANGE AND CARBON: THINGS WE SHOULD BE THINKING ABOUT FOR THE MANAGEMENT OF  
PEATLANDS IN A CHANGING WORLD  
**Nigel Roulet, Ph. D.**

#### BREAK

9:55 – 10:15

Borduas / Foyer

#### SCIENTIFIC SESSIONS

#### SESSION 8 – CARBON AND CLIMATE CHANGE

(*Simultaneous Translation*)

Suzor-Côté

10:15 – 10:45 CARBON BALANCES OF NORTHERN PEATLANDS  
**Mats Nilsson\***

10:45 – 11:00 ONTARIO FAR NORTH PEATLAND CARBON STORAGE AND SEQUESTRATION: WHAT ARE OUR MANAGEMENT OPTIONS?  
**Jim McLaughlin, K. Webster, B. Hamel and C. Akumu**

11:00 – 11:15 C-GREENHOUSE GAS EMISSIONS FROM DRAIN DITCHES OF ANTHROPOGENICALLY CHANGED PEATLANDS  
**Andrey Sirin, G. Suvorov, M. Glagolev, M. Chistotin, I. Kravchenko, A. Kizilova and N. Bazhin**

11:15 – 11:30 THE PHENOLOGY OF CARBON DIOXIDE EXCHANGE IN NORTHERN PEATLANDS: PATTERNS AND DRIVERS  
**Angela Kross, N.T. Roulet and T. Moore**

11:30 – 11:45 LITTER DECOMPOSITION IN EASTERN CANADIAN PEATLANDS  
**Tim Moore**

11:45 – 12:00 HOLOCENE CARBON ACCUMULATION RATES FROM THREE OMBROTROPHIC PEATLANDS IN BOREAL QUEBEC: IMPACT OF  
CLIMATE-DRIVEN ECOHYDROLOGICAL CHANGE  
**Simon van Bellen, M. Garneau and R.K. Booth**

**SESSION 10 – COMPOST AND ALTERNATIVE SUBSTRATES**

Krieghoff

10:15 – 10:45	FROM CONVERSION OF WASTE TO PRODUCTION OF GROWING MEDIA CONSTITUENTS; CHANGE OF FOCUS <b><u>Hans Verhagen*</u></b>
10:45 – 11:00	GROWING MARKET SHARE – BARRIERS TO UPTAKE OF PEAT-FREE GROWING MEDIA BY UK AMATEUR GARDENERS <b><u>Paul D. Alexander</u> and <u>R.H. Williams</u></b>
11:00 – 11:15	THE POTENTIAL OF <i>SPHAGNUM</i> SP. BIOMASS AS A COMPONENT OF GROWING MEDIA <b><u>Armin Blievernicht</u>, <u>S. Irrgang</u> and <u>S. Kumar</u></b>
11:15 – 11:30	ALTERNATIVE GROWING SUBSTRATE RESEARCH IN CANADA <b><u>Youbin Zheng</u> and <u>M. Dixon</u></b>
11:30 – 11:45	SUSTAINABLE GROWING SUBSTRATES FOR POTTED GREENHOUSE GERBERA PRODUCTION <b><u>Maria Dombrowsky</u>, <u>M. Dixon</u> and <u>Y. Zheng</u></b>
11:45 – 12:00	IMPACT OF DAIRY MANURE COMPOST AND WATER CONTENT ON WETTABILITY AND DENSITY IN PEAT MOSS-PERLITE ROOT SUBSTRATE <b><u>Jared Barnes</u>, <u>P. Nelson</u>, <u>K.Y. Jeong</u>, <u>W.C. Fonteno</u>, <u>B. Whipker</u> and <u>J. Frantz</u></b>

**SESSION 7 – PRODUCTION OF BERRIES IN BOGS**

Pilot

10:15 – 10:45	REHABILITATION OF EXHAUSTED MILLED PEATFIELDS WITH WILD BERRY PLANTS IN ESTONIA <b><u>Taimi Paal*</u>, <u>M. Starast</u> and <u>K. Karp</u></b>
10:45 – 11:00	STUDIES ON GROWING CROPS ON HARVESTED PEATLANDS IN NEW BRUNSWICK, CANADA <b><u>Lakshaman L. Ranasinghe</u>, <u>G. E. Williston</u> and <u>R. McIntyre</u></b>
11:00 – 11:15	BERRIES IN BOIS-DES-BEL PEATLAND – 10 YEARS AFTER RESTORATION <b><u>Line Lapointe</u>, <u>J. Bussières</u>, <u>M.C. LeBlanc</u> and <u>L. Rochefort</u></b>
11:15 – 11:30	HONEYBEES AND SNOW TRAPPING: LOW IMPACT METHODS OF INCREASING CLOUDBERRY YIELDS IN UNDISTURBED PEAT BOGS <b><u>Sara Kristine Naess</u></b>
11:30 – 11:45	ADOPTION OF PEST AND NUTRIENT MANAGEMENT PRACTICES THAT REDUCE INPUTS AND IMPROVE EFFICACY IN MASSACHUSETTS CRANBERRY PRODUCTION <b><u>Hilary A. Sandler</u>, <u>C.J. DeMoranville</u>, <u>M.M. Sylvia</u>, <u>A.L. Averill</u> and <u>F.L. Caruso</u></b>
11:45 – 12:00	

**LUNCH**

12:00 – 13:15

Borduas / Foyer

**SESSION 8 – CARBON AND CLIMATE CHANGE**

Suzor-Côté

13:30 – 14:00	PEATLAND CARBON ACCUMULATION AND CLIMATE CHANGE DURING THE LAST MILLENNIUM <b><u>Dan Charman*</u></b>
14:00 – 14:15	IDENTIFYING KEY PROCESSES IN PEATLAND DEVELOPMENT WITH THE HOLOCENE PEAT MODEL <b><u>Anne Quillet, M. Garneau, S. Frolking and N.T. Roulet</u></b>
14:15 – 14:30	THE RESPONSES OF PEATLANDS TO DRYING AND TEMPERATURE INCREASES OVER THE 21 <sup>ST</sup> CENTURY: A MODELLING STUDY <b><u>Julie Talbot, S. Frolking and D. Wisser</u></b>
14:30 – 14:45	SPATIAL AND TEMPORAL VARIATIONS OF METHANE FLUXES MEASURED BY AUTOCHAMBERS AT THE OMBROTROPHIC MER BLEUE BOG <b><u>Derrick Y.F. Lai, N.T. Roulet, T.R. Moore, E.R. Humphreys and M. Dalva</u></b>
14:45 – 15:00	CALISTO: CARBON LOSS FROM HISTOSOLS <b><u>Florence Renou-Wilson, D. Wilson, B. Foy and C. Mueller</u></b>
15:00 – 15:15	CARBON AND ORGANIC MATTER ACCUMULATION PATTERNS IN HIGH ELEVATION PEATLANDS OF THE NORTHERN ANDES AND THEIR RESPONSE TO THE GRADIENTS OF ELEVATION AND HUMAN DISTURBANCE <b><u>Juan Benavides, D.H. Vitt and R.K. Wieder</u></b>
15:15 – 15:30	EFFECT OF HARVESTING AND RESTORATION ON GREENHOUSE GAS EXCHANGE FROM CANADIAN PEATLANDS <b><u>Maria Strack*, Y.C.A. Zuback, M.S. Mahmood and J.M. Waddington</u></b>

**SESSION 9 – FUTURE OF REGULATIONS AND CERTIFICATION OF GROWING MEDIA BASED ON PEAT AND OTHER MATERIALS**

Krieghoff

13:15 – 13:45	STRATEGY FOR RESPONSIBLE PEATLAND MANAGEMENT - WHAT NEXT? <b><u>Jack Rieley*</u></b>
13:45 – 14:15	ENHANCING THE SUSTAINABILITY OF THE PEAT SUPPLY CHAIN FOR DUTCH HORTICULTURE <b><u>Hein Boon, M. Silvius, A.Verhagen and Herbert Diemont*</u></b>
14:15 – 14:30	NATIONAL STRATEGY FOR SUSTAINABLE AND RESPONSIBLE PEATLAND MANAGEMENT IN FINLAND - COMPARISONS & REFLECTIONS WITH THE SRPM OF IPS <b><u>Jaakko Silpola</u></b>
14:30 – 14:45	VERIFLORA® VOLUNTARY CERTIFICATION FOR RESPONSIBLE PEATLAND MANAGEMENT <b><u>Michael Keyes</u></b>
14:45 – 15:00	THE LIFE CYCLE ANALYSIS OF CANADIAN SPHAGNUM PEAT MOSS PRODUCTION: PERSPECTIVE ON RESEARCH OPPORTUNITIES AND ENVIRONMENTAL PERFORMANCE IMPROVEMENT OPTIONS <b><u>Marie-Luc Arpin</u></b>
15:00 – 15:15	THE IMPACT OF REGULATORY REQUIREMENTS FOR GROWING MEDIA AND PEAT MOSS PRODUCTS IN CANADA AND THE UNITED STATES <b><u>Ed Bloodnick</u></b>
15:15 – 15:30	ENVIRONMENTAL LABELING OF GROWING MEDIA IN FRANCE <b><u>Laurent Largent</u></b>
15:30 – 15:45	A DRAFT WETLAND STEWARDSHIP ACT FOR MASSACHUSETTS <b><u>Jerome Carr</u></b>



**SESSION 11 – PROPERTIES OF ORGANIC SOILS AND GROWING MEDIA**

Pilot

13:30 – 14:00	MICROBIOLOGICAL PROPERTIES OF GROWING MEDIA – METHODOLOGY AND FIRST RESULTS FROM PEAT SAMPLES OF DIFFERENT ORIGINS <b>Walter Wohanka*</b>
14:00 – 14:15	PHYSICAL PROPERTIES OF ORGANIC GROWING MEDIA AND THEIR EVOLUTIONS DURING DRYING/WETTING CYCLES <b>Jean-Charles Michel*, G. Qi, S. Charpentier and P. Boivin</b>
14:15 – 14:30	COMPARING THE EFFICIENCY OF SUBSTRATE QUALITY AND IRRIGATION MANAGEMENT IN GREENHOUSE PRODUCTION <b>Reza Nemati, J.P. Fortin and J. Massé</b>
14:30 – 14:45	COOL FINISHING OF POINSETTIAS RELATED TO SUBSTRATE QUALITY <b>Mylène Marchand-Roy, J.P. Fortin and M.R. Nemati</b>
14:45 – 15:00	EFFECT OF THE LENGTH OF STORAGE TIME IN BALES ON SELECTED CHEMICAL AND PHYSICAL PROPERTIES OF SPHAGNUM PEAT MOSS AND PEAT BASED GROWING MIXES <b>Lakshman L. Ranasinghe, G.E. Williston and R. McIntyre</b>
15:00 – 15:15	SALINITY MANAGEMENT IN PEAT-SAWDUST GROWING MEDIA <b>Guillaume Létourneau, J. Caron, R. Naasz, D.E. Elrick and C. Boily</b>
15:15 – 15:30	CHEMICAL CONTENT OF MAIN NUTRIENTS, ORGANIC SUBSTANCES AND TRACE ELEMENTS FROM DIFFERENT WETLAND TYPES <b>Juichi Omote and Yutaka Yamagiwa</b>

**SESSION 1 – FEN RESTORATION**

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13:15 – 13:45	MOUNTAIN FEN RESTORATION: DEVELOPING METHODS FOR DITCH RESTORATION <b>Rod Chimner*, D.J. Cooper and D. Schimelpfenig</b>
13:45 – 14:00	DESCRIPTION OF A REFERENCE ECOSYSTEM FOR RESTORATION: A CASE STUDY OF A MINEROTROPHIC PEATLAND <b>Vicky Bérubé, C. Lavoie and L. Rochefort</b>
14:00 – 14:15	RESTORATION OF A VALLEY BOTTOM FEN: REHABILITATION OF A 15 HA ECOSYSTEM <b>Marie-Claire LeBlanc, L. Rochefort, V. Bérubé, S. Boudreau, J. Landry, M. Poulin and J. Price</b>
14:15 – 14:30	HYDROLOGICAL RESPONSE TO REWETTING IN A FEN PEATLAND NEAR RIMOUSKI, QUÉBEC <b>Shannon Malloy and J.S. Price</b>
14:30 – 14:45	RESTORATION OF DITCHED PATTERNED PEATLAND IN MICHIGAN: FIRST YEAR VEGETATION RESPONSE AND POREWATER CHEMISTRY <b>James Bess</b>
14:45 – 15:00	BOTANICAL AND ECOLOGICAL INVENTORIES OF HIGH ANDEAN PEATLANDS FROM PERU <b>Flor Salvador, J. Monerris and L. Rochefort</b>
15:00 – 15:30	CAN MORE NATURAL WATER LEVELS SERVE AS RESTORATION MEASURE IN BASE-RICH FENS? <b>Annemieke Kooijman*, C. Cusell and L. Lamers</b>

**COMMISSION V MEETING**

15:30 – 16:30

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**POSTER SESSION**

Refreshments

15:45 – 18:15

Place Montcalm (Lower Level)

**BANQUET**

Chapelle du musée de l'Amérique française

18:15 – 22:00	You must be preregistered to attend the banquet.
By shuttle	Please meet in the lobby at 18:15. Shuttle is free.
By walk (1,4 km)	Please see indication (map) at the end of the program.

THURSDAY, JUNE 16, 2011

Suzor-Côté-Krieghoff

## PLENARY SESSION

**KEYNOTE SPEAKERS** (*Simultaneous Translation*)

8:30 – 9:55	THE FUTURE OF COMPOSTS AS INGREDIENTS OF GROWING MEDIA <b>Michael Raviv, Ph. D.</b>
	SOCIETY AND SUSTAINABLE MANAGEMENT OF PEATLANDS <b>Jean-Pierre Revéret, Ph. D.</b>

**BREAK**

9:55 – 10:15

Borduas / Foyer

## SCIENTIFIC SESSIONS

**SESSION 3 – BOREAL PEATLANDS: USE, MANAGEMENT, AND CONSERVATION***(Simultaneous Translation)*

Suzor-Côté

10:15 – 10:30	Foreword <b>Marcel Darveau</b>
10:30 – 11:00	STATUS OF PEATLAND INVENTORY IN NORTHERN EURASIA <b>Tatiana Minayeva* and Andrey Sirin</b>
11:00 – 11:15	MAPPING PEATLANDS AND MINERAL WETLANDS IN CANADA'S WESTERN BOREAL FOREST <b>Kevin Smith, C. Smith and A. Richard</b>
11:15 – 11:30	THREATS TO NORTH-AMERICAN BOREAL PEATLANDS <b>Stéphanie Boudreau and M. Darveau</b>
11:30 – 11:45	TODAY'S CANADIAN BOREAL PEATLAND FORESTRY <b>Sylvain Jutras</b>
11:45 – 12:00	STEWARDSHIP OPPORTUNITIES IN CANADA'S BOREAL PEATLANDS <b>Clayton Rubec*</b>

**SESSION 2 – RESTORATION AND REHABILITATION OF BOG PEATLANDS**

Krieghoff

10:15 – 10:45	PEATLAND MANAGEMENT AND WISE AFTER-USE / RESTORATION: IMPLEMENTING POLICY IN THE REAL WORLD <b>Catherine A. Farrell*</b>
10:45 – 11:00	FACTORS INFLUENCING SPONTANEOUS RE-VEGETATION OF CUT-OVER PEATLANDS IN ESTONIA <b>Triin Triisberg, J. Paal, J. Liira and E. Karofeld</b>
11:00 – 11:15	MANAGING AND RESTORING BLANKET BOGS TO BENEFIT BIODIVERSITY AND CARBON IN SCOTLAND: A SCOPING STUDY <b>Roxane Andersen, R. Artz, R. Cummins, R. Mitchell, B. Belana, D. Donnelly, S.J. Chapman, J. Smith and P. Smith</b>
11:15 – 11:30	NICHE BREADTHS AND OVERLAPS IN BOGS: ARE THERE SIMILARITIES BETWEEN NATURAL BOGS AND ABANDONED OR RESTORED PEATLANDS? <b>Rémy Pouliot and L. Rochefort</b>
11:30 – 11:45	GROWING BIRCH BIOMASS FOR ENERGY ON CUTAWAY PEATLANDS – DO WE NEED FERTILIZATION? <b>Lasse Aro and J. Hytönen</b>
11:45 – 12:00	PREMIER TECH HORTICULTURE: A WORLD LEADER IN PEAT BOG RESTORATION <b>Jacques Gagnon, M.C. Desbiens and R. Naasz</b>

## SCIENTIFIC SESSIONS

**SESSION 12 – TECHNOLOGY AND INNOVATION**

Pilot

10:15 – 10:45	DRIVERS OF INNOVATION AND TECHNOLOGY WITHIN THE CANADIAN HORTICULTURAL PEAT INDUSTRY <b><u>Paul Short*</u></b>
10:45 – 11:00	PROFITABLE TRACTOR FLEET MANAGEMENT THROUGH TELEMATIC <b><u>Rémi Bourgault</u></b>
11:00 – 11:15	DIESEL ENGINES EMISSIONS REGULATIONS FOR A BETTER, CLEANER FUTURE <b><u>Rémi Bourgault</u></b>
11:15 – 11:30	NATURAL WASTEWATER TREATMENT USING SPHAGNUM PEAT FILTER SYSTEMS, LOCAL RESOURCES <b><u>Kathleen Blanchard</u></b>
11:30 – 11:45	USE OF PEAT FOR WASTEWATER TREATMENT: A SUSTAINABLE SOLUTION <b><u>Roger Lacasse and Denis Pettigrew</u></b>
11:45 – 12:00	IRRIGATION MANAGEMENT BASED ON REAL-TIME SOIL TENSION MONITORING IN GREENHOUSE PRODUCTION <b><u>Jocelyn Boudreau</u></b>

**SESSION 4 – PEATLAND MANAGEMENT IN THE ENERGY SECTOR**

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10:15 – 10:45	HISTORY OF WETLAND RECLAMATION IN THE ALBERTA OIL SANDS <b><u>Christine Daly*</u></b>
10:45 – 11:15	CONSTRUCTION OF A FEN WETLAND IN THE OILSANDS: SYNCRUE'S SANDHILL FEN WATERSHED <b><u>Carla Wytrykush*</u></b>
11:15 – 11:30	THE CREATION OF SANDHILL FEN: GROWTH SEASON 2 OF THE U-SHAPED CELL STUDY <b><u>Rosemary Bloise and D. Vitt</u></b>
11:30 – 11:45	FEN RECLAMATION FROM CONCEPT TO CONSTRUCT: THE SUNCOR PILOT FEN <b><u>Jonathan Price, C. Daly, J. Atkinson, G. McKenna and M. O'Kane</u></b>
11:45 – 12:00	IMPACT OF OIL-SAND PROCESSED WATER ON MICROBIAL COMMUNITIES OF FEN PEAT <b><u>Roxane Andersen, J.S. Price and L. Rochefort</u></b>

**LUNCH**

12:00 – 13:15

Borduas / Foyer

## SCIENTIFIC SESSIONS

**SESSION 3 – BOREAL PEATLANDS: USE, MANAGEMENT, AND CONSERVATION**

Suzor-Côté

13:15 – 13:30	BOREAL PEATLANDS AND LAND USE PLANNING: THE CASE OF QUEBEC NORTHERN PLAN <b><u>Marcel Darveau</u></b>
13:30 – 13:45	PAN-BOREAL LANDSCAPE CONSERVATION: FUTURE OPPORTUNITIES AND CHALLENGES <b><u>Frederic Reid</u></b>
13:45 – 14:00	MIRE-MARGIN COMMUNITIES IN EASTERN CANADA <b><u>Étienne Paradis</u> and <u>L. Rochefort</u></b>
14:00 – 14:15	IMPACT OF FOREST HARVEST METHODS ON THE DYNAMICS OF BRYOPHYTE COMMUNITIES IN FORESTED BOGS <b><u>Nicole J. Fenton</u>, <u>B. Lafleur</u>, <u>D. Paré</u> and <u>Y. Bergeron</u></b>
14:15 – 14:30	AN EVALUATION OF THE EFFECTS OF PEATLAND EXPLOITATION ON THE EAST BRANCH PORTAGE RIVER, NEW BRUNSWICK, CANADA <b><u>Marie Clément</u>, <u>A. St-Hilaire</u>, <u>M. Aziz Es Salhi</u>, <u>D. Caissie</u> and <u>S. Courtenay</u></b>
14:30 – 14:45	EFFECTS OF NITROGEN DEPOSITION ON BOREAL BOGS: A THREE YEAR NITROGEN FERTILIZATION AND TRACER EXPERIMENT <b><u>Bin Xu</u>, <u>Dale Vitt</u> and <u>R.K. Wieder</u></b>
14:45 – 15:00	HABITAT SELECTION BY SPRUCE GROUSE: TESTING DETERIORATION AND ISOLATION IN A HUMAN-DOMINATED LANDSCAPE <b><u>Céline Macabiau</u>, <u>P. Blanchette</u>, <u>E. McIntire</u> and <u>A. Desrochers</u></b>

**SESSION 2 – RESTORATION AND REHABILITATION OF BOG PEATLANDS**

Krieghoff

13:15 – 14:15	BOIS-DES-BEL PROJECT  BOG RESTORATION: A WHOLE ECOSYSTEM EXPERIMENT <b><u>Line Rochefort</u></b>  HYDROLOGICAL CHANGES CAUSE BY RESTORING THE BOIS-DES-BEL PEATLAND; 1999-2002 <b><u>Jonathan Price</u></b>  SHORT-TERM IMPACT OF PEATLAND RESTORATION ON ECOSYSTEM CARBON EXCHANGE <b><u>Maria Strack</u></b>  VEGETATION RESPONSE IN A CUT-OVER BOG 8 YEARS AFTER RESTORATION: THE USE OF PRINCIPAL RESPONSE CURVES TO EVALUATE SUCCESS <b><u>Monique Poulin</u>, <u>R. Andersen</u> and <u>L. Rochefort</u></b>  FUNCTIONAL TRAITS SHED NEW LIGHT OVER VEGETATION CHANGES IN A BOG RESTORED 10 YEARS AGO <b><u>Amélie D'Astous</u>, <u>M. Poulin</u>, <u>L. Rochefort</u> and <u>I. Aubin</u></b>  NUTRIENT MINERALIZATION AND CARBON UTILIZATION BY MICRO-ORGANISMS 10 YEARS AFTER RESTORATION <b><u>Roxane Andersen</u>, <u>C. Wells</u>, <u>J. Price</u> and <u>M. Macrae</u></b>  HYDROLOGICAL ASSESSMENT OF RESTORATION OF THE BOIS-DES-BEL PEATLAND, QUEBEC: A DECADE LATER <b><u>Colin McCarter</u> and <u>J. Price</u></b>  AMPHIBIAN AND AQUATIC BEETLE COLONIZATION OF MAN-MADE POOLS IN A RESTORED PEATLAND <b><u>Marc Mazerolle</u> and <u>C. Lavoie</u></b>  PRIMARY PRODUCTION AND DECOMPOSITION OF THE VEGETATION OF A RESTORED CUTOVER PEATLAND IN QUEBEC: 10 YEARS AFTER <b><u>Flor Salvador</u> and <u>L. Rochefort</u></b>  CARBON DYNAMICS 10 YEARS POST-RESTORATION AT THE BOIS-DES-BEL PEATLAND <b><u>Yoseph Zuback</u> and <u>M. Strack</u></b>
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SCIENTIFIC SESSIONS

**SESSION 2 – RESTORATION AND REHABILITATION OF BOG PEATLANDS (SUITE)**

Krieghoff

14:15 – 14:45 PEAT EXTRACTION AND ENVIRONMENT: PROBLEMS AND CHALLENGES ON THE EXAMPLE OF ESTONIA  
**Edgar Karofeld\***

**SESSION 6 – CULTIVATION OF SPHAGNUM AND BIOMASS PRODUCTION**

Krieghoff

14:45 – 15:00 SPHAGNUM FARMING ON CUT-OVER BOG IN GERMANY: EXPERIENCES OF A SIX YEARS TRIAL  
**Greta Gaudig, Matthias Krebs and Hans Joosten**

**SESSION 12 – TECHNOLOGY AND INNOVATION**

Pilot

13:15 – 13:45 THE POTENTIAL OF BIOCHAR AS AN INGREDIENT IN POTTING MIXES  
**Julie Major\***

13:45 – 14:00 AMENDING GROWING MEDIA WITH MYCORRHIZAE: CHALLENGES AND BENEFITS  
**Younes Machrafi, R. Naasz, M.C. Desbiens and S. Gagné**

14:00 – 14:15 THE USE OF NITROGEN DRAWDOWN INDEX (NDI) TESTING AS AN ASSESSMENT OF THE STABILITY OF “SUSTAINABLE” PEAT ALTERNATIVES IN NURSERY MIXES  
**Claudia Lafreniere, A. Duncan, K. Osborne and N. McKeown**

14:15 – 14:30 ORGANIC BASED FERTILIZERS FOR THE PRODUCTION OF ORNAMENTAL BEDDING PLANTS: AS GOOD AS CONVENTIONAL FERTILIZERS?  
**Sophie Rochefort, N. Authier, M. Delorme and L. O'Donoughue**

14:30 – 14:45 PEAT-BASED GROWING MEDIUM AMENDED WITH *BACILLUS SUBTILIS* TO IMPROVE GROWTH STIMULATION AND PLANT PROTECTION  
**Rémi Naasz, M.C. Desbiens, Y. Machrafi and S. Gagné**

14:45 – 15:00 BIODEGRADABLE POTS: AN ALTERNATIVE TO PLASTIC POTS FOR THE PRODUCTION OF BEDDING PLANTS IN GREENHOUSES?  
**Sophie Rochefort, L. O'Donoughue, Y. Girault, G. Guitard, M.C. Lavoie, M. Delorme and B. Mongeau**

## SCIENTIFIC SESSIONS

**SESSION 4 – PEATLAND MANAGEMENT IN THE ENERGY SECTOR**

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13:15 – 13:30	CAN COMMON FEN SPECIES GROW IN SALINE CONDITIONS SIMILAR TO OIL SANDS PROCESSES WATER? RESULT FROM PETRI DISH AND GREENHOUSE EXPERIMENTS <b><u>Rémy Pouliot, L. Rochefort and M.D. Graf</u></b>
13:30 – 13:45	RESPONSES OF BOG VEGETATION TO CLEARING FOR OIL SANDS EXPLORATION AND EXTRACTION <b><u>Melissa House, D.H. Vitt, R.K. Wieder and S.C. Koropchak</u></b>
13:45 – 14:00	CAREX AQUATILIS AS A PIONEER SPECIES FOR BOREAL WETLAND RECLAMATION AFTER OIL SANDS MINING OPERATIONS IN NORTHERN ALBERTA <b><u>Sara C. Koropchak, D.H. Vitt, S. Ebbs, R. Kelman Wieder and M.K. House</u></b>

**SESSION 5 – REWETTING OF PEATLANDS**

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14:00 – 14:30	RESTORATION OF ERODING BLANKET PEATLANDS: LIMITS TO REWETTING? <b><u>Martin Evans*, T. Allott and C. Agne</u></b>
14:30 – 14:45	REWETTING IN HISTORICALLY HARVESTED PEATLANDS: ASSESSING CHANGE IN COMMUNITY-SCALE VEGETATION STRUCTURE AND ORGANIC MATTER ACCUMULATION RATES <b><u>Steven W. Henstra, G.E. Bradfield and L. Rochefort</u></b>
14:45 – 15:00	IF WE CAN'T REWET RED MOSS, IS CLIMATE CHANGE TO BLAME? <b><u>Olivia Bragg</u></b>

**BREAK**

15:00 – 15:15

Borduas / Foyer

**SESSION 6 – CULTIVATION OF SPHAGNUM AND BIOMASS PRODUCTION**

Krieghoff

15:15 – 15:30	SPHAGNUM REGROWTH AFTER HARVEST IN THE KOLKHETI LOWLANDS (GEORGIA/TRANSCAUCASUS) <b><u>Matthias Krebs and H. Joosten</u></b>
15:30 – 15:45	SPHAGNUM FARMING ON PREFABRICATED FLOATING MATS <b><u>Anja Prager, F. Gahlert, G. Gaudig, A. Blievernicht and H. Joosten</u></b>
15:45 – 16:00	SPHAGNUM FARMING IN CANADIAN MARITIMES: ADVANCEMENTS SINCE 2004 <b><u>Josée Landry and L. Rochefort</u></b>
16:00 – 16:15	ECONOMICS OF SPHAGNUM FARMING IN NORTHWEST GERMANY: PROFITABILITY AND EXTERNAL BENEFITS <b><u>Sabine Wichmann, S. Kumar and H Joosten</u></b>

**SESSION 13 – MANAGEMENT OF TROPICAL PEATLANDS**

Pilot

15:15 – 15:30	THE CARBON POOL IN TROPICAL PEATLANDS, UNCERTAINTIES AND GAPS IN KNOWLEDGE <b><u>Jack Rieley and S.E. Page</u></b>
15:30 – 15:45	SOIL CO <sub>2</sub> FLUXES FROM DIFFERENT AGES OF OIL PALM IN TROPICAL PEATLAND OF SARAWAK, MALAYSIA <b><u>Lulie Melling, K.J. Goh, A. Chaddy and R. Hatano</u></b>
15:45 – 16:15	RESTORING INDONESIA'S PEATLANDS FOR CLIMATE CHANGE MITIGATION; OPTIONS FOR PRIVATE SECTOR DRIVEN AND COMMUNITY-BASED ECOSYSTEM RESTORATION <b><u>Marcel Silvius* and H. Wösten</u></b>

## SCIENTIFIC SESSIONS

**SESSION 5 – REWETTING OF PEATLAND**

410

15:15 – 15:30	WETLAND MANAGEMENT AFTER TERMINATION OF PEAT EXTRACTION AND EFFECTS ON THE ENVIRONMENT <b><u>Lars Lundin</u>, E. Lode, M. Strömgren, T. Nilsson and S. Jordan</b>
15:30 – 15:45	PEATLAND RESTORATION AND HYDROLOGY: LINKING PEATLAND RESTORATION (REWETTING) TO THE MOISTURE DYNAMICS WITHIN SPHAGNUM MOSS CUSHIONS IN AN ABANDONED BLOCK-CUT BOG <b><u>Scott J. Ketcheson</u> and J.S. Price</b>
15:45 – 16:00	COMPARISON OF METHODS TO BLOCK DRAINAGE DITCHES, GRANDE PLÉE BLEUE, QUÉBEC, CANADA <b><u>François Quinty</u> and O. Marcoux</b>
16:00 – 16:15	DRAIN-BLOCKING TECHNIQUES ON BLANKET PEAT: A FRAMEWORK FOR BEST PRACTICE <b><u>Alona Armstrong*</u>, J. Holden, P. Kay, M. Foulger, S. Gledhill, A.T. McDonald and A. Walker</b>

**ROUND TABLE**

Suzor-Côté

16:15 – 17:15	TOWARDS IMPROVED RESPONSIBLE MANAGEMENT OF PEATLANDS												
<p><b>Organizers:</b> <b>Marcel Darveau</b> (Ducks Unlimited, Canada), <b>Marie-Chantal Denis</b> (Institut EDS en environnement, développement et société, Canada) and <b>Line Rochefort</b> (Université Laval, Canada)</p> <p>This round table will aim to answer the following questions:</p> <ul style="list-style-type: none"> <li>▪ What have we learned that we did not know 48 hrs before?</li> <li>▪ What are the next steps ?</li> </ul> <p><b>Round table animator:</b> <b>Björn Hånell</b> (International Peat Congress chair for Sweden 2012)</p> <p><b>Session reporters:</b></p> <table> <tr> <td>S1, S2 and S5:</td><td>Francis Muller (Pôle-relais tourbières, France)</td></tr> <tr> <td>S3 and S8:</td><td>Marcel Darveau (Ducks Unlimited, Canada) and Nigel Roulet (McGill University, Canada)</td></tr> <tr> <td>S4:</td><td>Dale Vitt (Southern Illinois University, USA)</td></tr> <tr> <td>S6 and S7:</td><td>Geneviève Potvin (Association des producteurs de tourbe horticole du Québec, Canada)</td></tr> <tr> <td>S9 and S13:</td><td>Jack Rieley (International Peat Society, UK)</td></tr> <tr> <td>S10, S11 and S12:</td><td>Jean Caron (Université Laval, Canada)</td></tr> </table> <p>After the summaries and presentation of the chairs, the audience will be invited for its recommendations, questions and solution propositions from participants.</p> <p>A synthesis of the round table will be published in the <i>International Peat Journal</i> and in <i>Chronica Horticulturae</i>.</p>		S1, S2 and S5:	Francis Muller (Pôle-relais tourbières, France)	S3 and S8:	Marcel Darveau (Ducks Unlimited, Canada) and Nigel Roulet (McGill University, Canada)	S4:	Dale Vitt (Southern Illinois University, USA)	S6 and S7:	Geneviève Potvin (Association des producteurs de tourbe horticole du Québec, Canada)	S9 and S13:	Jack Rieley (International Peat Society, UK)	S10, S11 and S12:	Jean Caron (Université Laval, Canada)
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S10, S11 and S12:	Jean Caron (Université Laval, Canada)												

**COMMERCIAL EXHIBIT AND BBQ**

Van den Henden Garden

17:15 – 22:00	<p>You must be preregistered to attend the BBQ.</p> <p><b><u>By shuttle</u></b> Please meet in the lobby at 17:15. Shuttle is free. In case of rain, BBQ will be inside (Envirotron Pavilion)</p> <p>Food and beverages will be served. One free drink is included with your meal. Beers and soft drinks will be sold on site.</p>
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# ORAL COMMUNICATIONS - ABSTRACTS SORTED BY FIRST AUTHOR

\*Guest speaker and presenting autor

GROWING MARKET SHARE – BARRIERS TO UPTAKE OF PEAT-FREE GROWING MEDIA BY UK AMATEUR GARDENERS

**Alexander, Paul D. and R.H. Williams**

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Peat has been a common constituent of growing media used by UK amateur gardeners since the mid 1960's. Since the late 1980's, pressure from government and environmental groups has been increasing for gardeners and professional growers to reduce their use. However, significant volumes of peat are still being used in UK horticulture: of all the peat used in growing media in the UK, 69% (2.03 million cubic metres) is consumed by amateur gardeners (Defra, 2010). Although the RHS has been working with government, non-governmental organisations, retailers, nurseries, trade associations, and media manufacturers for many years on this issue, progress away from a market dominated by peat-based products has been slower than many had hoped for. We believe there are five over-riding factors: 1) The provision of fit for purpose peat-reduced and peat-free alternatives (e.g. ensuring quality and consistent product). 2) The economics of the growing media supply chain (e.g. production and development costs). 3) The motivation of gardeners to change (e.g. education about bag content and product cost). 4) To enable successful gardening without peat (e.g. adapting plant management techniques). 5) To overcome previous adverse experiences (e.g. building consumer confidence). We believe that a co-ordinated strategy of raising public awareness of the environmental issues, explaining the importance of good growing media for successful gardening, improved product information on bags and company websites alongside research and development into better products is required to bring about change in behaviour amongst UK gardeners to reduce peat use.

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IMPACT OF OIL-SAND PROCESSED WATER ON MICROBIAL COMMUNITIES OF FEN PEAT

**Andersen, Roxane (1), J.S. Price (2) and L. Rochefort (3)**

(1) The Macaulay Land Use Research Institute, Craigiebuckler, Aberdeen, AB15 8QH, UK ([r.andersen@hotmail.com](mailto:r.andersen@hotmail.com))

(2) Dpt of Geography and Environmental Management, Faculty of Environment, University of Waterloo, Ontario, N2L 3G1, Canada

(3) Département de phytologie, Université Laval, 2425, rue de l'Agriculture, Québec, Québec, G1A 0V6, Canada

In the oil sands development areas near Fort McMurray (Alberta), where peatlands comprise up to 65% of the landscape, large tracts of undisturbed peatland are being removed in the extraction process. As mining goes way beyond the peat horizons, fen creation, rather than restoration, has emerged as a new concept to be tested in the post-mined areas. In addition to the disturbances associated with the physical removal of peat and soil, one further complication to reclamation is the presence of contaminants in the water, namely high levels of sodium (Na) and Naphthenic acids (NAs), which derive from bitumen. The impact of progressive contamination on microbial diversity was examined in the surface peat found underneath two contrasting vegetation types – mosses and graminoids, as part of a greenhouse experiment. Microbial diversity was compared using molecular and physiological approaches. Microbial communities behaved differently in response to contamination over time according to the vegetation type under which they were found, and were generally more active under graminoids than mosses. Short-time exposure to NAs modified carbon utilization patterns and increased microbial activity, which opens hypotheses on adaptation and avoidance mechanisms that could be developed by the microbial communities in the peat of the created fen. The implications of those findings and the consequences of alteration of microbial communities at the ecosystem level will be discussed in the presentation.

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MANAGING AND RESTORING BLANKET BOGS TO BENEFIT BIODIVERSITY AND CARBON IN SCOTLAND: A SCOPING STUDY

**Andersen, Roxane (1), R. Artz (1), R. Cummins (1), R. Mitchell (1), B. Belana (1), D. Donelly (1), S.J. Chapman (1), J. Smith (2) and P. Smith (2)**

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(2) Institute of Biological and Environmental Sciences, School of Biological Sciences, University of Aberdeen, 23 St Machar Drive, Aberdeen, AB24 3UU, UK

Blanket mires in Scotland cover an estimated 1.1 - 1.9 million hectares, which represents 80-85% of the UK's blanket bog and 13% of the world resource of this ecosystem. These bog areas hold over half of Scotland's soil carbon and contribute to increasing the biodiversity in the landscape, because they support animal and plant species that are highly adapted to their particular conditions, some of which are not found elsewhere. The value of peatland habitats is increasingly recognised through UK and European legal obligations for their protection and restoration. On the other hand, Scottish blanket bogs are under pressures from grazing, forestry, agriculture, burning practices and wind farm development, but the extent of disturbances and their consequences had not been clearly assessed. Scottish Natural Heritage (SNH) commissioned research that would develop a strategic approach to the selection and evaluation of criteria for scoping sites on blanket peat with a view to managing or restoring for maximum biodiversity and carbon sequestration benefits. We reviewed the literature and carried out a survey across Scotland to understand and map the disturbances affecting blanket bogs, as well as the techniques used to restore and/or manage them. We also engaged with stakeholders and used an ecosystem service approach and a multi-criteria analysis as decision-making tools to identify a list of priority areas for restoration. This approach, as well as the conclusions of those exercises will be discussed in the presentation.

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NUTRIENT MINERALIZATION AND CARBON UTILIZATION BY MICRO-ORGANISMS 10 YEARS AFTER RESTORATION

**Andersen, Roxane (1); C. Wells (2), J. Price (2) and M. Macrae (2)**

(1) The James Hutton Institute (Macaulay Land Use Research Institute) Craigiebuckler, Aberdeen, AB15 8QH, UK

(2) Department of Geography and Environmental Management, University of Waterloo, Waterloo, Ontario, N2L 3G1, Canada

The drainage and harvesting of peatlands may increase the mineralization of nutrients and affect microbial communities in peat by removing vegetation cover and lowering the water table, thereby exposing a highly humified substrate to aerobic conditions. Potential increases in the nutrient content of peat may then degrade water quality downstream of peatlands. Following exploitation, peatland restoration has the long-term objective of redressing the balance between carbon sequestration and release; an aim that can only be achieved when both the plant and the microbial communities are returned to a functional state. Evaluating long term success of peatland restoration therefore requires addressing belowground communities and associated processes along with aboveground communities and other attributes. A long-term monitoring program at the Bois-des-Bel experimental station was set up which included a follow up on the mineralization of N and P, as well as an evaluation of microbial functional diversity.

In summer 2010, peat KCl-extractable nitrate ( $\text{NO}_3$ ), ammonium ( $\text{NH}_4$ ) and water-extractable phosphate (P) concentrations and mineralization rates were compared between a natural bog (NAT) (reference), a restored (RES) bog, and vegetated (UNRV) and bare (UNRB) sites within an un-restored (UNR) bog. The functional diversity of microbial communities was also investigated over the same growing season (in June, mid-August and end of September) at the same sites. This was done using Community Level Physiological Profiles (MicroResp™), which measure the capacity of the microbial community to degrade various carbon sources.

In all sites, P concentrations and mineralization rates were negligible. Nitrogen (N) concentrations were similar across sites, but were highest at the NAT site, possibly due to external inputs of N in runoff. Net N mineralization rates (primarily driven by ammonification) were much higher at the UNR sites than at the NAT or RES sites. Within the UNR site, mineralization rates were more than twice as high at the UNRB sites than at the UNRV sites. Correspondingly, N concentrations were larger at the UNRB sites than the UNRV sites, although these differences were not as large as the differences in mineralization rates. N mineralization rates at the NAT site were lower than at the UNR sites. Net N mineralization and nitrification rates were very low at the RES site. This may be due to low mineralization rates overall, or it could be a consequence of moderate to high mineralization rates balanced by high microbial immobilization rates. Indeed, the microbial community from RES showed the highest rates of degradation for most of the carbon sources throughout the summer, suggesting a more active microbial community. The degradation rates were consistently the lowest in UNRB, supporting previous the finding of a dysfunctional and less active microbial community in disturbed conditions. NAT and UNRV had intermediate and similar rates of degradation for most of the carbon sources, although UNRV displayed greater seasonal variability, with marked decreases in degradation rates of amino acids (lysine, arginine, cysteine) in August. This might be a consequence of greater variation in the water table at the UNR site leading to drier conditions in the middle of the summer, combined with seasonal variation in the composition of rhizoexudates by plants. Overall, the preferred energy sources in RES, NAT and UNRV were carbohydrates (fructose, glucose, galactose) and carboxylic acid (malic acid, citric acid), which are common root exudates of peatland vegetation.

In conclusion, we believe that long-term monitoring will need to be continued in order to accurately gauge restorative success as it pertains to internal nutrient dynamics and microbial-related processes, as they still appear to be different than in natural conditions 10 years after restoration.

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\*Guest speaker and presenting autor

DRAIN-BLOCKING TECHNIQUES ON BLANKET PEAT: A FRAMEWORK FOR BEST PRACTICE

**Armstrong, Alona\* (1), J. Holden (2), P. Kay (2), M. Foulger (3), S. Gledhill (3), A.T. McDonald (2) and A. Walker (3)**

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Many peatlands have been drained throughout the world in order to increase their productivity for farming, grouse rearing, forestry or to facilitate peat harvesting. In more recent years legislative requirements and the desire to ensure peatlands are in good condition have prompted the wide spread blocking of artificial drains. This drain-blocking has been a disparate process with limited knowledge transfer between organisations and geographical areas. During this study thirty-two blanket peat drain-blocked sites were surveyed and key stakeholders interviewed, from which a best practice guide for drain-blocking was produced. Within this paper we present the best practice guide, detailing the different methods used to block drains, a decision tree which provides guidance on which method to use for a particular drain, how sites should be prioritised and some additional considerations to be borne in mind when planning a drain-blocking campaign.

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GROWING BIRCH BIOMASS FOR ENERGY ON CUTAWAY PEATLANDS – DO WE NEED FERTILIZATION?

**Aro, Lasse (1) and J. Hytönen (2)**

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Approximately 0.8-1.0 million ha of peatlands are suitable for peat harvesting in Finland. At present, peat is harvested on an area of roughly 60,000 hectares. Forestry is considered to be the main re-use option for cutaway peatlands in Finland. Besides timber production, these sites could also be suitable for growing woody biomass for energy production. Natural establishment of birch seedlings, especially on fertilized cutaway peatlands can be abundant. We studied growing of naturally regenerated birch along with willow stands for energy according to short-rotation management principles as dense stands. Fertilized (control, PK, wood ash fertilization) birch stands were grown as un-thinned dense thickets for energy wood (rotations of 16 and 21 years). Leafless, above-ground biomass production of two (16+21 years) energy wood rotations was 124-158 Mg DM ha<sup>-1</sup>. PK and ash fertilization increased the biomass of coppiced 21-year-old birch by 23 Mg ha<sup>-1</sup> and 33 Mg ha<sup>-1</sup> respectively. Thus we can conclude that satisfactory level of biomass production of birch can be reached in favourable site conditions, but it can be increased substantially by using fertilizers containing phosphorus and potassium.

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\*Guest speaker and presenting author

THE LIFE CYCLE ANALYSIS OF CANADIAN SPHAGNUM PEAT MOSS PRODUCTION: PERSPECTIVE ON RESEARCH OPPORTUNITIES AND ENVIRONMENTAL PERFORMANCE IMPROVEMENT OPTIONS

**Arpin, Marie-Luc**

École Polytechnique de Montréal Département de génie chimique, C.P. 6079, succ. Centre-Ville, Montréal, Québec, H3C 3A7, Canada ([marie-luc.arpin@polymtl.ca](mailto:marie-luc.arpin@polymtl.ca))

The ongoing research project aims at developing knowledge pertaining to Life Cycle Management (LCM) within the context of the horticultural peat industry. Life Cycle Analysis (LCA) and derived tools are used in order to support decision making and prioritization of actions, continuous improvement, reporting, and stakeholder dialogue. Different objectives are to be met by exploring different LCA potentials. The present communication focuses on the founding branch of the project: namely, the environmental Life Cycle profile of Canadian sphagnum peat moss production. More specifically, potential environmental impacts of Canadian sphagnum peat moss over its cradle-to-gate life cycle (production, conditioning and distribution) are presented and environmental hot spots and key parameters are identified for two midpoint indicators (Aquatic Acidification and Aquatic Eutrophication) and four endpoint indicators (Human Health, Ecosystem Quality, Climate Changes and Resource). Impact characterisation was carried out using the impact method IMPACT 2002+2.05. Results show that the product distribution life cycle stage dominates the profile for three indicators out of six, namely the Human Health, Aquatic Acidification and Aquatic Eutrophication potentials. For the Climate Change indicator, the impact score is dominated by post-production CO<sub>2</sub> and CH<sub>4</sub> emissions, in situ decomposition and product distribution. For the Resource indicator, the impact score is dominated by harvesting operations, in situ decomposition and product distribution. Increased knowledge of hotspots and key parameters allowed for potential environmental performance improvement options to be identified. Unveiled data gaps as well as scientific and methodological limits allowed for research opportunities to be engaged and complementary tools to be identified.

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IMPACT OF DAIRY MANURE COMPOST AND WATER CONTENT ON WETTABILITY AND DENSITY IN PEAT MOSS-PERLITE ROOT SUBSTRATE

**Barnes, Jared (1), P. Nelson (1), K.Y. Jeong (2), W.C. Fonteno (1), B. Whipker (1) and J. Frantz (3)**

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(2) The Scotts Company, LLC, Marysville, OH 43041, USA

(3) USDA-ARS-ATRU, 2801 W. Bancroft MS 604, Toledo, Ohio, 43606, USA

Addition of mature dairy manure compost (DMC) to peat moss base root substrate adversely increases bulk density (Db). The addition simultaneously enhances water sorption of the substrate. As an industry standard, it is desirable to raise the weight-based water content of soilless root substrate to 50% to ensure adequate wettability during crop establishment. This study investigated the possibility of lowering the percentage of water in substrate containing DMC in order to reduce Db without adversely affecting wettability. DMC was incorporated into a 3 peat moss: 1 perlite (v:v) formula as a partial substitution for peat moss at 0, 7.5, 15, 22.5, and 30% by volume of the substrate. The water content of each of the five formulations was adjusted to approximately 10, 20, 30, 40, and 50% by weight. Wettability curves were generated to assess the impact of DMC content and initial water content on substrate wettability. The wettability level in the 0% DMC substrate at the industry standard water content of 50% was achieved in 7.5, 15, 22.5, and 30% DMC substrates at water contents of 40, 30, 20, and 20%, respectively. Based on previous research, 15% DMC is a desirable level for plant growth. The Db of 0 and 15% DMC mixes at 50% water content are 130 and 232 g/L, respectively. However, our research indicates that only 30% water is required in the 15% DMC mix for it to equal the wettability in the 0% DMC-50% water mix. This lowers the Db of the 15% DMC mix to 180 g/L, which in turn, lowers the Db gain due to 15% DMC from 79 to 39%.

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\*Guest speaker and presenting author

CARBON AND ORGANIC MATTER ACCUMULATION PATTERNS IN HIGH ELEVATION PEATLANDS OF THE NORTHERN ANDES AND THEIR RESPONSE TO THE GRADIENTS OF ELEVATION AND HUMAN DISTURBANCE

**Benavides, Juan (1), D.H. Vitt (1) and R.K. Wieder (2)**

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(2) Department of Biology, Villanova University. Villanova, PA 19085-1699, USA

In the alpine zone of the northern Andes peatlands are large carbon deposits storing around 150 kgC/m<sup>2</sup> and are crucial to the local hydrological cycles. Here, we report for the first time carbon and organic matter accumulation rates for the last 150 years and how they relate to the gradients of elevation and human disturbance. We sampled 120 peatlands from 2,400 m to 4,700 m in elevation and sampled twenty-two 50 cm deep <sup>210</sup>Pb dated cores. Lowest elevation peatlands were found at 2,400 m and highest at 4,700 m, with gradual changes from *Sphagnum*-dominated peatlands, to sedges at intermediate elevations, to *Distichia*-dominated peatlands at the upper limit. Carbon accumulation patterns in the long term (>100 y) were higher at intermediate elevations of the total range, around 3500 m; however, during the last 25 years, accumulation rates at high elevations (4,700 m, 23.01 cm 25 y<sup>-1</sup>) have increased by one order of magnitude and decreased at lower elevations (3,500m, 10.85 cm 25 y<sup>-1</sup>). Low carbon accumulation values during the last 50 years at disturbed sites at intermediate (3,500 m, 1.5 Kg C m<sup>-2</sup> 50 y<sup>-1</sup>), and higher values at the lowest elevation sites (2,400 m, 39 Kg C m<sup>-2</sup> 50 y<sup>-1</sup>). Our data support the similarity in the carbon accumulation rates between the peatlands in the boreal areas and those at high elevations, and highlights the sensitivity of high elevation peatlands to current trends of global warming and subsequent changes in land use patterns.

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DESCRIPTION OF A REFERENCE ECOSYSTEM FOR RESTORATION: A CASE STUDY OF A MINEROTROPHIC PEATLAND

**Berubé, Vicky (1), C. Lavoie (2) and L. Rochefort (1)**

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(2) Peatland Ecology Research Group, Université Laval, École supérieure d'aménagement du territoire et du développement régional, Pavillon Félix-Antoine-Savard, Québec, Québec, G1V 0A6, Canada

For any restoration project, knowledge about the targeted ecosystem components and dynamics is an important tool for setting goals and for assessing the evolution of the newly restored system. Many sources of information can be used in the description of a reference system, including historical data and present-day studies. The aim of this presentation is to integrate vegetation data collected at both temporal and spatial scales in order to describe the reference ecosystem of a minerotrophic peatland in the process to be restored. The study site is a peatland abandoned after peat extraction activities carried out over several decades. Now, minerotrophic residual peat layers are exposed. A paleoecological study confirmed that the system regressed to a minerotrophic state. It also showed a major contribution of bryophytes to peat accumulation throughout the development of the peatland. To compare these results with actual data, vegetation surveys and productivity samplings were conducted in a set of undisturbed peatlands located in the area. The conclusions agreed with the paleoecological study. Bryophytes were a major component of vegetation communities followed by Cyperaceae. To a lesser extent, shrubs, forbs and trees were also part of the floral composition and structure but were considered as minor contributors for the peat accumulation function. In conclusion, it appears necessary to reintroduce the bryophyte communities within the ecosystem to be restored to ensure good ecosystemic capabilities to capture C again but care should also be given to the other vegetation components to restore the rich biodiversity associated with fens.

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RESTORATION OF DITCHED PATTERNED PEATLAND IN MICHIGAN: FIRST YEAR VEGETATION RESPONSE AND POREWATER CHEMISTRY

**Bess, James**

Michigan technological University SFRES1400 Townsend DriveHoughton, MI 49931, USA

In August of 2007, more than 18,000 acres of the Sleeper Lake Patterned Fen complex in Luce County Michigan burned following a prolonged drought. As part of fire-fighting effort, over 30 miles of firebreaks were made in the fen complex. The Michigan DNRE restored over 20 miles of these the following year, but 9 miles through the wettest portions remained. Two years after the fire, the authors entered into an agreement with The Nature Conservancy and DNRE to find appropriate, cost-effective procedures for restoring the remaining firebreaks/ditches. In November 2009, spoils were replaced into 1.25 miles of the ditch with a 19-ton excavator. The restored ditch is divided into 4 blocks, along a gradient of fen vegetative cover and pH. Each Block contained five replicates of a randomized split-plot design. The treatment was the presence or absence of applied mulch (marsh hay). Each split-plot pair has an associated control plot (no treatment or seeding). Seeds of 18 species of local wetland plants and diaspores of 5 mosses were spread on the surface of each set of treatment plots. Surveys in 2010 found excellent re-growth of vegetation both within the treatment plots and the controls. The unmulched plots have the greatest vascular vegetative cover and diversity of species, followed by the mulched plots and the unplanted controls. Mosses did well only in the first block (lowest pH) and this was reflected in the data from the undisturbed vegetation adjacent to the ditch. There was greater Bryophyte cover on the mulched plots than the unmulched or controls. The blocks also vary with respect to plant cover, diversity and species representation. Porewater data collected in November of 2010 vary with respect to block and ditch versus adjacent, undisturbed peatland. Some of this variation also correlates with differences in plant cover, species representation and diversity.

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NATURAL WASTEWATER TREATMENT USING SPHAGNUM PEAT FILTER SYSTEMS, LOCAL RESOURCES

**Blanchard, Kathleen**

Intervale Associates, P.O. Box 172, Doyles, Newfoundland, A0N 1J0, Canada ([kblanchard@intervale.ca](mailto:kblanchard@intervale.ca))

The use of sphagnum peat as an effective, natural medium for wastewater treatment is gaining recognition in Newfoundland and Labrador, where demonstration sites have been established for a school, a cluster of homes, and national park/historic site settings from 2001 to 2010. The nonprofit organization, Intervale, with the financial and partnership support of The EJLB Foundation, Golder Associates, and other partners, has been testing the use of Newfoundland sphagnum peat and encouraging municipalities, businesses, and the Government of Newfoundland and Labrador to consider using locally harvested sphagnum peat to address the pressing need for wastewater treatment in rural communities. Monitoring results from a system constructed for a 200-student school in 2001 and from a large system constructed by Parks Canada at Gros Morne National Park show very high treatment of harmful bacteria and other water quality parameters. The structure of the peat holds effluent in capillary pores, permitting multiple conversions to take place, while the acid nature of peat provides a level of disinfection. The effluent may be discharged into a conventional leaching bed system or sent through a small subsurface wetland. An educational DVD produced by Intervale describes the systems in detail. In partnership with Bryophyta Technologies, Intervale has also experimented with accelerating the natural revegetation of the peat filter surface and of disturbed embankments along the TransLabrador Highway.

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THE POTENTIAL OF *SPHAGNUM* SP. BIOMASS AS A COMPONENT OF GROWING MEDIA

**Blievernicht, Armin (1), S. Irrgang (1) and S. Kumar (2)**

(1) Humboldt-Universität zu Berlin, Faculty for Agriculture and Horticulture, Division Urban Plant Ecophysiology Lentzeallee 7514195 Berlin, Germany ([armin.blievernicht@agar.hu-berlin.de](mailto:armin.blievernicht@agar.hu-berlin.de))

(2) Torfwerk Moorkultur Ramsloh Moorgutstraße 126683 Saaterland, Germany

Worldwide, the harvesting of peat leads to the destruction of bogs, its unique biodiversity, and, in addition, to the release of greenhouse gases like carbon dioxide. Peat is the most important raw component of growing media in professional horticulture. White peat consists mainly of rare decomposed peat mosses (*Sphagnum* sp.). Maybe the decomposition of peat mosses is not the main cause for the outstanding properties of peat based growing media. Thus, the potential use of living *Sphagnum* as a main component of growing media was studied. Mosses were harvested in their natural habitat, and after cleaning, drying and shredding, several growing media with various proportions of *Sphagnum* and peat were manufactured. The growth of different horticultural crops was investigated. Proportions of *Sphagnum* biomass up to 100% in growing media did not negatively affect the growth of tested crops in some cases. The manufacturing of *Sphagnum* based growing media and the potential of using *Sphagnum* mosses for horticultural production systems is promising and discussed.

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THE CREATION OF SANDHILL FEN: GROWTH SEASON 2 OF THE U-SHAPED CELL STUDY

**Blaise, Rosemary and D. Vitt**

Southern Illinois University Carbondale 1125 Lincoln Drive Life Sciences 2, room 420 Carbondale, IL 62901-6509, USA ([roseb@siu.edu](mailto:roseb@siu.edu))

Peatlands, wetlands that form deep layers of organic soil, are an integral part of the northern Alberta landscape. Reclamation plans for northern Alberta should have a peatland element, particularly if the reclamation goal is to reclaim to former landscape conditions. Currently, there are no constructed fens in Alberta, however, Syncrude, CNRL, and Shell Canada are deep into planning, field research, and construction of a fen wetland on the East Endpit on Mildred Lake mine. The U-Shaped Cell is the pilot study for the larger reclamation plan; within the U-shaped cell, we are in the second growth season testing soil treatments and native plant survival/establishment. We are investigating the research questions: 1. Within a watershed, how variable are peatlands in size and by peatland types? 2. What are the tolerance limits to salinity (Na) for key fen plant species? 3. What protocols are required to cultivate native peatland plants (on a large scale)? 4. What are plant responses to peat compaction, peat age, peat depth, and time of transfer?

In the second growth season for our experimental vegetation, we found that peat compaction is not a significant factor in native plant establishment and growth. Vegetation establishment and growth performance is significantly higher in stockpile peat than in live fen peat. Three of the eleven test species, *Beckmannia syzigachne*, *Carex aquatilis*, and *Triglochin maritima*, have a significantly high survivorship in process water treatments. As in 2009, there were large fluctuations in stockpile peat cell water levels, and water level was difficult to control in the stockpile peat cells.

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THE IMPACT OF REGULATORY REQUIREMENTS FOR GROWING MEDIA AND PEAT MOSS PRODUCTS IN CANADA AND THE UNITED STATES

**Bloodnick, Ed**

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Federal and Provincial/State regulatory involvement and actions are becoming ever more evident for growing media and peat moss products in Canada and the United States. While packaging requirements are clearly defined, product labeling, licensing and/or registration can be quite challenging. The aim of this presentation is to present and compare the two major approaches on growing media regulation in North America. For Canada, regulations for standard growing media and peat moss products are clearly defined at the Federal level for universal compliance within each province. However, for the United States, universal federal law for growing media products does not exist. Individual product definitions vary by state, therefore product labeling, licensing and registration requirements vary. With the more recent market demand for bio-stimulants and organic labeled products, new product categories create some confusion for regulatory officials in the field where products are sold. In comparison to ingredients such as bio-pesticides, product licensing and registration is clearly defined in both Canada and the United States at the federal level, however, there is no synchronization in regulations and uniform product labeling cannot be used. All of these laws and regulations can be quite challenging for manufacturers to understand and to be compliant in an ever changing market.

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ENHANCING THE SUSTAINABILITY OF THE PEAT SUPPLY CHAIN FOR DUTCH HORTICULTURE

**Boon, Hein, M. Silvius, A. Verhagen and Herbert Diemont\***

Dutch glasshouse horticulture including suppliers has a turnover of 6 billion € and is using one third of the 4.2 million m<sup>3</sup> of imported peat used in The Netherlands. All peat used in The Netherlands is imported as indigenous peatlands have been developed and peat resources for extraction no longer exist. At the request of the Dutch government Alterra (Wageningen University and Research Centre) organized a working group to assess the impacts of the Dutch peat supply chain with respect to especially biodiversity and identify options to enhance the sustainability of use of peat as a growing medium constituent. The outcome of the assessment is discussed. Peat is recognized as an important growing medium constituent for many horticulture applications. One of the key conclusions of the assessment is that the availability of peat for such purposes does not necessarily have to compete with the need for peatland biodiversity conservation in view of availability of extensive areas of severely degraded peatlands that have no or very limited biodiversity values. However, there is a need for more transparency in the supply chain, a need to limit peat extraction to such degraded areas and a need to improve after-use. This also provides win-win options in which a focus of the sector on severely degraded areas may go hand in hand with enhancing biodiversity through peatland rehabilitation as part of the after-use. The link with the IPS Strategy for Responsible Peatland Management is discussed as well as a number of next steps for implementation.

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\*Guest speaker and presenting autor

IRRIGATION MANAGEMENT BASED ON REAL-TIME SOIL TENSION MONITORING IN GREENHOUSE PRODUCTION

**Boudreau, Jocelyn**

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Greenhouse vegetables are commonly grown using rock wool slabs. These slabs are replaced on a regular basis with every new crop. In North America it's not possible to recycle rock wool and growers are charged to send their slabs to landfill facilities. More and more growers are turning to organic substrates like coco coir and other organic substances. Changing to a new substrate in hydroponic production can be tricky as many aspects of production need to be managed differently. This is the case of fertilizers and also of irrigation. With rock wool, the most common irrigation management approach is to use solar radiations. This approach is a simplified evapotranspiration approach that is based on the assumption that wind speed, humidity and temperature are constant in a greenhouse so that the only variable parameter that affect plant water uptake is solar radiation. This approach is well suited for rock wool but could be misleading for organic substrate as water availability in the substrate can change overtime as the substrate decomposes. Measuring water availability in real-time, right in the root zone is a more direct approach that could lead to better yields. Two different studies were conducted using sawdust and peat substrates in tomato production, irrigated using real-time soil tension monitoring, in comparison to rock wool, irrigated using solar radiations. Results showed that not only the cost of substrate could be significantly reduced, but that yields could be significantly increased using real-time soil tension monitoring with sawdust and peat substrates.

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THREATS TO NORTH-AMERICAN BOREAL PEATLANDS

**Boudreau, Stéphanie (1) and M. Darveau (1, 2)**

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North American boreal peatlands are found across Canada (10.0 million km<sup>2</sup>) and in Alaska (1.7 million km<sup>2</sup>; in United States). Canada has about 1.1 million km<sup>2</sup> of peatlands, which represents about 12% of its land area and the majority of its total wetland area. Most of the peatlands (97%) occur in the boreal and subarctic regions. In comparison to terrestrial environment and despite their importance, few efforts have been devoted to mapping and monitoring of boreal peatlands across Canada. Notwithstanding that, regional studies show that the threats vary from an ecozones to another, in direct relationship with geological features and natural resources. As an example, hydroelectricity is a major threat in the Boreal Shield Ecozones whereas oil and gas mining are the main one in the Boreal Plain Ecozone. Other key threats affecting this region are: forestry (including timber harvest, drainage and previous timber floating), road development (which often cross wetlands and alters hydrology), mining activities and recreational use. Climate change poses a significant additional threat to boreal peatlands through permafrost thaw and other changes in hydrology.

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\*Guest speaker and presenting autor

DIESEL ENGINES EMISSIONS REGULATIONS FOR A BETTER, CLEANER FUTURE

**Bourgault, Rémi**

John Deere Limited, P.O. Box 1000, Grimsby, Ontario, L3M 4H5, Canada ([bourgaultremi@JohnDeere.com](mailto:bourgaultremi@JohnDeere.com))

Since 1 January 2011, the United States Environmental Protection Agency requires engines in new agricultural equipment to meet stringent Interim Tier 4 (IT4) emissions regulations. These regulations affect diesel engines with 174 to 750 hp, and require a 90-percent reduction in particulate matter and a 50-percent reduction in oxides of nitrogen emissions from Tier 3 levels. The ultimate goal of emissions regulations is to address the problem of increasing air pollution which causes smog and health issues. Diesel engine manufacturers have to develop technologies that reduce air pollutants to an acceptable level while maintaining optimal engine performance. The aim of this presentation is to compare two major approaches available to meet actual engine emissions; either EGR (Exhaust Gas Recirculation) or SCR (Selective Catalytic Reduction). While one technology relies on the use of a diesel exhaust fluid, the other leverages the use of a single fluid; diesel. Customers' concerns regarding the use of diesel exhaust fluid lead to the implementation of a single fluid solution by some engine manufacturers, which allows for meeting stringent IT4 emissions regulations with the least amount of inconvenience for customers

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PROFITABLE TRACTOR FLEET MANAGEMENT THROUGH TELEMATIC

**Bourgault, Rémi**

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As the cost of working the land continues to grow and the peat moss business is becoming more and more competitive, optimized machine management is vital. Keeping track of each machine's productivity and location during peak operating seasons, however, can be difficult. JDLink, the wireless communication and information solution by John Deere, allows for a real time follow up of tractors in fleets. Remote automated equipment management brings fleet administration to a next level by providing managers with the information needed to properly control diesel usage, machine utilization, operator behavior and tractor maintenance through a web-based application. Technicians are notified of alerts needing rapid attention while remote diagnostic and programming allows for time-efficient diagnostic minimizing traveling costs. GPS technology establishes machine location while machine installed hardware monitors functions and collects a variety of relevant tractor productivity, performance, and maintenance data. This information is then relayed wirelessly to a central database. From their office, fleet managers log onto an easy to use website to access that vital information to actively manage equipment fleet. Using Nebraska Tractor Test Laboratory results, we can demonstrate an increase in tractor fuel efficiency when using higher gear at lower engine RPM, when possible, as well as when using infinitely variable transmission automatic mode. The use of an integrated telematic monitoring system on tractors helps in optimizing machine performance by guiding operators toward adequate tractor operation as well as save fuel through proper management of idle time and machine-to-implement match.

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IF WE CAN'T REWET RED MOSS, IS CLIMATE CHANGE TO BLAME?

**Bragg, Olivia**

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Possibly all of the remaining primary bog in the UK has been disturbed by drainage. Available restoration techniques are essentially rewetting measures; usually the removal of any invading trees to reduce evapotranspiration followed by the blocking of ditch and erosion channels to reduce runoff. Outcomes so far indicate that, even if a positive effect on water table is recorded, the desired improvement in vegetation quality does not always follow. At Red Moss (Scotland), failure of the rewetting 'recipe', persistently repeated, eventually led the site manager to blame climate change; but a 'last-ditch' ecohydrological evaluation revealed a very different cause. Considered alongside numerous other projects—both failed and successful—that aimed to make or keep peatlands wet, the experience of trying to rewet Red Moss offers lessons that could save more costly 'mistakes' in larger-scale projects elsewhere. A need is indicated for fundamental but often simple modifications to aspects of established practice such as target-setting, project scoping and planning, as well as monitoring. The constraints on introducing some of these may lie beyond the control of site managers alone.

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A DRAFT WETLAND STEWARDSHIP ACT FOR MASSACHUSETTS

**Carr, Jerome**

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Since 1983, the Massachusetts Wetlands Protection Act (WPA) has become the weapon of choice to oppose any project in Mass. that lies within 100 feet of a wetland, because "It's a PROTECTION ACT ONLY!" The science of telmatology has advanced so far in the past 30 years, that every government bureau must be made aware of the facts that most mature wetlands, i.e., peatlands, offer little to no real benefits to society that can justify the "DON'T TOUCH IT!" regulations that are dominant in the USA. That is why I am trying to change the law to a WETLAND STEWARDSHIP ACT." Since President Obama is pushing for approval of a Coastal Stewardship policy, it may fail in Mass. because the WPA also over-protects all coastal features. Thus much of the benefits from federal funding may be lost due to obstructionism. See the list which compares pond values to those of a swamp, which follows and/or will be available at my presentation.

<b>COMPARISON OF POND VALUES VERSUS SWAMP VALUES</b>		
<b>VALUE OR FUNCTION</b>	<b>PONDS</b>	<b>SWAMPS</b>
<b>LAND FORM EVOLUTION</b>	Deep marsh to shallow marsh to wet meadow to swamp to bog	Bog
<b>WATER RESOURCES</b> (Eastern mass.)	Net source of water 12 to 18 inches per year	Net loss of water, 0 to 21 inches per year lost
<b>FLOOD PROTECTION</b>	Always available for flood storage Until filled with sediment	Loss of flood storage is 4 inches Per 100 years as peat accumulates
<b>WATER QUALITY</b>		
Ph	Generally Improves	Organic Acids lowers ph
Iron	Generally Decreases	Significant Increases
Heavy metals	Uptake by algal and aquatic plants And settles out with sediments	Uptake variable depending On site hydrology
Nutrients	Net Sink until Water Lilies Invade	Usually Source as Carbon Concentrates
Tannic acid	Zero to low source potential	Proven source of this carcinogen
Total dissolved solids	Decreases due to water surplus	Increases due to water losses
Color	Decreases due to Sun Light Action	Increases Due to Organic Compounds
Bacteria	Decreases Due to Sun Light Action & Consumption by Zooplankton	Survival Prolonged in Muck and Peat
Volatile organic compounds	Evaporated at air-water surface	Loss delayed by poor exposure to air
Turbidity	Decreases as Sediments Settle	Less Effective Settling
<b>WILDLIFE VALUES</b>		
Animals	Maximum value at 50% open water	Decreases over time as acids and phenols increase
Water fowl	Vital breeding habitat	Very low value habitat
Fish	Supports fish if deep enough	Fish habitat harmed due to water losses drying up small streams while organic acids harm fish & fish food

PEATLAND CARBON ACCUMULATION AND CLIMATE CHANGE DURING THE LAST MILLENNIUM

**Charman, Dan\***

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There is considerable uncertainty over possible feedbacks between peatland carbon sequestration rates and climate; do peatlands accumulate carbon faster or more slowly in a warmer world? In this talk, I will present results from a community effort to compile data on carbon accumulation rates over the last millennium. We have estimated total carbon accumulation over the last millennium for 90 sites throughout the northern hemisphere and calculated changes in carbon accumulation rates over time for a smaller subset of well-dated sites. These are compared with spatial and temporal variability in climate to determine large-scale relationships between long-term carbon accumulation and climate. We account for uncertainties in chronologies, long-term decay and ecosystem processes and find that peatland carbon accumulation has acted as a small negative feedback to climate change over the last millennium. The implications of this for understanding both the past and future carbon cycle will be considered. Finally, I will contemplate the prospects for global data-model comparisons of climate-peatland feedbacks.

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MOUNTAIN FEN RESTORATION: DEVELOPING METHODS FOR DITCH RESTORATION

**Chimner, Rod\* (1), D.J. Cooper (2) and D. Schimelpfenig (2)**

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Peatlands and disturbances to peatlands are common in many mountain ranges. A four year assessment of the San Juan Mountains, in southwestern Colorado found that approximately 2,000 fens occur in the subalpine zone (~3000–4000 m). The majority of fens were in excellent condition; however 10% of our sampled fens were impacted from roads, mining, and ditching and in need of restoration. Ditches and erosional gullies are especially problematic in mountain fens because most fens have surface slopes of 2 to 10%, although some have slopes greater than 20%. An additional problem with mountain fen restoration is that their remote locations limit restoration options. Our restoration research addresses four major topics: (1) Development of restoration methods for common impacts in mountain fens, (2) Development of a field manual of common mountain fen types, disturbances, and restoration and management protocols, (3) Development of an outreach document outlining fen protection program guidance for municipalities, counties and other interested parties, and (4) Transferring products to land managers and local governments to enable development and implementation of fen protection and restoration programs. This talk will review basic techniques of ditch and gully restoration that are part of our mountain fen restoration program.

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\*Guest speaker and presenting autor

AN EVALUATION OF THE EFFECTS OF PEATLAND EXPLOITATION ON THE EAST BRANCH PORTAGE RIVER, NEW BRUNSWICK, CANADA

**Clément, Marie (1), A. St-Hilaire (2), M. Aziz Es Salhi (2)(3), D. Caissie (1) and S. Courtenay (1)(4)**

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Under the New Brunswick provincial guidelines for peatland exploitation, suspended sediment concentrations (SSC) released into watercourses should not exceed 25 mg/L. Mitigation measures include sedimentation ponds constructed at the outlet of the drainage network as well as the presence of a vegetated buffer zone of at least 30 m between the sedimentation ponds and the watercourse.

A study was carried out to quantify the potential effects of peat extraction on the East Branch Portage River. Physico-chemical (SSC, sedimentation, water chemistry) and biological parameters (fish abundance) were monitored prior (2005 – 2006) and during (2007 – 2010) peat extraction activities. Following the beginning of the operations, levels of SSC well above 25 mg/L were recorded in all years. Suspended-sediment concentrations exceeded the provincial guidelines on numerous occasions soon after the maintenance of the sedimentation pond. A buffer zone of 250 m was also observed to capture very little of the sediment. In fact, the drained water did not diffuse throughout the buffer zone as expected. Water tended to concentrate in a natural depression (channel) within the buffer zone which connected the outflow of the sedimentation pond directly to the river. Results of water chemistry analysis and fish abundance will also be presented.

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FUNCTIONAL TRAITS SHED NEW LIGHT OVER VEGETATION CHANGES IN A BOG RESTORED 10 YEARS AGO

**D'Astous, Amélie (1), M. Poulin (1), L. Rochefort (1) and I. Aubin (2)**

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Ten years after its restoration, the Bois-des-Bel (BDB) bog shows a bryophyte cover similar to that found in natural bogs used as a reference ecosystem. However, its herbaceous layer remains more extensive and diverse than expected. The functional traits approach can be used to explain the potential of herbaceous species to establish and/or to persist in a site. In BDB, a systematic inventory of species occurrences over a grid of about 5675 points was made before restoration as well as 1, 3, 5, 7 and 10 years after restoration. Also, abundances were measured in natural bogs (n = 7) in order to see if the restored site tends toward natural bogs through time. All herbaceous species were characterized for their acidity tolerance, nutritional adaptation, means of reproduction, seed dispersal vector, seed size, water and habitat preference as well as their indigenous status in Quebec. Identification of significant functional traits and groups using the 4th corner analysis and Ward's agglomeration method were carried out respectively. Exotic or ruderal species can easily establish after restoration but they do not persist. Carnivorous species as well as those associated with a pH lower than 5.7 are associated with the natural bogs and the latest stage post-restoration of BDB. The evaluation of restored sites on a long term scale is primordial to ensure ecological efficiency of the methods used. In this respect, the integration of a functional trait approach into peatland restoration monitoring can help understanding the mechanisms driving the response of the ecosystem.

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\*Guest speaker and presenting autor

HISTORY OF WETLAND RECLAMATION IN THE ALBERTA OIL SANDS

**Daly, Christine\***

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Hundreds of square kilometers of boreal forest are disturbed in order to access the oil sands deposits underneath the earth's surface in northeastern Alberta, Canada. Post-mining landscape reclamation efforts focus on recreating the dominant ecosystems naturally present in the region - forests and wetlands. This presentation will focus on the history of wetland reclamation in the oil sands region, trends over time in wetland reclamation research, critical learnings and the latest wetland reclamation initiative. In particular, the presentation will focus on marsh reclamation and research over the past few decades and the newest research initiative – fen watershed research, design, construction and monitoring.

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BOREAL PEATLANDS AND LAND USE PLANNING: THE CASE OF QUEBEC NORTHERN PLAN

**Darveau, Marcel**

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Northern Quebec boreal commercial forest, taiga, and tundra total 1.2 million km<sup>2</sup> of relatively intact lands, of which 9% (108,000 km<sup>2</sup>) is estimated to be covered by peatlands. These peatlands are largely intact, as it is estimated that <2000 km<sup>2</sup> of them have been altered or lost. However, losses are expected to increase rapidly, as Northern Quebec faces an unprecedented pressure arising from a governmental economic development plan that, in the next 25 years, will allocate up to 50% of the area to industrial activities. The challenge is thus to set an approach that will maximize the maintenance of the ecosystem services provided by peatlands by allocating the best areas to the non-industrial 50% and by minimizing the negative effects in the industrial 50%. The first steps include peatland mapping in the taiga and tundra, identification of the ecosystem services they provide, monetisation of their value, conservation planning, and implementation. The legal existing or proposed means are protected areas network (coarse filter approach; 17% of the North), zones primarily devoted to ecosystem services other than resource extraction (including carbon storage, wildlife habitat and heritage areas; 33%); and sustainable development of industrial activities in the other 50%. Obviously, there is will lot to do in the next years if we want to maintain the key roles provided by peatlands in northern Quebec.

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\*Guest speaker and presenting autor



SUSTAINABLE GROWING SUBSTRATES FOR POTTED GREENHOUSE GERBERA PRODUCTION

**Dombrowsky, Maria, M. Dixon and Y. Zheng**

Controlled Environment Systems Research Facility, School of Environmental Sciences, University of Guelph, Guelph, Ontario, N1G 2W1, Canada

Greenhouse ornamental plant production is a billion dollar industry requiring substantial amounts of growing substrates. Four newly formulated substrates comprised of locally available, sustainable materials were tested against a commercial product, BM6 (80% peat and 20% perlite) in potted greenhouse *Gerbera jasmonii* production. The substrates included: 1) peat, coir chunks, compost, aged bark, composted pine mulch (CPM); 2) peat, coir chunks, manure, aged bark, CPM; 3) peat, coir chunks, compost, aged bark nuggets, CPM; and 4) coir fines, coir chunks, compost, aged bark nuggets, CPM. After a 14 week period plants in BM6 exhibited higher above-ground dry and fresh weights, and leaf area. Plants in substrates 1 and 3 had similar leaf areas as plants in BM6 by the final harvest. At 14 weeks there were no differences in substrates total porosity ( $84.2\% \pm 0.85$ ), container capacity ( $65.9\% \pm 0.74$ ) or air space ( $18.1\% \pm 0.75$ ). BM6 had the lowest bulk density; however the new substrates decreased in bulk density throughout the 14 weeks whereas BM6 did not. The pH ( $6.1 \pm 0.05$ ) and EC ( $1.596 \text{ dS}\cdot\text{m}^{-1} \pm 0.06$ ) of the new substrates were not within the optimal range (pH of 5.8-6.0) for gerbera production, and were higher in pH ( $5.5 \pm 0.07$ ) and lower in EC ( $2.451 \text{ dS}\cdot\text{m}^{-1} \pm 0.2$ ) than BM6, which may have contributed to the delay in growth of the plants. Although BM6 outperformed the new substrate mixes in some aspects, two of the substrates indicated promise as a growing medium comprised of sustainable materials.

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RESTORATION OF ERODING BLANKET PEATLANDS: LIMITS TO REWETTING?

**Evans, Martin\*, T. Allott and C. Agnew**

Upland Environments Research Unit, School of Environment and Development, University of Manchester, UK

The blanket peatlands of the UK and Ireland are severely degraded by extensive gully and sheet erosion. This paper will present recent data on the impacts of erosion on water tables in blanket peatlands which demonstrate not only a change in mean water table associated with erosion but also significant changes in water table behaviour. Current restoration of eroded blanket peatland has focussed on stabilisation of the peat surface through seeding a nurse crop of grasses. We will present data from restored peatlands in the southern Pennines which suggest that re-vegetation raises average water tables but does not restore normal water table behaviour. It seems likely that desiccation of the upper layers of the peat enhances macropore flow so that restoring stable high water tables is challenging given the high slopes typical of blanket peatlands. More significant impacts on local water table are achieved by gully blocking; however there is uncertainty as to the long term impacts of re-wetting efforts. We will argue that ongoing work on properly understanding flow pathways in restored peatlands is necessary to define the limits of achievable rewetting.

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\*Guest speaker and presenting autor

PEATLAND MANAGEMENT AND WISE AFTER-USE / RESTORATION: IMPLEMENTING POLICY IN THE REAL WORLD

**Farrell, Catherine A.\***

Bord na Móna, Leabeg, Tullamore, Co. Offaly, Ireland

Peatlands are extensive in Ireland, originally comprising up to 17% of national land cover, and the current examples range from pristine bog and fen systems to a suite of degraded peatland types. The greater proportion of peatlands in Ireland are considered to be degraded or under threat from drainage and/or development activities. However, the potential to restore degraded peatland areas either to their previous 'reference' ecological condition or to restore functional aspects such as carbon sequestration is recognised as being significant in Ireland. Despite this potential, limited resources and poor implementation of peatland conservation legislation and management policy is leading to yet further degradation of peatlands on a national scale. This presentation will outline the background to the current status of Irish peatlands while also drawing on examples from other countries in terms of how wise-use and after-use/restoration principles might be applied to improve their current ecological status. The potential for international policy instruments and guidelines, such as the EU Habitats Directive, the Ramsar Convention and the recently published IPS Strategy for Responsible Peatland Management, to improve peatland management practices will also be discussed.

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IMPACT OF FOREST HARVEST METHODS ON THE DYNAMICS OF BRYOPHYTE COMMUNITIES IN FORESTED BOGS

**Fenton, Nicole J., B. Lafleur, D. Paré and Y. Bergeron**

Université du Québec en Abitibi-Témiscamingue, Université du Québec à Montréal, Natural Sciences and Engineering Research Council of Canada (UQAT-UQAM-NSERC) Chair in sustainable forest management Laurentian Forest Centre, Canadian Forest Service, Canada ([nicole.fenton@uqat.ca](mailto:nicole.fenton@uqat.ca))

A significant proportion of the global boreal forest is represented by forested bogs, particularly in Alaska, central North America and Siberia. These ecosystems frequently differ from both upland forests and true bogs in composition and dynamics of both tree and bryophyte layers, although like in true bogs over 2 meters of peat can be accumulated in some sites. On the Clay Belt (in eastern Ontario and western Québec) these ecosystems are also used by the forestry industry that values the high quality black spruce growing on these sites. The impact of different types of forest operations on the composition and dynamics of the bryophyte layer is unknown, yet it may influence both peat accumulation and tree layer productivity in the long term. In this retrospective study we examined the effects of four forest harvest types, representing a disturbance severity gradient, on bryophyte layer composition and dynamics. Harvest types resulted in significantly different communities, and the most severe disturbance resulted in the reduced bryophyte cover over all. Harvest types that minimised soil impacts had bryophyte community types that most resembled very old forested bogs (dominated by *Sphagnum fallax* and *S. fuscum*), while harvest types with more significant soil impacts resulted in communities similar to forested bogs of intermediate ages (dominated by *S. capillifolium*, *S. girgensohnii*, and *S. magellanicum*). As these community types have different rates of peat accumulation, mostly because of different litter decomposition rates, the type of forest harvest used results in long term impacts on the community dynamics.

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\*Guest speaker and presenting autor

PREMIER TECH HORTICULTURE: A WORLD LEADER IN PEAT BOG RESTORATION

**Gagnon, Jacques, M.C. Desbiens and R. Naasz**

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In 1991, the Canadian Sphagnum Peat Moss Association (CSPMA) developed a policy for peat bog development and restoration. Premier Tech was the first peat producer to work with Laval University researchers (Peatland Ecology Research Group) to determine various restoration methods. After several years of research and trials, methods and procedures for peat bog restoration were developed for the peat industry. In 1995, Premier Tech had implemented its first large-scale program of peat bog restoration and Premier Tech continues to lead the industry on bog restoration in North America. The aim of this presentation is to outline the Premier Tech specific approach developed for restoration programs. It includes policy aspects and procedures for the opening and closing of peat bogs. Within our restoration programs we have also developed particular management principles that are followed at all bog locations. The final goal of this environmental management of the peat bogs is to ensure the company's continuance and secure this ecosystem for future generations.

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SPHAGNUM FARMING ON CUT-OVER BOG IN GERMANY: EXPERIENCES OF A SIX YEARS TRIAL

**Gaudig, Greta, M. Krebs and H. Joosten**

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Peat moss (*Sphagnum*) biomass may provide a sustainable alternative to fossil white peat as a raw material for horticultural growing media. Since 2004 we farm *Sphagnum* on a 1.200 m<sup>2</sup> large plot on a rewetted cut-over bog in North-West Germany. We established *Sphagnum* by spreading fragments of *Sphagnum papillosum* and covering the fragments with straw mulch. We monitored vegetation development, *Sphagnum* growth and water levels over a six years period. After 3 years *Sphagnum* had reached coverage of 55% and biomass productivity (over the 3 year period) of an average 1 t DM ha<sup>-1</sup> yr<sup>-1</sup>, one year later > 90% coverage and > 2 t DM ha<sup>-1</sup> yr<sup>-1</sup> (over the 4 year period). After this establishment phase, *Sphagnum* productivity increased in the subsequent 2 years to an average 3.6 t DM ha<sup>-1</sup> yr<sup>-1</sup> with highest productivity (5 t DM ha<sup>-1</sup> yr<sup>-1</sup>) being reached on sites with permanently high water levels. Our results indicate that by maintaining continuously high water levels the establishment phase can be shortened and *Sphagnum* productivity can be substantially increased.

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\*Guest speaker and presenting autor

REWETTING IN HISTORICALLY HARVESTED PEATLANDS: ASSESSING CHANGE IN COMMUNITY-SCALE VEGETATION STRUCTURE AND ORGANIC MATTER ACCUMULATION RATES

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A comparative study was conducted in rewetted and non-rewetted areas of three historically block-cut exploited peatlands in the Rivière-du-Loup region of Québec, Canada. Specific research questions of the study were as follows: To what extent does rewetting facilitate a community-scale shift in vegetation assemblages of historically harvested peatlands towards that of a natural peat-forming bog? A) What are the relative ratios of vegetation strata comprising above-ground biomass? B) What is the rate and amount of organic matter accumulation in rewetted areas, and how does this compare to non-rewetted areas? Vegetation was characterized in rewetted (N=22) and non-rewetted (N=32) areas of historically block-cut peatlands using eight vegetation strata classifications, and was surveyed using a frequency point-encounter method. Above-ground biomass and organic matter accumulation since time of abandonment were quantified in rewetted and non-rewetted areas. Collected samples were sorted into their respective vegetation strata, dried to a constant mass, and weighed. Community-scale vegetation composition was found to differ significantly in rewetted areas, in comparison to non-rewetted areas as well as historical survey data collected in areas prior to rewetting. Relative ratios of above-ground biomass and densities of accumulated organic matter differed significantly between rewetted and non-rewetted areas, due to tree/shrub mortality and subsequent proliferation of heliophilous, hydrophytic species. Cores from rewetted areas display a distinct stratified shift from ericaceous litter to newly formed fibric peat. Results suggest that while rewetting is effective at shifting peatland vegetation back to a peat forming, *Sphagnum* dominated community; success is heavily dependent on pre-existing topographical variation.

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RESPONSES OF BOG VEGETATION TO CLEARING FOR OIL SANDS EXPLORATION AND EXTRACTION

**House, Melissa (1), D.H. Vitt (1), R.K. Wieder (2) and S.C. Koropchak (1)**

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Oil sands extraction and exploration activities in western boreal Canada continue to increase and diversify. Conventional drilling activities begin by constructing a mineral pad on organic terrain to support equipment. Recent activities involve removing trees and hummocks, creating a flat surface, and waiting until winter when the ice provides a stable working surface so that extensive seismic exploration for oil sands or natural gas extraction may take place. In the spring, the ice melts and the ground is an open peat layer lacking vegetation. The current assumption for these 'minimum-disturbance' sites is that the vegetation will return to that of a natural bog. To determine the vegetation response to bog clearing, two comparative chronosequence studies were conducted. Cleared site (constructed 1987-2008) vegetation was surveyed and compared to recently burned (1982-2002) vegetation. This allowed for the comparison of the succession of bogs cleared for oil sands operations to a natural disturbance (fire). The anthropogenic clearing of bogs has a more profound impact upon the landscape causing a varied response of sites compared to fire. Some cleared sites were found to resemble fens with species of *Salix* and *Carex* up to 15 years after disturbance, whereas other cleared sites support *Sphagnum*-dominated communities with returning *Picea mariana*. Conversely, burned bogs follow a much more predictable succession, and by 20 years post-fire support a community that closely resembles that of a mature bog. Added minerotrophy may have a strong affect on the fate of these minimum-disturbance sites, possibly complicating the succession of these sites.

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\*Guest speaker and presenting author

TODAY'S CANADIAN BOREAL PEATLAND FORESTRY

**Jutras, Sylvain**

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In 1995, an extensive and comprehensive review of the ecology and principles of peatland forestry was published (Paavilainen & Päivänen 1995). At that time, Northern Europe countries were attaining the maturity in their management approach concerning forested peatlands, aiming their interest towards a sustainable maintenance of drained areas. In Canada, at the same time, peatland forestry was gaining in popularity and great success of certain silvicultural treatments, such as drainage, was expected in many provinces where vast forested peatlands could be found. Today, forested peatland management is not what it was expected to become 15 years ago. Black spruce and Scots pine behaving very differently, peatland forestry inspired from Northern Europe expertise had to be adapted, or even sometimes proven inappropriate to our situation. Many factors have influenced the faith of forestry in Canada, consequently forcing the evolution of laws, regulations, guidelines and silvicultural approaches. In many provinces, major changes occurred; it is generally more difficult to act in forested peatlands without considering the fragile and easily disturbed hydrological cycle of these ecosystems and the consequence it can have on stream water quality. The way forested peatland management is done now in the boreal region of Canada will be described and compared to what was expected 15 years ago. (Reference: Paavilainen, E. & Päivänen, J. 1995. Peatland forestry: ecology and principles. Springer-Verlag, Berlin. 248 pp.)

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PEAT EXTRACTION AND ENVIRONMENT: PROBLEMS AND CHALLENGES ON THE EXAMPLE OF ESTONIA

**Karofeld, Edgar\***

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The problems caused by abandoned peat extraction areas and the prospects for sustainable peat extraction are the topics of the presentation. In Estonia peatlands of various states cover ~22 % of the territory and the productive peat reserve is ca 755 million t. Mechanized peat cutting started in Estonia in 1861, but until the 1940s peat for fuel was mostly extracted manually without drainage in bog margins. The impact on the environment was relatively small and localized, and these areas re-vegetated spontaneously. The situation changed drastically from the 1950s when milling techniques were introduced and the number and especially the area of drained peat extraction sites having a negative impact on their surroundings increased dramatically. After the collapse of the Soviet economy, peat extraction was dis-continued at many sites without any restoration. The recent inventory indicates that there are ~9400 ha of abandoned peat extraction areas in Estonia and peat is extracted in ~80 bogs (18-19 thousand ha) and therefore the area of abandoned peat fields is expected to increase. Estonia's statutes require that abandoned mining sites must be re-cultivated but almost no full scale restoration has been carried out on peatlands. The reasons and justifications for this will be analysed. In 2005 National Audit Office focused on this problem, but the response has been minimal, although some steps have been undertaken. The role of local NGO-s and potential problems initiated by the foreign campaigns against peat extraction will be discussed and likely scenarios analysed.

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\*Guest speaker and presenting autor

PEATLAND RESTORATION AND HYDROLOGY: LINKING PEATLAND RESTORATION (REWETTING) TO THE MOISTURE DYNAMICS WITHIN SPHAGNUM MOSS CUSHIONS IN AN ABANDONED BLOCK-CUT BOG

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Initially, restoration efforts aim to create hydrological conditions more favourable for the recolonization of non-vascular *Sphagnum* mosses, ultimately facilitating the reestablishment of an upper acrotelm layer and a self-sustaining (peat accumulating) ecosystem. The spontaneous revegetation of an abandoned block-cut bog in Quebec (the Cacouna bog) favoured vascular vegetation over *Sphagnum* moss recolonization due to deep water tables and low soil-water pressures in the unsaturated zone caused by remnant drainage networks established during the peat extraction process. In an assessment of the site hydrology prior to (2006) and following (2007) the blockage of site drainage networks (site rewetting), the extent of the summer water deficit was reduced in 2007, caused predominantly by a reduced runoff efficiency following ditch blocking. The large-scale effect included higher water table levels and flooding of many trenches and low-lying areas. At a smaller scale, the connectivity between spontaneously regenerated *Sphagnum* moss cushions and the moisture regime of the remnant cutover peat substrate was strong when conditions were wet. This relationship weakened as conditions within the substrate became drier, indicating that the *Sphagnum* cushions may not be reliant upon the substrate as a source of water for physiological functions, though only require that the substrate remain sufficiently wet so that water is not drawn from the mosses. Rewetting created conditions more favourable for *Sphagnum* survival; although it appears that the moss cushions are likely dependent upon atmospheric water inputs (e.g. rain, dew) rather than fluctuations in the position of the water table within the remnant peat deposit. The purpose of this presentation is to assess the impact of rewetting on the site hydrology within the Cacouna bog and discuss water exchanges between the cutover peat substrate and *Sphagnum* moss cushions.

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VERIFLORA® VOLUNTARY CERTIFICATION FOR RESPONSIBLE PEATLAND MANAGEMENT

**Keyes, Michael**

VeriFlora Certification Program - Scientific Certification Systems, USA ([mkeyes@scscertified.com](mailto:mkeyes@scscertified.com))

Peat moss production systems are diverse and poorly understood by lay and highly educated consumers alike. A third party socio-environmental code has been under development since late 2008 with multiple stakeholders, primarily centered in Quebec, Canada. The newly established Peatmoss Annex for use by participating peat moss producers and blenders is now operational within the VeriFlora Certification program. This voluntary standard provides a benchmark that requires responsible stewardship practices and continuous improvement for the participating peatland managers. Specifically the standard strives to restore carbon accumulating wetland ecosystems, reduce the environmental footprint in peat moss production, and stimulate innovation, while favoring horticultural and other biological uses of peat moss. In addition to specific environmental requirements, certification criteria and indicators for energy efficiency, integrated waste management, fair labor practices, community benefits, and product quality form the body of this code of practice. This initiative forms a part of North America's largest voluntary certification program in horticulture. The VeriFlora program involves many of the most advanced and forward thinking companies engaged both in the production of growth media and as downstream users of this critically important material for greenhouse production. The evolution of this voluntary standard will be highlighted.

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\*Guest speaker and presenting autor

CAN MORE NATURAL WATER LEVELS SERVE AS RESTORATION MEASURE IN BASE-RICH FENS?

**Kooijman, Annemieke\* (1), C. Cusell (1) and L. Lamers (2)**

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In the Netherlands, rich fens are highly threatened by P-eutrophication. Rich fens belong to the Natura 2000 priority habitats, but in the west, *Scorpidium* rich fens are overgrown by tall *Sphagnum* species with high acidification capacity, which under P-eutrophic conditions may already establish at high pH. Well-developed rich-fens only remain in the north-east, where P-availability is still relatively low. Nevertheless, rich fens are threatened by ongoing succession, and new pioneer stages have not yet formed, due to water pollution. Perhaps more natural water levels, fixed for agricultural reasons, could help. Inlet of water from IJsselmeer, polluted with P and SO<sub>4</sub>, could be reduced by lower water levels in summer, and storage of water in winter. Also, in winter higher water levels might flood the fens, and thus increase base saturation. However, in winter, water mainly comes from adjacent agricultural polders, which is even more polluted with P and SO<sub>4</sub>. Input of P and SO<sub>4</sub> from polders in winter is thus much higher than input from IJsselmeer in summer. Also, flooding of rich fens with P-rich water might induce establishment of tall *Sphagnum* species with high acidification capacity. In addition, flooding might lead to P-mobilization via reduction of SO<sub>4</sub> and dissolution of iron phosphates. In practice, in floating fens, flooding did not even happen, because the root mat moved with the water level. In fens with fixed peat soil, flooding did occur, but did not lead to increased base saturation, because infiltration of surface water was reduced by the oversaturated soil.

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CAREX AQUATILIS AS A PIONEER SPECIES FOR BOREAL WETLAND RECLAMATION AFTER OIL SANDS MINING OPERATIONS IN NORTHERN ALBERTA

**Koropchak, Sara C. (1), D.H. Vitt (1), S. Ebbs (1), R.K. Wieder (2) and M.K. House (1)**

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Since the initiation of oil sands development, exploration and mining operations have increased exponentially. Oil sands deposits cover approximately 25% of Alberta's area, which is a mosaic of peatland and upland ecosystems. Most mining is conventional drilling, but approximately 20% of mining activities are surface mining operations. Both methods alter the landscape such that they require non-passive reclamation efforts. While protocols for upland reclamation are fairly standard, there are no clear guidelines for peatland reclamation after oil sands mining. To establish guidelines, primary reclamation constraints must be used to determine which species best tolerate the new environmental conditions. This research aims to show that *Carex aquatilis* is a potential pioneer species in peatland reclamation after surface mining operations. A greenhouse experiment was conducted to determine the tolerance of *Carex aquatilis* to one of the main stressors after surface mining; sodium. Plants were grown in the greenhouse and transplanted into five different [Na<sup>+</sup>] from 5 mg L<sup>-1</sup> to 2000 mg L<sup>-1</sup>. Findings indicate that 1000 mg L<sup>-1</sup> is the upper limit for [Na<sup>+</sup>], as just over 1/3 of plants survived in this concentration, but survival (75%) and performance improved at 500 mg L<sup>-1</sup>. These data are supported by peatland vegetation surveys, which found *C. aquatilis* did not occur where [Na<sup>+</sup>] was higher than 1000 mg L<sup>-1</sup>. Currently, preparations are beginning for another sodium tolerance experiment to test the tolerances of *Larix laricina*, other *Carex* sp., *Scirpus microcarpus*, and *Betula glandulifera*.

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\*Guest speaker and presenting autor

SPHAGNUM REGROWTH AFTER HARVEST IN THE KOLKHETI LOWLANDS (GEORGIA/TRANSCAUCASUS)

**Krebs, Matthias and H. Joosten**

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*Sphagnum* biomass attracts increasing attention as a substrate for special cultures (e.g. orchids, bromelias) and as an alternative to peat for the production of horticultural growing media. As commercial harvesting from natural peatlands may easily lead to overexploitation, *Sphagnum* farming has to be developed in order to protect natural mires and to cover the growing demand. Central question for *Sphagnum* farming is the optimal harvest cycle that is determined by the speed of regrowth after harvest. We studied regrowth of *Sphagnum papillosum* and *S. palustre* after cutting and removing a 5 or 10 cm deep moss layer in mires of the Kolkheti Lowlands (Georgia/Transcaucasus) where natural conditions for high *Sphagnum* productivity prevail. One year after cutting, new *Sphagnum* capitula already covered almost 100%, of the cut area, independent from cutting depth, indicating a short re-establishment phase. Length increment 2 years after cutting was significantly higher than after 1 year. Biomass production and length increment were 180 g m<sup>-2</sup> and 2.0 cm after one year and 490 g m<sup>-2</sup> and 5.3 cm (*S. papillosum*) or 13.2 cm (*S. palustre*) after two years growth. Thus a fast regrowth of *Sphagnum* after harvest is observed in the Kolkheti Lowlands, indicating short harvest cycles. *Sphagnum palustre* showed a larger length increment than *S. papillosum* whereas biomass production was similar. Consequent differences in moss structure may be relevant for horticultural substrate quality.

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THE PHENOLOGY OF CARBON DIOXIDE EXCHANGE IN NORTHERN PEATLANDS: PATTERNS AND DRIVERS

**Kross, Angela, N.T. Roulet and T. Moore**

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It is important to understand how peatlands will respond to changes in climate and environmental variables, as even relatively small changes could affect the stability of the huge carbon pool in these ecosystems. There is a need for more studies relating the carbon dioxide (CO<sub>2</sub>) exchange to environmental variables over large areas, and remote sensing technologies are currently the only way to obtain such information, especially when considering the location of peatlands and their difficult accessibility. Ecosystem phenology can provide important information related to CO<sub>2</sub> exchange and can be captured by satellite data. Our main objectives were to examine if peatland vegetation presents clear phenological transitions, and to study the relationship between these transitions and the CO<sub>2</sub> exchange and climate variables at four functionally different peatland sites. We extracted a set of time-related phenological indices (e.g. start and length of the growing season) and a set of CO<sub>2</sub>-exchange-rate-related phenological indices (e.g. annual peak and recovery CO<sub>2</sub> exchange rates). Our results confirmed the presence of clear phenological transitions and phases at all sites. Overall, our findings suggest that time-related indices, which were mainly related to monthly and seasonally averaged temperatures, set the limits for the maximum "potential" CO<sub>2</sub> exchange. Yet, vegetation and site characteristics, such as leaf area index, nitrogen content and water and nutrient availability may play a larger role for the "actual" gross and net carbon uptake, and are better reflected by the peak, recovery and senescence CO<sub>2</sub> exchange rates. Monthly and seasonally accumulated precipitation had strong relationships with these indices.

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USE OF PEAT FOR WASTEWATER TREATMENT: A SUSTAINABLE SOLUTION

**Lacasse, Roger and Denis Pettigrew**

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In mid 80's, Premier Tech started investigations to identify added value alternatives of sphagnum peat moss applications. After different pilot testing, the use of peat as filtering media for wastewater treatment was selected for further development. Similarly to horticultural applications, the use of peat for wastewater treatment required a good knowledge of hydrodynamic properties (static and dynamic liquid phases, air and solid phases) but applied in a different context characterized by oxygen demand required for aerobic biological treatment in the filtering bed, residues accumulation with time in the peat media (inert and oxidized organic matters), compaction and degradation of the media with time. Since 1995, Premier Tech Aqua commercialized the Ecoflo® system, a high performance peat based biofilter in North America, requiring no external energy for wastewater treatment. Actually, more than 40,000 residential units are installed and under normal use, the life span of the filtering media exceeds 10 years before replacement. Characterization of this used peat demonstrated that after stabilization (ex: pathogens inactivation by composting), this material can be reused as soil amendment and for erosion control on degraded soil. Globally, the use of peat for wastewater treatment is a sustainable solution contributing to a better environment.

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THE USE OF NITROGEN DRAWDOWN INDEX (NDI) TESTING AS AN ASSESSMENT OF THE STABILITY OF "SUSTAINABLE" PEAT ALTERNATIVES IN NURSERY MIXES

**Lafreniere, Claudia, A. Duncan, K. Osborne, and N. McKeown**

Gro-Bark (Ontario) Ltd., 12300 Britannia road, Milton, Ontario, L9T 7G5, Canada ([keith@gro-bark.com](mailto:keith@gro-bark.com))

Sustainability has become a key component of every industry, and a driving force of environmental stewardship. This has brought attention to the increased use of sustainable raw material alternatives to peat in soilless growing media. Several types of composts and barks have been researched and are successfully being utilized in recipes for the horticultural sector. The purpose of this project is to evaluate test methods which most properly describe the nitrogen fixation properties of some peat alternatives. The Nitrogen Drawdown Index (NDI) is a method that was created in the early nineties for the determination of the total nitrate taken up by the media over a designated period of time, 4 days for most tests. In assessing the usefulness of the methodology to determine the stability of different substrates, Gro-Bark has re-examined aspects of the methodology itself and identified potential pitfalls from empirical data. The first trials concentrated on two separate peats and several bark sources. The initial results revealed some inconsistencies which may be related to certain physical characteristics of the materials – especially moisture content. Test results on a single bark source at different stages of decomposition also varied -possibly as a result of the presence of fungal microbes at the time of testing. While there is the potential for NDI to predict nitrogen fixation, further research is needed to better understand the dynamic environment of peat alternatives that contain high microbial populations.

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\*Guest speaker and presenting author

SPATIAL AND TEMPORAL VARIATIONS OF METHANE FLUXES MEASURED BY AUTOCHAMBERS AT THE OMBROTROPHIC MER BLEUE BOG

**Lai, Derrick Y.F. (1), N.T. Roulet (1), T.R. Moore (1), E.R. Humphreys (2) and M. Dalva (1)**

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Northern peatlands contain one third of the world's soil carbon and play a key role in the global carbon cycle. Owing to the presence of predominantly anaerobic conditions, these peatlands may release some of the stored carbon to the atmosphere in the form of methane gas (CH<sub>4</sub>). This study investigated the spatial and temporal variations of CH<sub>4</sub> flux measured by autochambers at the ombrotrophic Mer Bleue bog near Ottawa, Canada. Significantly higher CH<sub>4</sub> emissions were found from Eriophorum-dominated than shrub-dominated chambers. For shrub-dominated sites, higher fluxes were obtained at hollows than hummocks. Seasonal peaks in CH<sub>4</sub> emissions were partly related to plant photosynthetic activity. Water table was a major control of CH<sub>4</sub> flux over time when the site was relatively dry, while peat temperature became more strongly correlated with CH<sub>4</sub> flux during the wetter period when water table remained high. Spatio-temporal modelling of peatland CH<sub>4</sub> flux should take into account emission hotspots and changes in dominant environmental controls over the course of growing season.

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SPHAGNUM FARMING IN CANADIAN MARITIMES: ADVANCEMENTS SINCE 2004

**Landry, Josée and L. Rochefort**

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A peatland located in the Canadian Maritimes, where peat had been harvested by bloc cutting, is now dedicated to an emerging economical activity: *Sphagnum* farming. The main objective of the experimental *Sphagnum* farming station is to rapidly produce a source of *Sphagnum* fibre biomass on a renewable basis. The *Sphagnum* farming station is quickly expanding, more or less, every year a new production cycle is established using the *Sphagnum* layer transfer technique. A total of 0.7 hectare is presently dedicated to *Sphagnum* cultivation. Production cycles were started in 2004, 2006, 2008, 2009 and 2010. Growth parameters are closely monitored yearly. Parameters measured include rate of vegetation establishment, biomass accumulation, *Sphagnum* productivity, rate of decomposition and hydrology. The production cycle 2004 have shown that this system is as productive as a natural reference peatland with mean annual productivity for the *Sphagnum* layer of 264 g m<sup>-2</sup> (four years after establishment) and 268 g m<sup>-2</sup> (five years after establishment). In the first 2-3 years of establishment, the production basins should be wet but not flooded for optimal growth.

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BERRIES IN BOIS-DES-BEL PEATLAND – 10 YEARS AFTER RESTORATION

**Lapointe, Line (1), J. Bussi res (1), M.C. LeBlanc (2) and L. Rochefort (2)**

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Cover of berry plant species was followed in Bois-de-Bel restored peatland over the past 10 years since restoration of the site by the North American restoration technique. We wanted to determine 1) to which extent different berry plant species recolonized the site following restoration and 2) the impact of restoration on fruit yield. Vegetative cover of berry plant species was measured the year before restoration and every one to three years following restoration using both the pin point technique and the percentage cover in permanent plots in a restored and non-restored area of the peatland. Yield was measured by harvesting all the blueberry (*Vaccinium angustifolium*) and cranberry (*V. oxycoccos*) fruits in small plots 10 years after restoration in the two areas of the site as well as in a natural peatland nearby. Not all berry plant species did recolonize the restored area at level observed in natural peatland areas, but blueberry and cranberry did. Restoration is necessary for cranberry reintroduction and its fruit yield 10 years after restoration was comparable to yield recorded in the natural peatland. Blueberry was present before restoration. Non restored conditions continued to favor blueberry cover and fruit yield. Restoration reduced blueberry abundance to the levels found in the nearby natural peatland.

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ENVIRONMENTAL LABELING OF GROWING MEDIA IN FRANCE

**Largant, Laurent**

CAS (French Federation of manufacturers of growing media and soils improvers), France

The aim of this presentation is to highlight main objectives and requirements of the French project "Environmental Labeling" and its potential application to growing media. Environmental labeling will provide specific information printed on each product packaging available for the final consumer. This informative labeling will include the total greenhouse gases emissions of the product (content, packaging, and transportation impact), as well as the impact of eco-toxicity and water consumption. Working groups, for each product group have begun to collect LCA information and are determining the specific labeling requirements. Implementation of environmental labeling was planned for the beginning of 2011, as one of the key points of president Sarkozy's environmental program. But many questions are still pending relating to data bases and the capacity of France to impose such labeling regulations on other EU member states.

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RESTORATION OF A VALLEY BOTTOM FEN: VEGETATION ESTABLISHMENT AND RECOVERY OF THE DONOR SITE

**LeBlanc, Marie-Claire (1), L. Rochefort (1), V. Bérubé (1), S. Boudreau (2), J. Landry (1), M. Poulin (1) and J. Price (3)**

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A peatland abandoned after 50 years of peat extraction was rewetted and partly restored with the moss layer transfer technique using fen plants as the peat layers had been extracted down to former fen layers. Indeed pH were above 5.5 throughout the site and the remnant peat botanical composition resembled moderate-riche fen conditions. Fen plant material has been reintroduced on approximately 2 hectares of the rewetted partly mechanically on a large scale and partly by hand as part of a community education project. Material for restoration was collected at the margin of a drained lake fen in the same region and presenting a similar chemical composition as the fen to be repaired. In this talk we will present the methods used, the early results and the challenges encountered during the restoration of the Bic-St-Fabien fen. The different restoration approaches and monitoring programs that have been carried out for the past two years will be discussed as well as ideas for future ecological restoration management.

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SALINITY MANAGEMENT IN PEAT-SAWDUST GROWING MEDIA

**Létourneau, Guillaume (1), J. Caron (1), R. Naasz (2), D.E. Elrick (3) and C. Boily (1)**

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The use of moderately decomposed peat (H4-H5 on de von Post scale) and white spruce (*Picea glauca*) sawdust mixtures as growing media in intensive greenhouse production systems has shown a great potential to increase productivity while promoting the recycling of by-products from peatland and forest industries. With a proper fertigation management, the use of these substrates could also generate considerable water and fertilizer savings, hence having beneficial economical and environmental effects. However, with conventional irrigation management based in part on the leaching fraction of applied nutrient solution, salinity levels limiting crop growth have often been observed in these substrates. The objectives of this study were to 1) evaluate the productivity of two peat-sawdust growing media for greenhouse tomato production, 2) obtain a better understanding of the mechanisms leading to salt accumulation in these substrates and 3) evaluate the effects of different fertigation practices on salt accumulations. Greenhouse tomato production experiments were conducted in order to evaluate the productivity of a peat sawdust mixture as well as the spatio-temporal distribution of salts in the substrates. Combined laboratory experiments were conducted in order to assess the physico-chemical properties of these growing media and their influence on solute transport properties. The results from these experiments were used to perform water and solute transport simulations of different fertigation management scenarios. It appeared that simple management practices would allow growers to maintain salinity levels in the growing media within the optimal range for optimum tomato production.

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\*Guest speaker and presenting autor

WETLAND MANAGEMENT AFTER TERMINATION OF PEAT EXTRACTION AND EFFECTS ON THE ENVIRONMENT

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Peatlands are used for activities such as agriculture, forestry and peat harvesting. The use is often dependent on drainage to regulate the water conditions. In peat excavation plans, after-use when terminated is strictly regulated. Restoration of wetlands is highlighted. In industrial use of peatlands, considerable changes in site conditions and new prerequisites exist as the very old peat bottom layers are exposed to land surface conditions. In Sweden, rewetting of two such areas started more than ten years ago. Investigations were carried out before and after rewetting using the comparison and calibration period technique. Ecological characteristics of wetlands differ considerably and are reflected in remaining peat conditions, established hydrology and water chemistry, being the driving force for vegetation development, water quality, limnic life and biogeochemistry. Vegetation and surface soil conditions changed with time and there was new spontaneous *Sphagnum* colonisation. Changes in hydrochemistry after rewetting relate to altered redox conditions influencing especially pH, sulphur, nitrogen and phosphorus. Reduced peat decomposition promoted peat accumulation and denitrification influenced element turnover, due to anaerobic conditions in the sediments. Peat site properties such as vegetation and chemical conditions affect the greenhouse gas emissions. Both CO<sub>2</sub> and CH<sub>4</sub> emissions varied with site type. However, while bare drained peat did not emit much CH<sub>4</sub>, tussocks on drained peat showed higher values. This suggests that the plants can (i) emit CH<sub>4</sub>, (ii) promote the transport of CH<sub>4</sub> from the soil to the atmosphere and/or (iii) promote the formation of CH<sub>4</sub> in the soil.

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HABITAT SELECTION BY SPRUCE GROUSE: TESTING DETERIORATION AND ISOLATION IN A HUMAN-DOMINATED LANDSCAPE

**Macabiau, Céline (1), P. Blanchette (2), E. McIntire (1) and A. Desrochers (1)**

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Influences of habitat loss on distribution of avian populations and individual fitness fall in two main categories: habitat deterioration and isolation. Both of these categories have been documented by empirical studies of forest birds. Determining whether habitat deterioration or isolation is the main process is key to effective conservation, because solutions to stop or reverse these processes differ greatly. Spruce Grouse (*Falci pennis canadensis*) is common throughout Canadian boreal forests, but scarce at the southern limit of its range, where conifer habitat is often patchy. To answer concerns about the long term viability of the species in southern Québec, we conducted call-response surveys associated with radio-telemetry to determine whether this species distribution is mostly influenced by habitat deterioration or isolation. In addition to nesting surveys, radio-tagged individuals have been translocated (mean distance 20 km) and released into unoccupied contiguous and isolated conifer patches in autumn 2009 and winter 2010 to investigate the relative roles of habitat deterioration vs. isolation. Occupancy by grouse was high in coniferous forests adjacent to bogs, and nesting success was higher in bogs than in forests. Translocations suggest that grouse are more mobile in fragmented habitat than in contiguous habitat. Thus, Spruce Grouse distribution in our study area appears to result from habitat deterioration and a low dispersal capacity of the species.

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\*Guest speaker and presenting autor

AMENDING GROWING MEDIA WITH MYCORRHIZAE: CHALLENGES AND BENEFITS

**Machrafi, Younes, R. Naasz, M.C. Desbiens and S. Gagné**

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The beneficial effects of mycorrhizae in agriculture, horticulture (ornamental), turf and landscape sectors is nowadays well recognized. Professional growers can increase yields and crop quality, improve drought tolerance, allowing watering reduction, decrease the use of chemical fertilizers, and etc. These practices are in perfect harmony with the concept of sustainable agriculture. However, only a few commercial inoculants are available on the market due to their complex development and long registration process in many countries. Premier Tech has acquired over the past 20 years a unique expertise in industrial scale production of top quality mycorrhizal inoculants. The mycorrhizal production process developed by Premier Tech requires a strictly controlled environment and uses standards of the high-technology industry. This results in contaminant-free mycorrhizal spore suspensions that are used to formulate very high quality products. PRO-MIX® substrates with MYCORISE® PRO are good examples illustrating the successful use of beneficial biological agents at large scale in growing media. For example in greenhouse trials, adding mycorrhizae to growing media has increased significantly the shoot dry weight of pepper, lettuce, pansy and scarlet sage by 43%, 44%, 60% and 68% respectively compared to the control treatment (without mycorrhizae). Finally, quality, quantity and formulation of microbial inoculants are important factors to consider in order to ensure efficient and performing products.

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THE POTENTIAL OF BIOCHAR AS AN INGREDIENT IN POTTING MIXES

**Major, Julie**

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Biochar is considered the only currently available tool to sequester carbon in soil in significant amounts, while simultaneously improving soil fertility. Biochar refers to a kind of charcoal made from biomass. This talk will give a broad and brief overview of biochar technology, from biochar production from waste biomass to its use in soil for achieving a number of goals including soil fertility management and soil carbon sequestration. The scientific basis for these agricultural and environmental advantages will be presented. Biochar has been used in potting media in tropical regions and for orchid production, but very little published scientific information is available on the substitution of ingredients currently used in commercial potting mixes for biochar. The information available to date on the use of biochar in potting mixes will be presented.

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HYDROLOGICAL RESPONSE TO REWETTING IN A FEN PEATLAND NEAR RIMOUSKI, QUÉBEC

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Water availability is a major concern when restoring degraded vacuum harvested peatlands. Rewetting is typically the first step in peatland restoration and aims to improve the hydrological conditions necessary for nutrient cycling and ecological development. Rewetting peatlands has traditionally been limited to bog peatlands with little research pertaining to fen peatlands, especially at a larger scale. Site scale hydrological data exist for the 2008 and 2009 field seasons in the vacuum harvested moderate-rich fen (Bic-St. Fabien) near Rimouski, Québec. Restoration (rewetting) occurred fall 2009 by blocking active drainage ditches and contouring the peat surface to create bunds to prevent runoff. Due to the conditions at the centre of the cutover peatland machinery was unable to contour the entire site. Minor variations in surface elevation also influenced rewetting. A peripheral active drainage ditch was dammed in the 2010 field season and leaky drainage ditches were re-blocked to aid the rewetting process. Hydrological data from the 2010 field season indicate that the site is substantially wetter. The overall hydrological conditions of the cutover peat field have improved; however the greatest improvement is localized in regions directly affected by rewetting practices. A rise in the water table position as well as its stability is more pronounced and evident in regions where surface contouring occurred and in the region of the dammed drainage network. The water table response to rewetting is weakened with distance away from directly rewet areas. Despite the water table becoming more stable, soil water pressure did not follow this trend.

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COOL FINISHING OF POINSETTIAS RELATED TO SUBSTRATE QUALITY

**Marchand-Roy, Mylène (1), J.P. Fortin (2) and M.R. Nemati (3)**

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Greenhouse heating represents from 15% to 20% of the cost of goods in the horticulture industry in Eastern Canada. Cool finishing of poinsettias was presented as a growing method to reduce the cost. The objective of the project was to study the relationship between the quality of the substrate and the growth of poinsettias under cold finishing temperatures. Two substrates with saturated hydraulic conductivity (Ksat) of 0,04 cm/s and 0,08 cm/s were tested under two finishing temperatures of 15,5 °C or 17,5 °C. Rooted cuttings of *Euphorbia pulcherrima* var. Premium Red were planted on July 22<sup>nd</sup> and harvested on December 23<sup>th</sup> of 2008. The crops were grown at a temperature of 21 °C until finishing. Root, top growth, bracts and plant quality were measured weekly throughout the production. The crop were maintained at pH and EC recommended for the cultivar. There was no interaction between temperatures and substrate quality. Greater Ksat gives shorter plants height, better roots, greater bracts and the plants were of better quality and produced in a shorter period. Cropping time depended on finishing temperature as better earliness was observed at higher temperature. Similar results were obtained in another experiment using conventional finishing temperature (21°C). The cost for heating were compared and it was concluded that lower production cost may be obtained when growing poinsettias in a substrate with high fluid diffusion rate under conventional production temperature, providing that pH, irrigation and nutrition are maintained at optimum levels.

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\*Guest speaker and presenting autor

AMPHIBIAN AND AQUATIC BEETLE COLONIZATION OF MAN-MADE POOLS IN A RESTORED PEATLAND

**Mazerolle, Marc J. (1) and C. Lavoie (2)**

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(2) École supérieure d'aménagement du territoire et de développement régional, Université Laval, Québec, Québec, Canada

As a component of a large-scale project aiming to study the success of peatland restoration techniques, we studied the colonization of man-made pools between 1 and 10 years following restoration. Specifically, we conducted call surveys to detect anuran males and funnel trapping to detect the presence of amphibians under all life stages (adult, juvenile, tadpole) as well as aquatic beetles (Dytiscidae). Results for amphibians indicate that the man-made bog pools had a greater number of individuals and species than natural bog pools, and that the difference increases with time following restoration. A greater number of aquatic beetle species occurred at bog pools in 2010 than during the earlier sampling periods. Though beetle bog specialists colonized pools both early and later after restoration, a species shift occurred and a number of non-bog specialists also colonized pools. These faunal patterns reflect the structure of the man-made bog pools, which are more akin to fen than ombrotrophic peatlands. Even 10 years following creation, man-made pools did not fully emulate the characteristics of natural bog pools.

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HYDROLOGICAL ASSESSMENT OF RESTORATION OF THE BOIS-DES-BEL PEATLAND, QUEBEC: A DECADE LATER

**McCarter, Colin and J. Price**

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Understanding the eco-hydrological processes occurring within both restored and undisturbed peatlands is an integral part of determining the success of the restoration and the current hydrological trajectory of a restored ecosystem; however it is currently unknown if restored peatlands will eventually behave in a similar way to un-disturbed peatlands. The Bois-des-Bel peatland was restored a decade ago (2000) and the eco-hydrological functions were assessed at the restored site along with un-restored (abandoned 30 years) and undisturbed sections of the peatland. Since restoration, a complete cover of *Sphagnum* moss (primarily *S. rubellum*) has developed at the restored site, while no *Sphagnum* regeneration has occurred at the control site. The control and restored sites had similar average water tables (-0.48 m), while the undisturbed site had an average water table of -0.36 m. In addition to higher water tables, the average volumetric water contents within the upper 10 cm of the *Sphagnum* was 0.20 - 0.25 cm<sup>3</sup>/cm<sup>3</sup> at the undisturbed site compared to 0.10 - 0.15 cm<sup>3</sup>/cm<sup>3</sup> at the restored site. Although Bois-des-Bel has complete *Sphagnum* cover, the water table does not yet fluctuate within the new moss layer. This sets limitations to the accessibility of water to the uppermost portion of the moss layer where the plants have physiological water supply requirements. The presence of a complete moss layer is one measure of success, but the divergent hydrological conditions indicate that the eco-hydrological function has not yet fully returned.

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ONTARIO FAR NORTH PEATLAND CARBON STORAGE AND SEQUESTRATION: WHAT ARE OUR MANAGEMENT OPTIONS?

**McLaughlin, Jim (1), K. Webster (2), B. Hamel (1) and C. Akumu (1)**

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Passage of Bill 191 the Far North Planning Act in 2010 mandates the Ontario government to develop policy statements incorporating carbon storage and sequestration into Far North land use planning. This region contains the Hudson Bay Lowlands, the second largest peatland complex in the world. Key peatland management policy-drivers include mineral mining, peat extraction for energy, hydroelectric power generation, and climate change. The Ontario government is also considering a carbon cap and trade policy and this, along with post-2012 Kyoto reporting may require Ontario to report on peatland management and carbon sinks. However, these are emerging issues with few research data available and the reporting framework developments are in their infancies. We will present Ontario's scientific approach to incorporate peatland carbon storage and sequestration into land use planning in the Hudson Bay Lowlands.

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SOIL CO<sub>2</sub> FLUXES FROM DIFFERENT AGES OF OIL PALM IN TROPICAL PEATLAND OF SARAWAK, MALAYSIA

**Melling, Lulie (1), K.J. Goh (2), A. Chaddy (1) and R. Hatano (3)**

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Large store of organic matter in tropical peatlands undergoes natural decomposition and respiration processes which produce carbon dioxide (CO<sub>2</sub>). The conversion of tropical peatland into oil palm plantation has been assumed to enhance the decomposition process due to drainage, causing further emission of huge amounts of CO<sub>2</sub>. It is postulated that this process will increase with time of oil palm cultivation. Hence, the objective of this study is to understand the relationship between the different ages of palm and CO<sub>2</sub> emission as influenced by environmental variables and soil physical characteristics. The soil CO<sub>2</sub> fluxes were measured for 28 months from three palm ages (1, 5 and 7 years old) in tropical peatland of Sarawak, Malaysia using a closed-chamber technique. The highest mean CO<sub>2</sub> flux was recorded in the 7 years old palm (218.88 mg C m<sup>-2</sup> h<sup>-1</sup>) followed by 5 years old (197.11 mg C m<sup>-2</sup> h<sup>-1</sup>) and 1 year old (181.99 mg C m<sup>-2</sup> h<sup>-1</sup>) palm. Pearson correlation showed that water-filled pores pace (WFPS) was negatively associated with CO<sub>2</sub> fluxes in all three different ages of oil palm. The cumulative CO<sub>2</sub> fluxes for 1 year, 5 years and 7 years palm were 3.49, 3.84 and 4.28 kg C m<sup>-2</sup> yr<sup>-1</sup> respectively. The increase in CO<sub>2</sub> emission with palm age corresponded with higher root biomass of growing palms implying that root respiration was a major component of soil respiration in tropical peatland under oil palm.

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\*Guest speaker and presenting autor

PHYSICAL PROPERTIES OF ORGANIC GROWING MEDIA AND THEIR EVOLUTIONS DURING DRYING/WETTING CYCLES

**Michel, Jean-Charles (1), G. Qi (1), S. Charpentier (1) and P. Boivin (2)**

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The precise measurement of the evolution of the physical properties of growing media over time is important for the effective management of irrigation and fertilization. A new apparatus was developed for simultaneously and continuously measuring the water retention and shrink/swell properties of growing media (slightly and highly decomposed sphagnum peats and coco fiber) during several drying/wetting cycles with varying intensities (0↔-5 kPa, 0↔-10 kPa, 0↔-32 kPa). Regardless of the intensity of drying, water retention and shrink/swell properties are mainly modified after the first drying process, resulting in degradation of physical properties, whereas these properties are not affected by the other cycles, even if reversible hysteresis phenomena are shown to take place. Variations in drying intensity reveal different physical behaviors, with an inflection point observed for the shrink/swell and water retention curves for the highest intensity tested.

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STATUS OF PEATLAND INVENTORY IN NORTHERN EURASIA

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Several recent reviews on peatland diversity and distribution in Eurasia demonstrated significant gaps on the subject. We analyze the challenges of inventory based on Russian experience. Russia makes up the larger part of continental Eurasia where peatlands and paludified lands are dominating type of the landscape especially in the boreal zone. Peatlands in Russia are extremely diverse, including a wide variety of peatland types, from permafrost palsas and polygon mires to aapa mires, raised bogs, fens and swamps within boreal, temperate, steppe and semi-arid zones. Russia has strong traditions in peatland studies; nevertheless basic data on Russian peatlands (area, distribution etc.) is not yet sufficiently identified. Different sectors of economy and scientific sectors have various peatlands considerations - as land, geological deposit, water body, habitat or forest - with related system of inventory and statistics. Different land status cause problem for statutory statistics and lead to problems for peatland management, as mentioned in the 2002 Action Plan on Peatland Conservation and Use in Russia. For general estimates the Institute of Forest Science of Russian Academy of Sciences maintains GIS "Peatlands of Russia" since 1990ies. Within Wetlands International Project "Peatlands Wise Use in Russia" the GIS is accompanied with information on direct and indirect threats related to peatlands as well as the area and status of their protection. The data base and GIS served for scientific and governmental expertise related to different environmental assessment and management tasks.

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\*Guest speaker and presenting autor

LITTER DECOMPOSITION IN EASTERN CANADIAN PEATLANDS

**Moore, Tim**

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The accumulation of large amounts of organic matter in northern peatlands is generally ascribed to slow rates of decomposition derived from poor quality litter, with low nutrient concentrations and high concentrations of organic compounds that are slow to decompose, as well as with the generally cool temperatures, anoxic conditions and functionally limited decomposer communities. I present information on decomposition rates derived from a series of litter-bag studies conducted at several sites in eastern Canada (subarctic Schefferville, Québec, boreal Sèpt-Iles, Québec, cool-temperate Mont St. Hilaire, Québec, cool-temperate Mer Bleue, Ontario and boreal Experimental Lakes Area, Ontario) in which decomposition was measured in litter-bags over 4 to 6 years. The locations included bogs, a swamp and fens and the litter types ranged from deciduous leaves and evergreen needles of trees, through shrubs and sedges to mosses, thus include most of the peat-forming litters and peatland types in eastern Canada. Mass loss was characterized by simple and double exponential models and the continuous-quality model (Hyvönen et al. 2005). Simple exponential k values of surface litters ranged from 0.05 to 0.76, depending on plant functional type and chemistry (primarily N content and proximate composition) and location (primarily climate and water table position). The effect of shallow flooding on decomposition rates was examined in the ELA Reservoir Project, showing variable changes over litter decomposed on the peat surface. Data on below-ground rates of decomposition are sparse, but show the influence of water table position, which is critical in determining the time taken for surface litters to reach the anoxic part of the profile, thereby slowing decomposition rates.

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PEAT-BASED GROWING MEDIUM AMENDED WITH *BACILLUS SUBTILIS* TO IMPROVE GROWTH STIMULATION AND PLANT PROTECTION

**Naasz, Rémi, M.C. Desbiens, Y. Machrafi and S. Gagné**

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Biological agents can offer a sustainable and efficient alternative to chemical pesticides used in agriculture. Pesticides are often considered as one of the major pollution source of ground and surface water inducing depletion of freshwater. Extensive experiments have been done by Premier Tech over the last years to select the best promising biocontrol agents use to protect plants against the major greenhouse diseases caused by *Pythium* spp., *Rhizoctonia* spp. and *Fusarium* spp.. Consequently, *Bacillus subtilis* MBI600 amended in PRO-MIX® peat based growing medium was registered as a biofungicide (Subtilex™) and also as a biostimulant (Stimulex™). The aim of this communication is to present the most recent results supporting the biostimulation and biofungicide activities of *B. subtilis*. Several experiments were conducted on vegetables (tomato, lettuce, cucumber and sweet pepper) and ornamental plants (celosia, geranium and vinca). Data obtained in this study demonstrated the beneficial effect of the presence of *B. subtilis* in general purpose and germination PRO-MIX®. In presence of *P. ultimum*, root rot were significantly reduced (20 to 150%) and shoot dry weight significantly improved (20 to 80%) compared to the control treatment without *B. subtilis*.

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\*Guest speaker and presenting autor

HONEYBEES AND SNOW TRAPPING: LOW IMPACT METHODS OF INCREASING CLODBERRY YIELDS IN UNDISTURBED PEAT BOGS

**Naess, Sara Kristine**

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The cloudberry, *Rubus chamaemorus* L., is a small herbaceous bramble growing in the peat bogs of the northern hemisphere. The uniquely flavoured fruit of the cloudberry is highly treasured and the market demand for the fruit outstrips the supply. The cloudberry is currently collected almost exclusively from the wild where yields are poor and year to year yield variation high. Increased yields could greatly contribute to the diversification of the economy in northern areas while reducing pressure currently being put on the resource in the wild. Two low impact methods of increasing yields useful in the natural setting are the use of honeybees for cloudberry pollination and the use of snow trapping. Honeybees visit both male and female cloudberry flowers thus affecting pollination. Their use leads to increased fruit and seed set, increased fruit quality and increased yields. Cloudberry plants sheltered by snow fences produce greater numbers of flowers and fruits than those in unsheltered plots.

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COMPARING THE EFFICIENCY OF SUBSTRATE QUALITY AND IRRIGATION MANAGEMENT IN GREENHOUSE PRODUCTION

**Nemati, Reza, J.P. Fortin and J. Massé**

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Physical and hydrodynamic properties of a substrate play a key role in irrigation management in horticulture. Following irrigation, a high performance substrate should provide an adequate amount of water and air to the plant to ensure its optimal growth. Some producers pay less attention to the quality of the substrate. When working with low quality substrates, they try to adapt the irrigation methods in order to produce high performance plants similar to those produced in high quality substrates. In this manner, producers use several methods for irrigation (dry, optimal, and wet methods) depending on substrate quality. The objective of this study is to evaluate the impact of substrate quality in comparison with the impact of irrigation management on the growth and development of two popular species in greenhouse production (New Guinea impatiens and geraniums). According to our results, the use of a high quality substrate combined with an appropriate irrigation method resulted in earlier maturity of the plants. This reduces the duration of plant growth and hence decreases the cost of energy by reducing the heating period in the greenhouse. The numbers of days saved using high quality substrates depended on irrigation management and were about 23 to 25 days for geraniums and 17 to 22 days for New Guinea impatiens. The production of plants in high quality substrates improved the growth and the development parameters and resulted in high performance plants.

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CARBON BALANCES OF NORTHERN PEATLANDS

**Nilsson, Mats\***

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In this presentation I will address three main issues: 1 – The relative importance of the component carbon (C) fluxes for the annual mire Net Ecosystem Carbon Balance (NECB); 2 – The importance of gross primary production (GPP) versus ecosystem respiration ( $R_{eco}$ ) for the annual Net Ecosystem Exchange (NEE) and finally 3) whether NEE of different mire types respond in the same or different ways to controlling factors. The annual mire NECB is made up principally by the biosphere-atmosphere exchange of  $CO_2$  (NEE) and  $CH_4$  and the runoff C-export. The two processes constituting NEE are GPP and  $R_{eco}$  and they normally totally dominate the mire NECB quantitatively. However, these two processes counterbalance each other resulting in a NEE of a size that may be significantly further reduced by the emission of  $CH_4$  and runoff export of C. The relative importance of the different flux components on the annual NECB may though differ between mire types. Reliable estimates of annual mire NECB are still very limited, but when compared to the long-term Holocene C accumulation rates these estimates indicate that the contemporary mire C balance is not significantly different from the Holocene long-term average rate. One important research issue is to further understand what controls the relative contribution from the component fluxes to annual mire NECB. A second important major research issue is to reveal the relative importance of gross photosynthesis (GPP) and ecosystem respiration ( $R_{eco}$ ) respectively for the annual mire NEE. The general understanding is that the low rate of decomposition constitutes a major control on peat accumulation. There is though growing evidences from estimates of contemporary annual as well as growing season NEE and peat core based estimates of long-term C accumulation that GPP is at least as important for the annual NEE. Finally, I will address the question whether all mires respond in the same way to controlling factors or if different mire types i.e. bogs and fens respond differently. Recent empirical as well as modeling studies indicate that e.g. changes in water table level causes contradictory response in mire NEE.

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\*Guest speaker and presenting autor

CHEMICAL CONTENT OF MAIN NUTRIENTS, ORGANIC SUBSTANCES AND TRACE ELEMENTS FROM DIFFERENT WETLAND TYPES

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Wetlands have very complex ecosystems, developing under different conditions and in different situation. Wetlands include a wide spectrum of aquatic habitats: from temporary waterbodies in arid and semi-arid regions to lake littorals and river floodplains, from boreal bogs to tropical mangroves, and shallow lakes, marshes, swamps and inland deltas( Gopal and Junk 2000)(1).The interactions between different components of hydrology, geomorphology, soil and water chemistry, and climate result in large diversity habitats. This habitat is reflected in many classification schemes for wetlands in different countries (Gopal et al.1990 Finlayson and van der Valk 1994) (2).The wetland ecosystems can be classified on several hierarchy levels. The Japanese classifications of wetland sites has been derived from Germany fundamental division and include 3-4 hierarchy levels of their structure: 1) types are identified according to dominating plant associations and plant species on general patterns of facia microtopography (microrelief ;hollow and hummock) ; 2)classes are distinguished in according to the trophic levels ?from oligotrophic?bogs?to eutrophic(fen)? Or ; 3) to the various water sources (ombrotrophic to minerotrophic mire ).The variation wetland types and high biodiversity are influenced specially by hydrological conditions. Soil chemistry is important and linked to the different hydrological characteristics. The rise, fall and flow of the water influences the reactions and release or locking up of nutrients within the soil, which in turn influences the species composition of a habitat (Miller, Hedges and Fermor 2005) (3).These hydrological conditions and seasonal variation (water table, water sources, soil dryness status) influences the levels of chemical contents and organic substances within the soil and plant.The aim of this study is to investigate of the structure of wetlands in different nutrient, organic substance and trace elements and its connection to the flora.

(References: (1) Gopal, B and W.J. Junk (2000): Biodiversity in wetlands: an introduction: Biodiversity in wetlands: assessment, function and conservation (volume 1)(edited by B. Gopal, W.J. Junk and J.A. Davis): 1-10 (2) Finlayson, C.M and van der Valk, A.G (1994) (Editor): Classification and Inventory of the World's Wetlands Vegetatio 118:1-192 (3) Helen S. Miller, Peter D. Hedges and Philip M Fermor (2005): The Response of the Biodiversity of Wet Woodlands to Differing Management Practices: Natural and Constructed Wetlands (nutrients, metals and management (edited by Jan Vymazal) Backhuys Publishers: 33-42)

REHABILITATION OF EXHAUSTED MILLED PEATFIELDS WITH WILD BERRY PLANTS IN ESTONIA

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The need for rehabilitation of exhausted peatfields appeared in the late 1960s, when large quantities of peat were used in collective farms for animal bedding. At present the area of abandoned extracted peatlands constitutes 9371 ha. A perspective method for their rehabilitation is cultivation of berry plants. Trials of cultivation of common cranberry (*Oxycoccus palustris*) began in the late 1960s in Nigula Nature Reserve. At first peatfields were cultivated by sowing cranberry seed, later cuttings of selected varieties were used. At the end of the 1980s the area of peatfields restored by cranberry plantings was about 275 ha. The first commercial cranberry plantation on 4 ha was established in 1988 in Marjasoo farm. The best crop reached 10 t·ha<sup>-1</sup> in 2008.

In the early 1990s in the same farm lowbush blueberry (*Vaccinium angustifolium*) trials were started. Implementation of lowbush blueberry plants for peatland rehabilitation was there the first time experience in Europe. Moreover, a rapid seedling growing methodology was elaborated, a selection of fruitful and good shaped bushes of blueberry for obtaining high quality seeds was carried out, optimal doses for fertilization and liming as well as optimal density of seedlings planting were studied. In 1999-2002 the Canadian Embassy in Estonia initiated a joint blueberry project between Nova Scotia Agricultural College, Canada and Estonian University of Life Sciences. Trials with lowbush blueberry planting for exhausted peatfields rehabilitation have been very successful; at present already more than 50 ha of lowbush blueberry plantations are established for that purpose in Estonia.

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MIRE-MARGIN COMMUNITIES IN EASTERN CANADA

**Paradis, Étienne and L. Rochefort**

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From a literature review of North American peatland studies, we found over 30 references to the different types of mire-margin communities ("laggs", "lagg-fens", "lagg-swamps" and "mire-margin swamps"). However, there was almost no information on these types of communities in eastern Canada, a region where raised bogs are among the dominant features of the landscape. In order to fill this gap in our ecological knowledge, a field study was carried out to characterize the bog-forest transitions in twenty large raised bogs of eastern Canada. Our results suggest that transition zones vary widely, but swamp communities with a dense shrub layer are the most common transition zones. Peat depth measurements show that these swampy communities can be considered part of the peatland complex, since they are mostly found on more than 30cm peat. The definition of those transitional communities is a crucial step in ameliorating our abilities to delineate peatlands and improving their management post industrial activities.

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\*Guest speaker and presenting autor

VEGETATION RESPONSE IN A CUT-OVER BOG 8 YEARS AFTER RESTORATION: THE USE OF PRINCIPAL RESPONSE CURVES TO EVALUATE SUCCESS

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Following large-scale restoration of a cut-over peatland in Eastern Canada, vegetation was monitored bi-annually over 8 years. One of the criteria for successful restoration is the recovery of biodiversity, for instance, of a plant community which falls within the range of natural variation expected under a similar climate and in the same geographical region. So far, most of the studies looking at vegetation change following restoration in various ecosystems have been using general indices of diversity. We advocate that biodiversity components need to be dissected into functional groups to provide a more complete picture of success of establishment and trajectory of various components of the ecosystem. In this study, we evaluated restoration success using principal response curves (PRC) applied on plant species grouped by life forms or preferred habitat, comparing restored sites and non-restored sites to a natural reference. We show that whereas total diversity and richness do not differ between any of the sites after 8 years when all species are considered equally, there are clear distinctions between the sites in terms of functional groups of species, with forest and ruderal species more prominent in non-restored areas, and peatland and wetland species dominant in restored areas. The PRC revealed that the restoration method is particularly successful at re-instating a typical ground layer (mosses, particularly *Sphagna*, and hepatica) but that some differences remained between the restored and the natural species pool, the former having more herbaceous species associated with wetlands, the latter having a more diverse Ericaceous shrub cover.

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CAN COMMON FEN SPECIES GROW IN SALINE CONDITIONS SIMILAR TO OIL SANDS PROCESSES WATER? RESULT FROM PETRI DISH AND GREENHOUSE EXPERIMENTS

**Pouliot, Rémy, L. Rochefort and M.D. Graf**

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Studying the salinity thresholds of peatland species and their capacity to grow in peat exposed to Oil Sands Processed Water (OSPW) are two essential goals of peatland creation in post-disturbed landscapes following oil sands exploitation. We tested effects of salts or OSPW on growth of common brown mosses and graminoid plant species of northern Alberta fens. To test resistance to salt concentration, a first approach was to immerse mosses in saline conditions for different periods of time and then assess vitality in Petri dishes watered with rain water. Four salt concentrations (between 0-500 mg L<sup>-1</sup> of NaCl) and four immersion times (between 6 hours to 7 days) were tested. A second approach was to watered mosses in Petri dishes with saline solutions. Three salt solutions (NaCl, Na<sub>2</sub>SO<sub>4</sub> and a combination of both) and four concentrations (between 0-70% of the concentrations found in OSPW – 100% = 500 mg L<sup>-1</sup> of NaCl and 600 mg L<sup>-1</sup> of Na<sub>2</sub>SO<sub>4</sub>) were tested. Thirdly, effects of underground inflow of OSPW were tested on five graminoid plants and four brown moss species in greenhouse. Plants were given two months to establish in fen peat initially not contaminated before the following treatments were applied a) non-diluted OSPW, b) diluted OSPW, and c) rain water. Moss species tolerated their immersion in saline conditions. However, continuous watering with salt concentration inhibited the development of new innovations. Tested moss species would thus probably survive to periodic inundations in OSPW, but permanent flooding of OSPW should be avoided. Peat had a high buffering capacity in our greenhouse experiment and several years would likely be available to establish a healthy cover of plants. Nevertheless, OSPW seemed to be detrimental for mosses in situation of water stresses (as in greenhouse experiment), indicating that water control should be a crucial step in fen creation following oil sands exploitation.

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\*Guest speaker and presenting autor



NICHE BREADTHS AND OVERLAPS IN BOGS: ARE THERE SIMILARITIES BETWEEN NATURAL BOGS AND ABANDONED OR RESTORED PEATLANDS?

**Pouliot, Rémy and L. Rochefort**

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Many concepts, such as the principles of competitive exclusion or competitive hierarchies, as well as stochastic niche theory or stress-gradient and niche overlap hypotheses, have been issued to explain the development of ecological niches. These concepts allowed us to predict that, under similar abiotic conditions, realized niches would be larger and would present more overlapping in re-vegetated peatlands than in natural bogs because of the low competition for space in the early stages of re-colonization. Our objective was to compare realized niches of common species in re-vegetated peatlands (restored (R) or abandoned (A)) with those in natural bogs (N) using breadth and overlap indices. Vegetation surveys and water analyses have been conducted for 222 sites across eastern Canadian bogs (R = 25, A = 25 and N = 172). Climatic variables were estimated using the nearest meteorological station. Contrary to our hypothesis, niche breadth and overlap between species were larger in natural peatlands. Bigger differences for niche breadths and overlaps were found between natural and abandoned peatlands, whereas restored peatlands showed intermediate values. The same species did not usually occupy the same niche in each peatland category. Peat extraction methods, duration of exploitation and time since abandonment or restoration, as well as site hydrology influenced the abiotic conditions met on re-vegetated sites. This altered plant interactions, causing changes in realized niches. However, peatland restoration allows species niches to resemble more the ones of natural bogs than abandoned sites. Finally, no concept associated to ecological niches seemed to perfectly explain the realized niches in re-vegetated or natural peatlands, regardless of the perturbation level.

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SPHAGNUM FARMING ON PREFABRICATED FLOATING MATS

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White peat is the main raw material for the production of growing media for horticulture. Growth experiments have shown that this fossil and finite resource can be substituted by *Sphagnum* biomass. This biomass can be produced on cut-over peat bogs, but its cultivation requires permanently high water levels. Alternatively, *Sphagnum* biomass may also be produced on floating mats where water levels are inherently stable. We investigated growth rates of *Sphagnum fallax*, *S. palustre*, *S. papillosum* and *S. magellanicum* on pre-fabricated floating mats under controlled conditions (greenhouse). All species appeared to prosper. Growth rates were highest for *S. palustre* (7.5 cm yr<sup>-1</sup>, 3.5 t DM ha<sup>-1</sup> yr<sup>-1</sup>) and *S. fallax* (23 cm yr<sup>-1</sup>). Larger propagules (50-100 mm) started faster with length increment and increasing of cover with green scions than small propagules (1-3mm). *S. fallax* appeared to be highly vulnerable to fungal infection. Field experiments in artificial pools (in a cut-over bog in NW Germany and in abandoned lignite mines in E Germany) showed similar high growth rates for *S. palustre* (3.4 t DM ha<sup>-1</sup> yr<sup>-1</sup>). Biomass production was, however, reduced if water pH and salinity were high. In wind exposed lakes, propagules were washed away by waves. At two sites, cultures were severely damaged by water fowl. During low water levels vascular plants rooted in the pool bottom, anchoring the mats which consequently drowned. Our experiments show, that on artificial floating mats *Sphagnum* biomass can reach high productivity.

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\*Guest speaker and presenting author

FEN RECLAMATION FROM CONCEPT TO CONSTRUCT: THE SUNCOR PILOT FEN

**Price, Jonathan (1), C. Daly (2), J. Atkinson (3), G. McKenna (3) and M. O'Kane (4)**

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At the 2003 Cumulative Effects Management Association Creating Wetlands in the Oil Sands: Reclamation Workshop in Fort McMurray, Alberta, Canada a challenge was made to the assumption that mine reclamation to create peatlands was not possible given the time-scale of peatland development. Building on successful experience in restoring cutover peatlands, it was proposed that a fen-like wetland could be created on mined out land by designing a watershed feeding a low area filled with peat salvaged ahead of oil sands mining. In other words, the objective was to create a reclaimed landscape with a hydrological design to sustain ecohydrological functions of a fen system, in particular a system that would stay wet enough to restrict decomposition of the organic material. The design concept was to create an unconfined aquifer underlain by a low-permeability liner, directing seepage water to a peat-deposit. This concept was tested with a numerical groundwater model driven by local climate conditions to simulate the hydrological response of the peatland to various combinations of geometry (ratio of upland to peatland, thickness of constructed aquifer and aquitard, slope, etc.) and material properties (hydraulic conductivity, water retention, etc.) to find an optimal design.

Moving from the design concept rooted in a numerical groundwater model to a blueprint for construction required: 1) consideration of the availability of materials and the ability to engineer them to suitable geotechnical and hydraulic standards; 2) a site investigation to determine existing hydrogeologic conditions; 3) design of the fen shape, boundary configurations, elevation, etc.; 4) design of the watershed including the recharge area to intercept surface runoff and maximize recharge while minimizing the potential for salinization, and 5) consideration of transport of oil sands process-affected water (from the tailings sand used to construct the unconfined aquifer) and its impact on peatland plants. The evolution from concept to construct was thus based on theoretical and empirical knowledge backed by a numerical model, engineering experience and a good measure of intuition. The system is under construction.

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BOIS-DESBEL RESTORATION PROJECT (TITLE TO COME)

**Price, Jonathan**

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Abstract to come, see separate page.

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IDENTIFYING KEY PROCESSES IN PEATLAND DEVELOPMENT WITH THE HOLOCENE PEAT MODEL

**Quillet, Anne (1), M. Garneau (1)(2), S. Frolking (3) and N.T. Roulet (4)**

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The Holocene Peat Model (HPM, Frolking et al. 2010) integrates up-to-date knowledge on peatland dynamics and explores peatlands development and carbon dynamics on a millennial timescale. HPM combines water and carbon cycles with net primary production and peat decomposition from 12 plant functional types and takes multiple feedbacks into account. The model remains simple and few site-specific inputs are needed. HPM simulates the transient development of the peatland and delivers peat age, peat depth, peat composition, carbon accumulation and water table depth for each simulated year. The work presented here aims at analysing the role of each component of the system on peatland dynamics. The influence of the model parameterization on the simulation results is examined. Therefore, a sensitivity analysis is performed with use of a screening method (Morris' elementary effects and extended elementary effects methods, Morris, 1991, Campolongo et al. 2007) and with calculation of the Sobol' indices (Sobol', 1993). These methods rank parameters and combinations of them according to their influence on simulation results and allow the identification of non influential parameters. Results emphasize the role of environmental and climatic conditions (e.g. precipitation, runoff, and potential productivity) and highlight the need for further research in the representation of hydrological processes in peatlands over large areas. The role of *Sphagnum* species is also stressed since these species may lead to major changes at different stages in the development of peatlands.

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COMPARISON OF METHODS TO BLOCK DRAINAGE DITCHES, GRANDE PLÉE BLEUE, QUÉBEC, CANADA

**Quinty, François (1), O. Marcoux (2)**

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The Grande plée Bleue is a 1500 ha peat bog that is still in relatively pristine condition despite its proximity to urban areas. The bog contains many rare species, and is in the process of being designated as a conservation area. However, it has been affected by ditches that drain portions of the bog for many years. The objective of the present project is to block the ditches to restore hydrologic conditions in the bog. Because of the conservation status, the ditches cannot simply be filled with peat or mineral material; dams must be built instead. We tested several types of dams to determine their efficiency and cost effectiveness. Wells were installed to measure water levels, and permanent plots were set up to evaluate changes in vegetation due to the increased water levels. The types of dams built in the fall of 2010 and the preliminary water level data results are presented.

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EFFECT OF THE LENGTH OF STORAGE TIME IN BALES ON SELECTED CHEMICAL AND PHYSICAL PROPERTIES OF SPHAGNUM PEAT MOSS AND PEAT BASED GROWING MIXES

**Ranasinghe, Lakshman L., G.E. Williston and R. McIntyre**

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Peat moss and peat moss based growing media are extensively used in the horticultural industry in many parts of the world. However, not much research information is available on the effect of the length of storage time of these products in bales on its quality parameters. This study evaluated selected properties of baled Sphagnum peat moss and growing mixes as affected by the length of storage. Bales of coarse grade peat moss and two different formulations of professional growing media were kept in regular outside storage conditions in Baie-Sainte-Anne, New Brunswick. These were sampled after 3, 6 and 12 months of storage. Electrical conductivity of growing mixes were stable for the first three months and gradually reduced by 20-30% of initial values after 12 months. pH of growing mixes remained stable for the first six months, and then declined slightly with storage. Wettability of growing mixes (wetting agent action) and water holding capacity remained stable for the first six months, and then declined by 10-15% after 12 months. Particle size of peat moss (determined by wet sieving) was lower after 12 months of storage relative to initial and 3 months of storage. Therefore mix producers / growers need to manage production programs to reduce the duration of storage and minimize above quality issues.

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STUDIES ON GROWING CROPS ON HARVESTED PEATLANDS IN NEW BRUNSWICK, CANADA

**Ranasinghe, Lakshman L., G.E. Williston and R. McIntyre**

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New Brunswick is one of the main peat harvesting regions in Canada. Presently there is a considerable extent of harvested peatlands in the region. The Canadian Sphagnum Peat Moss Association recommends three types of restoration procedures for these harvested peatlands; return to a functioning peatland, cultivate for agricultural uses and cultivate for forestry uses. Studies on growing crops on harvested peatlands at Theriault & Hachey Peat moss Limited were initiated in 2007. Field experiments are being done with high bush blueberry (*Vaccinium corymbosum*), wild blueberry (*Vaccinium angustifolium*), edamame (vegetable soybean; *Glycine max* L. Merr) and haskap (*Lonicera caerulea* L.) to evaluate agronomic performances. Five varieties of high-bush blueberry were planted in 2007 and data collection is in progress. Wild blueberry was planted during 2009 to evaluate the commercial potential of the crop on harvested peatlands. Several varieties of edamame were grown successfully on these lands during last four summer seasons. A field experiment to evaluate the performances of new berry crop haskap on these lands was initiated in spring 2010. All initial studies showed potential but the performances of these crops have to be evaluated further to make conclusions and plan for commercial scale cultivations.

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PAN-BOREAL LANDSCAPE CONSERVATION: FUTURE OPPORTUNITIES AND CHALLENGES

**Reid, Frederic**

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The Pan-boreal is the largest remaining frontier forest in the World. Globally, nearly 30 percent of the soil organic carbon is locked in tundra and boreal ecosystems. Changes in hydrology facilitate decomposition of soil and peat, resulting in enhanced carbon emission. Climate changes to hydrology are predicted to impact fire frequency and size, as well as lake and wetland numbers. Industrial activities have expanded greatly over the last 20 years within broad parts of the Boreal Forest and can exasperate degradation on wetland complexes. World-class industrial conservation practices and large tracts of wilderness protection are needed to conserve boreal landscapes and provide a shield for global warming. Opportunities for conservation differ greatly among Boreal states, because of historical industry activities, existing human populations, and the conservation will of national populace.

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CALISTO: CARBON LOSS FROM HISTOSOLS

**Renou-Wilson, Florence (1), D. Wilson (2), B. Foy (3) and C. Mueller (1)**

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In reporting carbon (C) emissions from grassland on organic soils, the Republic of Ireland currently uses the Tier 1 default value of 0.25 tC/ha. This value is at variance with Emissions Factors (EFs) used by countries in similar climatic zone and suggests that the ROI may have underestimated C emissions from this land use category. A progression to Tier 2 and 3 reporting levels has been recommended, where individual countries can produce country specific EFs and improved spatial data. In the CALISTO project, we are quantifying the gaseous fluxes of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O at four peatland sites under grassland as well as quantifying and characterising fluvial C losses (DOC, POC, pCO<sub>2</sub>, DIC). In addition, the bioavailability of DOM in surface water leaving the sites is quantified used OXITOP oxygen demand method to assess the proportion of OC in water which is respired over a set period and therefore returned to the atmosphere as CO<sub>2</sub>. Experimental factors follow three dichotomies: (1) improved vs. unimproved grassland types; (1) wet vs. well-drained peat soils and (3) the sites are located within two geographical areas expected to experience least vs. greatest changes in precipitation and temperatures. Details regarding the methodologies used in his project as well as preliminary results will be discussed. This project will contribute significantly to national inventory reporting by allowing Ireland to develop EFs for CO<sub>2</sub> and CH<sub>4</sub> and to assess the potential of mitigation measures to reduce C losses from this land use category.

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\*Guest speaker and presenting autor

STRATEGY FOR RESPONSIBLE PEATLAND MANAGEMENT - WHAT NEXT?

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“Guidelines for Global Action on Peatlands” (GAP) was adopted in Resolution VIII.17 of the Ramsar Convention held in Valencia, Spain, in 2002 with the overall aim to achieve recognition of the importance of peatlands for the maintenance of biodiversity, storage of water and carbon and to promote their wise use, conservation and management. A Coordinating Committee for Global Action on Peatlands (CGAP) was established to develop an Implementation Plan that would deliver the priority actions and encourage international organisations to prepare or refine their own plans in a way that their contribution to the implementation of the Guidelines is clear. This presentation outlines the importance of these events in developing the IPS Strategy for Responsible Peatland Management (SRPM) and discusses how it can form the basis of certification, practical wise use guidelines and sustainable supply chains. The European Peat and Growing Media Association (EPAGMA) and the International Peat Society are already working together towards certification of responsible peat production and to establish common international standards, of which the SRPM is the first stage. Comparison will be made with the certification system being established in Canada.

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THE CARBON POOL IN TROPICAL PEATLANDS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

**Rieley, Jack (1) and S.E. Page (2)**

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Accurate inventory of tropical peatlands is important to determine the magnitude of their carbon pool, in order to include peatland in carbon emission policies or estimate the scale of transfers of peat-derived greenhouse gases to the atmosphere resulting from land use change and fire. Almost 80% of all tropical peat carbon is in Southeast Asian countries where inappropriate developments are causing enormous amounts of carbon to be transferred to the environment with major implications for climate change processes. We shall present a revised estimate of the area of peatland, thickness of peat and carbon pool in every country with peat in the tropical zone. Data are lacking from many countries, especially in South America and Africa. In addition, there is a general lack of information on the bulk density, carbon content and thickness of tropical peat. We shall identify areas of uncertainty and gaps in the available data.

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BOG RESTORATION: A WHOLE ECOSYSTEM EXPERIMENT

**Line Rochefort**

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Ecological restoration gained in popularity over the past twenty years as a method of assisting the recovery of an ecosystem that has been degraded and also as conservation tools. Ecological restoration projects became a good opportunity for scientists to improve our knowledge on ecosystem functioning and structure. However, many restoration projects are not planned in such a way to answer scientific questions and the results have been criticized as lacking a general model to learn from. This talk aims to introduce a conceptual framework adapted for peatland restoration projects. A description of this framework using as an example the restoration project of Bois-des-bel peatland, Québec, Canada, will be presented. This 11 ha cut-over peatland has been restored 10 years ago. Key points' learning on the Sphagnum layer transfer restoration method will be presented along with results of monitoring programs.

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BIODEGRADABLE POTS: AN ALTERNATIVE TO PLASTIC POTS FOR THE PRODUCTION OF BEDDING PLANTS IN GREENHOUSES?

**Rochefort, Sophie, L. O'Donoghue, Y. Girault, G. Guitard, M.C. Lavoie, M. Delorme and B. Mongeau**

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In the last few years, new biodegradable pots have appeared on the market in response to « greener » products needs. These pots have the advantage of being recyclable by the consumer by planting or by composting, and consequently contribute to considerably reduce plastic waste. However, before using biodegradable pots, a better understanding of their characteristics and behaviours in a production cycle is essential. The objective of this project was to compare the performance of different types of biodegradable pots to the standard polypropylene pot in a greenhouse bedding plants production. Plants of *Argyranthemum frutescens* 'Yellow Butterfly' were planted and grown in one of the seven types of biodegradable pots and in a control (plastic pot). Resistance to mechanization, irrigation needs and effects on the quality of plants were measured. Operating costs and consumer response were also evaluated to identify marketing potentials of these products. Overall, biodegradable pots were comparable to conventional plastic pots. Few models are less suitable to use with automatic filling machinery but all performed well during the potting process. Some of biodegradable pots showed signs of moulds, algae, cracks, degradation or discoloration. Very little difference in plants growth and quality was observed and the general final aspect was acceptable for all types of pots. The integration of biodegradable pots in the production will certainly add a value to the commercialized product but as well as the consumer is informed about its characteristics and benefits.

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\*Guest speaker and presenting autor

ORGANIC BASED FERTILIZERS FOR THE PRODUCTION OF ORNAMENTAL BEDDING PLANTS: AS GOOD AS CONVENTIONAL FERTILIZERS?

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More and more producers have an interest in environmentally friendly practices such as biological and organic fertilizers. However, most of biological fertilizers have a low percent of nutrients, can be expensive and are usually used as a booster. Recently, products called organic based fertilizers have appeared on the market. These products, in addition to the 15% of organic matter, have a source of soluble nitrogen making them more suitable to use in a fertilization program. The objective of this study was to evaluate if organic based fertilizers can be used throughout a cycle of production of bedding plants species with different fertilization needs, and to verify if the quality of plants is comparable to those fertilized with conventional fertilizers. Surfinias (high nutrients needs) and Begonias (low nutrients needs) were fertilized with three organic based fertilizers (Daniels 10-4-3™, Professional Plant Food; General Purpose 15-3-11™, Biofert; Solo Tek Grow 8-14-12™, Growtek) and compared to a control (conventional program: a 20-8-20 alternating with a 12-2-4, and ending the production with a 20-5-30 fertilizer). Surfinia as well as Begonia plants fertilized with any organic based fertilizers in the study showed the same quality than those grown under a conventional fertilization program. Some differences were detected in the content of certain elements following foliage analyses with however no sign of deficiency. Because of their low cost, their low impact on the environment and their easy to use with conventional greenhouse equipment, organic based fertilizers have a great potential to be included in a fertilization program for bedding plant production.

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STEWARDSHIP OPPORTUNITIES IN CANADA'S BOREAL PEATLANDS

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As campaigns proceed on Boreal conservation planning and management, new attention must be directed to corporate and community-based stewardship, including the action of local volunteer stewards to ensure program success. The adoption of the Boreal Forest Conservation Framework provides a mechanism to look beyond the creation of protected areas to such stewardship programs, including creation of "Friends Of" groups with long-term support. It has long been recognized that national and international conservation networks need to more strongly focus on boreal ecosystems including peatlands. Examples include designation of more Wetlands of International Importance under the Ramsar Convention and Biosphere Sites through UNESCO, both in Canada and throughout the Northern Hemisphere. Regrettably, in the past decade there has been a significant decline in core support in Canada for stewardship organizations and their interest and ability to work together in a collaborative way. This had led to unhealthy competition among stewardship groups for scarce support by government, corporate and philanthropic interests. The author will look at the opportunities for cooperation among such partner organizations through stewardship tools in the Boreal Wetland Regions of Canada.

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\*Guest speaker and presenting autor



BOTANICAL AND ECOLOGICAL INVENTORIES OF HIGH ANDEAN PEATLANDS FROM PERU

**Salvador, Flor (1), J. Moneris (2) and L. Rochefort (1)**

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High Andean peatlands have been used by local people for millennia as they provide important resources of water and pastures in the arid landscape of the Andean mountains, thus are considered key ecosystems in the High Andes of Peru. Botanical and ecological inventories were conducted above 4000 m.a.s.l. in the Central and Southern Andes of Peru. The objective of this study was to do a first assessment of the ecological integrity of High Andean peatlands in regions where poly-metallic mining is an important economical activity. A better knowledge of the floral composition and peat soil properties of disturbed and natural peatlands will help to design actions towards their responsible management. Preliminary reference systems have been described and level of restoration actions identified for these types of fen peatlands dominated by cushion vascular plants.

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PRIMARY PRODUCTION AND DECOMPOSITION OF THE VEGETATION OF A RESTORED CUTOVER PEATLAND IN QUEBEC: 10 YEARS AFTER

**Salvador, Flor and Line Rochefort**

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We present the preliminary results of the evaluation of the peat-accumulating potential of the vegetation in the restored cutover peatland of Bois-des-Bel (Quebec) 10 years after the restoration work. The objectives were to assess production and decomposition rates of vegetation in restored, non-restored and natural peatlands. The net annual primary production (NPP) for *Sphagnum* was measured by the cranked wire method. NPP of *Sphagnum* was estimated at 105 g m<sup>-2</sup> yr<sup>-1</sup> and 135 g m<sup>-2</sup> yr<sup>-1</sup> on the restored and natural peatlands, respectively. The annual aboveground biomass for vascular plants production was measured using the destructive sampling method. Annual above-ground net primary production (AGNPP) was estimated for the shrubs and herbs from published relationships between above-ground biomass and NPP. In the restored and natural peatland AGNPP was 182 g m<sup>-2</sup> yr<sup>-1</sup> and 270 g m<sup>-2</sup> yr<sup>-1</sup>, respectively. For comparison, at the adjacent non-restored peatland the AGNPP was significantly lower, with mean of 9.1 g m<sup>-2</sup> yr<sup>-1</sup>. The annual belowground production of fine roots (<2 mm in diameter) was measured using the ingrowth bag method. Below-ground production averaged 21.7 g m<sup>-2</sup> at the restored peatland, compared with 23.3 g m<sup>-2</sup> at the natural peatland and 2.7 g m<sup>-2</sup> at the non-restored peatland site. The litter-bag technique was used to determine the mass loss from decomposing tissue (*Sphagnum* and above-ground biomass of vascular plants) over 1 year. Decomposition rates were highest for the *Picea mariana* litter type (leaves) and lowest for the *Sphagnum* litter types. Decomposition rate did not differ between the restored and the natural peatland sites. Consequently, our data suggest that after 10 years following peatland restoration, net primary production and decomposition of the vegetation have been re-established in the site of Bois-des-Bel.

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ADOPTION OF PEST AND NUTRIENT MANAGEMENT PRACTICES THAT REDUCE INPUTS AND IMPROVE EFFICACY IN MASSACHUSETTS CRANBERRY PRODUCTION

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Research and extension efforts over the past decade have guided important changes in the techniques that Massachusetts cranberry growers use to manage pests and apply nutrients. The use of broad-spectrum organophosphate (OP) insecticide has declined due to resistance or loss of registration. In the early part of the decade (2003-05), OP use out-paced non-OP insecticides (e.g., growth regulators, neonicotinoids) 2:1 in terms of acres treated; primarily driven by improved efficacy of the new compounds, the ratio has reversed. Postemergence herbicide use against localized patches has increased; flooding is being used to manage dodder and perennial weeds in some situations. In addition, the use of new fungicides, such as azoxystrobin, has been adopted by many growers for control of fruit rot. Since more than 90% of chemicals are applied through the irrigation system (chemigation), efforts (supported by federal cost-sharing) are being made to improve the uniformity coefficients on producing farms; this includes installing systems on smaller spacings (from 18 x 21 m to 15 x 18 m or 12 x 15 m). We worked with growers to encourage reduction of phosphorus (P) inputs. By 2009, 65% of growers surveyed reported that they had reduced P use (17% were using reduced P in 2005). A survey of 7 sites showed no relationship between P inputs and yield, while a cluster of the highest yielding sites received 11.2 kg P/ha/yr or less. P concentration in drainage water dropped dramatically at sites where P inputs dropped to 16.8 kg/ha or less.

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DRIVERS OF INNOVATION AND TECHNOLOGY WITHIN THE CANADIAN HORTICULTURAL PEAT INDUSTRY

**Short, Paul**

Canadian Sphagnum, Peat Moss Association, Alberta, Canada

This presentation is an overview of current drivers that are affecting the development of innovation and technology within the Canadian horticultural peat industry. It is not a detail review of the current specific technology within each sector of the industry. Reference to specific technological or innovative approaches is used as examples currently in place that have been developed to respond to the drivers.

Today's modern harvesting, processing, mixing and bagging operations' speaks to an industry that's modernization and manufacturing sophistication depends heavily on electronics, robotics, sensors and computerization. Management structures and practices parallel the advances in manufacturing with organizational sophistication comparable to many of the advanced corporations involved in industrial manufacturing.

Drivers are often referred to as external forces which act upon an industry or company which effects a change in the performance of the industry or company. For the purpose of this presentation the following drivers are evaluated:

- A) Environmental and regulatory changes
- B) Productivity and Competitiveness
- C) Maximizing value from the resource.

Constraints and opportunities are discussed and suggestions for advancing the interests of Canada's horticultural peat industry are commented on.

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NATIONAL STRATEGY FOR SUSTAINABLE AND RESPONSIBLE PEATLAND MANAGEMENT IN FINLAND - COMPARISONS & REFLECTIONS WITH THE SRPM OF IPS

**Silpola, Jaakko**

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The proposal for a national strategy for mires and peatlands defines the objectives and measures relating to the sustainable and responsible use of mires and peatlands. Sustainable and responsible use reconciles the different objectives of the use of mires and peatlands so that a significant social, economic and ecological benefit can be derived from their use. The objective is to secure the benefits and energy supply for agriculture and forestry, reduce the harmful impacts on waters and climate, achieve a favourable conservation status for mire nature and ensure the multiple use and cultural services. According to the proposals of the strategy, the sustainable and responsible use of mires and peatlands is reconciled by directing activities which considerably change the mires to such peatlands which have been drained or whose natural state has otherwise been significantly changed as well as by implementing sector specific strategies and measures relating to sustainable and responsible use. In addition, the strategy presents the main research needs for promoting the sustainable use of mires and peatlands. The strategy also summarises the factors which influence the magnitude of the impacts of the strategy on a general level and issues which impact on the implementation of the strategy. The Ministry of Agriculture and Forestry, together with the Ministry of Employment and Economy, set up a working group to prepare a national strategy for mires and peatlands on 10 February 2009. The objective of the strategy was to create an up-to-date understanding of the diversified and sustainable use of mires and peatlands and reconcile the different needs relating to their use. The proposal of the working group for a national strategy for mires and peatlands was submitted to the Minister of Agriculture and Forestry on 16 February 2011.

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RESTORING INDONESIA'S PEATLANDS FOR CLIMATE CHANGE MITIGATION: OPTIONS FOR PRIVATE SECTOR DRIVEN AND COMMUNITY-BASED ECOSYSTEM RESTORATION

**Silvius, Marcel and H. Wösten**

Wetlands International, The Netherlands

Extensive degradation of Indonesian peatlands by deforestation, drainage and recurrent fires causes release of huge amounts of peat soil carbon to the atmosphere. Lowering groundwater levels, which naturally are close to the peat surface throughout the year, increases CO<sub>2</sub> emissions by peat oxidation (decomposition). Moreover, once groundwater levels fall below a critical threshold of -40 cm, the dry peat surface becomes susceptible to fire. Complete rewetting by blocking drainage canals by dams to raise groundwater levels is a first step in peatland ecosystem restoration. Efficient and cost-effective methodologies have been developed for hydrological restoration of disturbed tropical peat lands in Central Kalimantan. Some experience has been gained with reforestation using a number of indigenous peat swamp forests tree species. Several methods are available to assess emission reductions. Significant emissions reduction can be achieved. The Indonesian system of long-term ecosystem restoration concessions provides prospects for both private sector and local communities to engage in peatland restoration and may provide an attractive alternative to large scale unsustainable peatland developments.

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MAPPING PEATLANDS AND MINERAL WETLANDS IN CANADA'S WESTERN BOREAL FOREST

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Delivery of conservation programs across the Western Boreal Forest of Canada (~300 million hectares) is often limited by a lack of current and detailed landscape-level datasets necessary to advance sustainable development practices and protect natural areas. To address this information gap, Ducks Unlimited, Inc. and Ducks Unlimited Canada have established an international partnership-based approach that combines industry, government, universities, aboriginal groups, and other not-for-profit agencies to produce landscape-level inventories including satellite-based wetland mapping. A wetland classification system was designed to fit into the Canadian Wetland Classification System that utilizes satellite imagery datasets, helicopter-based field surveys, and existing GIS layers as classification inputs. Traditional wetland classification techniques typically yield varying results because they do not incorporate ecological information into the classification. This wetland classification system uses a hierarchical approach that incorporates information on remotely-observable site characteristics at multiple scales with inferred ecological patterns and processes of wetlands to ultimately determine wetland type. An object-based classification which allows for ecological patterns to be incorporated into wetland classification, combined with a knowledge base of ecological processes, has improved the classification resolution (one hectare minimum mapping unit), number of classes mapped (19 classes), and overall map accuracy (75-85% accuracy range). This wetland classification system has been used to map over 65 million hectares of peatlands and mineral wetlands throughout the western boreal forest. The detailed datasets on peatland and mineral wetland types are the first of their type for the boreal region of Canada, and are used to assist conservation planning efforts.

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EFFECT OF HARVESTING AND RESTORATION ON GREENHOUSE GAS EXCHANGE FROM CANADIAN PEATLANDS

**Strack, Maria\* (1), Y.C.A. Zuback (1), M.S. Mahmood (1) and J.M. Waddington (2)**

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Extraction of peat for horticultural use drastically alters ecological and hydrological conditions in peatland ecosystems resulting in significant shifts in fluxes of greenhouse gases such as carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). Removal of vegetation cover eliminates CO<sub>2</sub> uptake via photosynthesis while drainage leads to peat aeration. This aeration shifts the system from slow, anaerobic decomposition (often resulting in CH<sub>4</sub> production) to faster, aerobic decomposition. Thus, harvested peatlands are large sources of atmospheric CO<sub>2</sub> with CH<sub>4</sub> emission limited to wet areas such as ditches. In contrast, undisturbed peatlands generally act as sinks of CO<sub>2</sub> and sources of CH<sub>4</sub>. Restoration in North America aims to return these peatlands to peat accumulating systems and new vegetation growth and wetter conditions following restoration result in lower CO<sub>2</sub> emissions and a return of CH<sub>4</sub> efflux. Greenhouse gas fluxes from several harvested, abandoned and restored peatlands in Alberta and Quebec, Canada will be presented to illustrate these patterns. The greenhouse gas exchange at any given site is related to the interaction among local ecological, hydrological and chemical conditions and better understanding of these controls can help improve peatland management strategies.

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\*Guest speaker and presenting author

C-GREENHOUSE GAS EMISSIONS FROM DRAIN DITCHES OF ANTHROPOGENICALLY CHANGED PEATLANDS

**Suvorov, Gennady (1), M. Glagolev (2), M. Chistotin (3), I. Kravchenko (4), A. Kizilova (4), N. Bazhin (5) and Andrey Sirin (1)**

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Peatlands are important sources and sinks for C-greenhouse gases, and intensity of their fluxes is varied significantly under anthropogenic disturbance. The accurate data about flux magnitude are essential for proper evaluation of peatlands function in regulation of atmosphere gas composition and climate change. A large amount of data supporting high importance in this respect of drained ditches and channels in anthropogenic disturbed peatlands were obtained. Greenhouse gases fluxes were measured from drainage ditches and channels of different form and purpose on testing areas in European part of Russia (Tver and Moscow Provinces) and in West Siberia (Tomsk Province and Khanty-Mansy Autonomous Area), including all-year observations (Dubnensky mire massif, Moscow). The relationship between CO<sub>2</sub> and CH<sub>4</sub> fluxes and environmental parameters was investigated, and water and hydrochemistry regime were found to be of key importance. Greenhouse gas, especially methane emission is increased simultaneously with growth of organic and mineral components content, intensity of water flow and reduction of water volume. These conclusions were validated by observations at back and tail-bay of dams and checks of different origin. Methanogenic activity of bottom deposits was evaluated, and its connection with parameters of ditches, flooded zones and other hydrological elements of anthropogenic disturbed peatbogs were analyzed. It was found that changes in activity and composition of methanogenic and methanotrophic communities were depended on hydrological conditions and anthropogenic disturbance. Based on obtained results main points of conceptual model describing processes of influx, formation and efflux of methane and carbon dioxide in artificial water objects on peatlands (canals, ditches, flooded zones, etc.) were worked out and stated.

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THE RESPONSES OF PEATLANDS TO DRYING AND TEMPERATURE INCREASES OVER THE 21ST CENTURY: A MODELLING STUDY

**Talbot, Julie, S. Frolking and D. Wisser**

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The 21<sup>st</sup> century climate change is likely to subject northern peatlands to climatic conditions not experienced in the Holocene. Northern peatland carbon stocks are large and potentially vulnerable, since several key climatic variables that are expected to change (i.e., precipitation, potential evapotranspiration, temperature, growing season duration) influence peatland net carbon exchange. However, this vulnerability is not well understood, and the widespread persistence of peatlands and net peatland carbon accumulation through the Holocene indicates that peatlands have some degree of inherent stability. We hypothesize that projected climatic change over the 21<sup>st</sup> century will lead to changes in northern peatland structure (i.e., vegetation composition) and function (i.e., net primary production and decomposition rates), and that these changes will affect only moderately the net carbon balance of northern peatlands that are not located at the driest end of the hydroclimatic continuum in which northern peatlands are stable, or are not underlain by permafrost. We address these hypotheses by simulating the response of different types of peatlands in different climatic settings to hydrological and changes and temperature increase using the Geophysical Institute Permafrost Lab model (GIPL 2.0) to simulate soil temperatures and freezing and thawing depths in peatland soils and projected growing season length; and the Holocene Peatland Model (HPM) to simulate long-term carbon and water balance of peatlands in a transient climate.

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\*Guest speaker and presenting author

FACTORS INFLUENCING SPONTANEOUS RE-VEGETATION OF CUT-OVER PEATLANDS IN ESTONIA

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The area of abandoned cut-over peatlands in Estonia is ca 9500 ha and it will more than double in the next decades. Understanding the factors controlling the spontaneous re-vegetation of these areas is important to promote their restoration. The study presented is based on the inventory data of 64 cut-over peatlands carried out by Geological Survey of Estonia by the request of Ministry of the Environment. For each site the peat characteristics (peat type, the average depth of peat, pH etc.), the time elapsing since the end of peat mining and land-use of adjacent areas (mire, forest or peat field) were recorded. Also, for each site a vegetation survey was carried out separately on peat fields, ditch margins and ditches. We aimed to establish the relationships between environmental factors and individual plant species as well as plant communities. According to the results of CCA ordination, the main factors influencing the re-vegetation of cut-over peatlands are: surface peat type, pH and ash content; peat depth, time elapsed since the last mining activities and the size of abandoned area. The same factors appeared to be the most important also for the occurrence of the most frequent plant species but on the species level the burning of the site, adjacent habitats and the surface microforms significant effect also. These findings enable us to propose optimized technologies for restoration of cut-over peatlands.

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HOLOCENE CARBON ACCUMULATION RATES FROM THREE OMBROTROPHIC PEATLANDS IN BOREAL QUEBEC: IMPACT OF CLIMATE-DRIVEN ECOHYDROLOGICAL CHANGE

**van Bellen, Simon (1), M. Garneau (2) and R.K. Booth (3)**

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Understanding the processes controlling peatland carbon (C) sequestration is critical to anticipate potential changes in the global C cycle in response to climate change. Although identification of factors may be relatively straightforward on seasonal timescales, at longer timescales complexities arise due to interactions between climate, vegetation, hydrology and site-specific conditions. To better understand controlling factors, Holocene rates of C sequestration were quantified from three pristine ombrotrophic peatlands in boreal Quebec (52°N, 75-76°W). Bulk density and loss-on-ignition analyses, combined with radiocarbon dating and age-depth modelling, were used to obtain long-term apparent rates of C accumulation. Past changes in vegetation and water table depth were obtained from plant macrofossil and testate amoeba analyses. Earliest regional peat accumulation started ~7520 cal BP, with mean Holocene rates of 14.9-22.6 g C m<sup>-2</sup> yr<sup>-1</sup>. High rates occurred during the mid-Holocene when relatively stable *Sphagnum* section *Acutifolia* communities were present, while low rates were found during the cooler late-Holocene when Cyperaceae and ligneous vegetation were more dominant. However, highly variable C sequestration among cores implies that local factors have mediated the influence of climate. Reconstructed water table depths reveal several regional dry shifts since 3000 cal BP, suggesting that episodic cold and dry conditions may have contributed to lower C sequestration rates. Given the intensity of the water table shifts at these times, we hypothesize that recurrent episodes of frozen subsurface peat might have intensified surface drying. As projected by climate scenarios, anticipated warmer and wetter conditions may lead to greater stability of hummock *Sphagnum* cover and increased C sequestration potential in boreal peatlands.

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\*Guest speaker and presenting author

FROM CONVERSION OF WASTE TO PRODUCTION OF GROWING MEDIA CONSTITUENTS; CHANGE OF FOCUS

**Verhagen, Hans**

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Nowadays a lot of residues are offered as potential constituents for growing media. These streams are mostly available from processes of waste collection and conversion. In a lot of cases as such these are not usable as constituents for growing media, because they do not meet basic requirements for phyto-hygienic and nutritional aspects. Processes should be converted from waste conversion towards production of a qualified growing media constituent. Production based on horticultural demands can lead to a better suitability of constituents to be produced. Recognition and allocation of potentially suitable streams of materials are a keystone towards production of a valuable constituent for growing media.

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ECONOMICS OF SPHAGNUM FARMING IN NORTHWEST GERMANY: PROFITABILITY AND EXTERNAL BENEFITS

**Wichmann, Sabine (1), S. Kumar (2) and H. Joosten (1)**

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About 30 million m<sup>3</sup> of slightly humified ('white') Sphagnum peat are used annually as a hitherto irreplaceable raw material for horticultural growing media. A promising alternative to this fossil resource is Sphagnum biomass, which can be sustainably provided by Sphagnum farming. Preconditions for a successful market launch of Sphagnum biomass are appropriate product properties and sufficient availability. Equally important is the profitability of Sphagnum farming, as determined by the costs for preparing the production site, establishing and maintaining the Sphagnum cover, harvesting the biomass and producing the growing media. We recorded these data for pilot sites on formerly agriculturally used bogs in Northwest Germany, estimated potential earnings by using market prices and conducted a sensitivity analysis considering different levels of productivity and prices. Under current conditions, high Sphagnum productivity rates of 5 t DM ha<sup>-1</sup> a<sup>-1</sup> appeared to be necessary to compete with moderately priced white peat. In contrast, application of Sphagnum moss in specialized orchid cultivation may generate much higher returns making Sphagnum farming already profitable at productivity rates of 1,5 t DM ha<sup>-1</sup> a<sup>-1</sup>. In addition, we estimated welfare relevant effects of Sphagnum farming as a sustainable land use option for degraded peatlands and of replacing fossil white peat by a renewable resource.

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\*Guest speaker and presenting autor

MICROBIOLOGICAL PROPERTIES OF GROWING MEDIA – METHODOLOGY AND FIRST RESULTS FROM PEAT SAMPLES OF DIFFERENT ORIGINS

**Wohanka, Walter**

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Evaluation of growing media (GM) usually is focused on their chemical, physical and sometimes botanical properties. In addition, commercial GM has to be free of pathogens, pests and weed seeds and should not develop unwanted moulds. Although microbiological effects on the quality of GM are well known, microbiological analyses are not part of the standard procedures for quality assessment. Moreover, to develop system designed and biologically defined GM ("growing media of the third generation") a thorough microbiological characterization is necessary. A wide range of direct and indirect methods is available to depict the occurrence of specific groups of microorganisms and their functions. Direct counts, plate counts, biochemical as well as physiological and molecular techniques can be applied to describe the biological status of GM. However, to cover the dynamic microbiological evolution of GM and their performance from production to use and re-use the manifold interactions of microorganisms and chemical and physical factors of GM have to be considered. Bio-assays with indicator plants may play a key function in this context. Here, as an example, first results are shown from a research project (MIKROPT) which is mainly focused on the microbiological properties of peat and their relation to disease suppressive effects.

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CONSTRUCTION OF A FEN WETLAND IN THE OILSANDS: SYNCRUDE'S SANDHILL FEN WATERSHED

**Wytrykush, Carla\***

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Fen wetlands comprise a large proportion of wetlands typical to the Athabasca oilsands region. However, full construction of a fen and surrounding watershed have previously not been attempted in the post-mining landscape of this region. Few documented examples of large scale constructed fen wetlands exist in the literature. Syncrude Canada Ltd.'s Sandhill Fen Watershed is one of the first fens to be established in a mined out area. It is also the first time that an entire watershed has been specifically designed to support a wetland, and will be the first to be constructed on a soft tailings deposit. Fen design methods, elements, supporting research and results from the first phases of construction are summarized.

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\*Guest speaker and presenting autor



EFFECTS OF NITROGEN DEPOSITION ON BOREAL BOGS: A THREE YEAR NITROGEN FERTILIZATION AND TRACER EXPERIMENT

**Xu, Bin (1), D. Vitt (1) and R.K. Wieder (2)**

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A three-year N fertilization experiment with  $^{15}\text{N}$  double labeled  $^{15}\text{NH}_4^{15}\text{NO}_3$  as a tracer was designed to study the effects of increasing N deposition on various N pools in oligotrophic boreal peatlands (including microbial communities, moss, roots, litter and aboveground vascular plants) and how these N pools process and retain applied nitrogen in four ombrogenous bogs in Alberta, Canada. Linear growth of *Sphagnum* mosses was highly variable. Capitula and stem bulk density as well as tissue N concentrations all increased with N deposition, resulting in slight increase of annual primary production in high N treatment plots. Microbial biomass N measured by chloroform fumigation-extraction showed a decrease with N deposition in the first year of the experiment. Fungal biomass declined with N deposition as nutrients are readily available under high N loads, eliminating the need for symbiotic fungi for nutrient uptake. However, the growth of *Sphagnum* mosses and microbial communities are both influenced by a drier and warmer growing period during 2005 to 2007. These abnormal climatic events could have masked the effects of nitrogen deposition on surface *Sphagnum* moss and microbial communities. The  $^{15}\text{N}$  tracer experiment revealed high retention rates of  $^{15}\text{N}$  by moss layers as expected; however, retention efficiency of the moss layers declined over time and with increasing N deposition. This suggests a leakier system as N deposition exceeds the critical load of *Sphagnum* moss. Aboveground vascular plants overall benefited from N deposition, but different species responded differently based on the root morphology, rooting depths, and mycorrhizal associations.

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ALTERNATIVE GROWING SUBSTRATE RESEARCH IN CANADA

**Zheng, Youbin and M. Dixon**

Controlled Environment Systems Research Facility, University of Guelph, Guelph, Ontario, Canada

Environmental awareness in the general public has increased dramatically especially in the face of global climate change. This has led to the increasing demand for sustainably produced plant products rather than conventionally produced plant materials. Canadian vegetable and ornamental plant growers are proactive in pursuing the production of plants in a more sustainable manner - while staying competitive in the global market. To assist growers, some research projects have been conducted in Canada in recent years to develop alternative growing substrates. This presentation will summarize the major results from these studies.

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CARBON DYNAMICS 10 YEARS POST RESTORATION AT THE BOIS-DES-BEL PEATLAND

**Zuback, Y. and M. Strack**

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Peatlands are an important contributor to the global carbon cycle; as a sink of atmospheric carbon dioxide, a source of atmospheric methane, and also as a store of soil carbon. Some 25% of the world's soil carbon is stored in peatlands which cover 2% of the world's surface area. When peatlands are harvested as a horticultural or as an incendiary resource this stored carbon is released to the atmosphere. While it is known that restoration can limit carbon losses, the time required to restore the carbon sink function of a peatland is unknown. In Bois-de-Bel, Quebec (N47.9671°, W69.4285°) 11.5 ha of peat-bog was harvested between 1972 and 1980. After twenty years of abandonment 7.5 ha of the 11.5 ha site was restored according to the North American restoration guidelines. To address whether carbon is stored or released, measurements were made ten years post-restoration at the Bois-des-Bel peatland to determine CO<sub>2</sub> exchange, methane (CH<sub>4</sub>) efflux, and the amount of dissolved carbon exported.

Carbon dioxide flux analysed when photosynthetically active radiation was above 1000  $\mu\text{mol m}^{-2} \text{d}^{-1}$ , showed significant differences between the un-restored section, restored section, and the nearby natural section at 3.4 g C m<sup>-2</sup> d<sup>-1</sup> released, to 4.6 g C m<sup>-2</sup> d<sup>-1</sup> stored, and 4.2 g C m<sup>-2</sup> d<sup>-1</sup> stored, respectively. On average over the growing season, the un-restored site was a small CH<sub>4</sub> sink with uptake of 0.16 mg C m<sup>-2</sup> d<sup>-1</sup>. Methane flux remained low at the restored site where efflux from restored fields was 0.68 mg C m<sup>-2</sup> d<sup>-1</sup> compared to 30.9 mg C m<sup>-2</sup> d<sup>-1</sup> at the natural peatland. Efflux of CH<sub>4</sub> from ditches was 41.9 mg C m<sup>-2</sup> d<sup>-1</sup> and is important to the total CH<sub>4</sub> of both un-restored and restored sites. Dissolved organic carbon concentrations were found to be greater in the un-restored discharge (101.1±16.4mg L<sup>-1</sup>) than the restored discharge (88.9±22.8mg L<sup>-1</sup>). DOC exported from the restored site (May-October) amounted to 0.9g m<sup>-2</sup> and 9.4 g m<sup>-2</sup> at the un-restored site.



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# POSTER COMMUNICATIONS

Abstracts sorted by session and by first author

## Session 1 – Fen Restoration

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### ANNUAL CARBON DIOXIDE BUDGET OF A REGENERATING FORMER ARABLE FEN

**Morrison, Ross, S. Page, J. Kaduk and H. Balzter**

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Fens are minerotrophic peatlands of high conservation status. The base-rich and highly organic status of fens has made them particularly vulnerable to drainage and conversion to agricultural landuse. Agriculture on drained peat soils is always associated with transfers of historically accumulated soil carbon to the atmosphere as CO<sub>2</sub>. The restoration of arable fens is expected to become an increasingly widespread land management activity. In the intensively farmed East Anglian Fens of the United Kingdom, the inherently unsustainable nature of arable farming on peat soils, coupled with concerns over biodiversity conservation are driving efforts to restore large areas of agriculturally degraded fen peatland for purposes of habitat (re)creation. Whilst restoration has the potential to significantly reduce or even reverse current rates of CO<sub>2</sub> emission, C cycle processes in regenerating fens are poorly quantified and the magnitude of any potential CO<sub>2</sub> benefits remains uncertain. Here, an annual CO<sub>2</sub> budget of a regenerating former arable fen is presented. Net ecosystem-atmosphere CO<sub>2</sub> exchange was measured using the eddy covariance technique at a highly degraded former arable fen that has been under restoration management since 1994. Our results indicate that the regenerating ecosystem functioned as a small net source of atmospheric CO<sub>2</sub> over this period but also demonstrate that restoration management is capable of delivering significant net CO<sub>2</sub> benefits relative to much higher CO<sub>2</sub> emissions associated with former arable landuse.

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## Session 2 – Restoration and Rehabilitation of Bog Peatland

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NUTRIENT MINERALIZATION AND CARBON UTILIZATION BY MICRO-ORGANISMS 10 YEARS AFTER RESTORATION

**Andersen, Roxane (1); C. Wells (2), J. Price (2) and M. Macrae (2)**

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The drainage and harvesting of peatlands may increase the mineralization of nutrients and affect microbial communities in peat by removing vegetation cover and lowering the water table, thereby exposing a highly humified substrate to aerobic conditions. Potential increases in the nutrient content of peat may then degrade water quality downstream of peatlands. Following exploitation, peatland restoration has the long-term objective of redressing the balance between carbon sequestration and release; an aim that can only be achieved when both the plant and the microbial communities are returned to a functional state. Evaluating long term success of peatland restoration therefore requires addressing belowground communities and associated processes along with aboveground communities and other attributes. A long-term monitoring program at the Bois-des-Bel experimental station was set up which included a follow up on the mineralization of N and P, as well as an evaluation of microbial functional diversity.

In summer 2010, peat KCl-extractable nitrate ( $\text{NO}_3$ ), ammonium ( $\text{NH}_4$ ) and water-extractable phosphate (P) concentrations and mineralization rates were compared between a natural bog (NAT) (reference), a restored (RES) bog, and vegetated (UNRV) and bare (UNRB) sites within an un-restored (UNR) bog. The functional diversity of microbial communities was also investigated over the same growing season (in June, mid-August and end of September) at the same sites. This was done using Community Level Physiological Profiles (MicroResp™), which measure the capacity of the microbial community to degrade various carbon sources.

In all sites, P concentrations and mineralization rates were negligible. Nitrogen (N) concentrations were similar across sites, but were highest at the NAT site, possibly due to external inputs of N in runoff. Net N mineralization rates (primarily driven by ammonification) were much higher at the UNR sites than at the NAT or RES sites. Within the UNR site, mineralization rates were more than twice as high at the UNRB sites than at the UNRV sites. Correspondingly, N concentrations were larger at the UNRB sites than the UNRV sites, although these differences were not as large as the differences in mineralization rates. N mineralization rates at the NAT site were lower than at the UNR sites. Net N mineralization and nitrification rates were very low at the RES site. This may be due to low mineralization rates overall, or it could be a consequence of moderate to high mineralization rates balanced by high microbial immobilization rates. Indeed, the microbial community from RES showed the highest rates of degradation for most of the carbon sources throughout the summer, suggesting a more active microbial community. The degradation rates were consistently the lowest in UNRB, supporting previous the finding of a dysfunctional and less active microbial community in disturbed conditions. NAT and UNRV had intermediate and similar rates of degradation for most of the carbon sources, although UNRV displayed greater seasonal variability, with marked decreases in degradation rates of amino acids (lysine, arginine, cysteine) in August. This might be a consequence of greater variation in the water table at the UNR site leading to drier conditions in the middle of the summer, combined with seasonal variation in the composition of rhizoexudates by plants. Overall, the preferred energy sources in RES, NAT and UNRV were carbohydrates (fructose, glucose, galactose) and carboxylic acid (malic acid, citric acid), which are common root exudates of peatland vegetation.

In conclusion, we believe that long-term monitoring will need to be continued in order to accurately gauge restorative success as it pertains to internal nutrient dynamics and microbial-related processes, as they still appear to be different than in natural conditions 10 years after restoration.

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\*Guest speaker and presenting autor

INFLUENCE OF SUBSTRATE AND LIGHT ON THE GERMINATION OF *TYPHA LATIFOLIA* L. IN A CONTEXT OF PEATLAND RESTORATION IN EASTERN CANADA

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Depressions are dug prior to introduction of vegetation to improve plant diversity in peatlands restored by the *Sphagnum* moss transfe method (developed by the Peatland Ecology Research Group). After blocking the drainage ditches, these depressions will fill up with water and should create ecological niches suitable for species typically associated with the natural pools which are biodiversity hotspots at the peatland scale. However, Fontaine *et al.* (2007) showed that even six years post-restoration, vegetation associated with created pools is still different from that of natural pools. One of the reasons to explain this discrepancy is the encroachment of pools by atypical species for peatlands. Our goal was to study the influence of substrate and light on the seed germination of *Typha latifolia* that have rapidly invaded created pools after their creation. Firstly, a greenhouse experiment was carried using a randomized complete block design to test the influence of four different substrates on seed germination. The tested substrates were: 1- bare peat from fen, 2- bare peat from bog, 3- fragments of brown mosses collected in fen, 4- fragments of *Sphagnum* collected in bog, 5- well established carpet of brown mosses collected in fen and 6- well established carpet of *Sphagnum* collected in bog. A growth chamber experiment was also conducted to test the influence of shade cloth on the germination of *Typha latifolia*. Different shading intensities were tested in a split-plot design. Results concerning germination rate for both experiments and possible application will be presented.

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FUNCTIONAL TRAITS SHED NEW LIGHT OVER VEGETATION CHANGES IN A BOG RESTORED 10 YEARS AGO

**D'Astous, Amélie (1), M. Poulin (1), L. Rochefort (1) and I. Aubin (2)**

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Ten years after its restoration, the Bois-des-Bel (BDB) bog shows a bryophyte cover similar to that found in natural bogs used as a reference ecosystem. However, its herbaceous layer remains more extensive and diverse than expected. The functional traits approach can be used to explain the potential of herbaceous species to establish and/or to persist in a site. In BDB, a systematic inventory of species occurrences over a grid of about 5675 points was made before restoration as well as 1, 3, 5, 7 and 10 years after restoration. Also, abundances were measured in natural bogs (n = 7) in order to see if the restored site tends toward natural bogs through time. All herbaceous species were characterized for their acidity tolerance, nutritional adaptation, means of reproduction, seed dispersal vector, seed size, water and habitat preference as well as their indigenous status in Quebec. Identification of significant functional traits and groups using the 4th corner analysis and Ward's agglomeration method were carried out respectively. Exotic or ruderal species can easily establish after restoration but they do not persist. Carnivorous species as well as those associated with a pH lower than 5.7 are associated with the natural bogs and the latest stage post-restoration of BDB. The evaluation of restored sites on a long term scale is primordial to ensure ecological efficiency of the methods used. In this respect, the integration of a functional trait approach into peatland restoration monitoring can help understanding the mechanisms driving the response of the ecosystem.

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\*Guest speaker and presenting autor

VEGETATION ESTABLISHMENT TRIALS IN SEAWATER CONTAMINATED BOGS

**Emond, Catherine, J. Landry and L. Rochefort**

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In New-Brunswick (Canadian Maritimes), the harvesting of horticultural peat is an important economic activity. Once the commercially viable peat deposit is depleted, peat producers are required in that province to restore abandoned peatlands and they have done so by using the *Sphagnum* layer transfer restoration technique since 1995. However, in low coastal areas, bogs are more susceptible to salt water contamination when there is a combination of high tides and storms. In bogs with high salinity, alternatives have to be found to the reintroduction of mosses not tolerant to saline conditions. If no restoration action is carried out, the remaining peat remains un-consolidated and can contaminate seafood cultures. Nevertheless no vascular plants have colonised such sites even after ten years of monitoring. Thus for peat producers, it is critical to find the appropriate vegetation able to efficiently restore these harsh and unusual conditions (low pH peat substrate and high salt content). Trials using a variety of typical bog herbaceous species have shown that some genus like *Juncus* can survive but had, after transplantation, limited development. The goal of this study is to find plant communities able to tolerate salty conditions, low pH, poor nutrient availability and root zone anoxia. Salt marsh species could be good candidates; especially high marsh species since they are less dependent of frequent flooding from tides than lower marsh species.

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BIOMASS PRODUCTION OF DENSE DOWNY BIRCH STANDS ON CUT-AWAY PEATLAND AT HIRVINEVA, LIMINKA, NORTHERN FINLAND

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In Finland energy wood is harvested from young thinnings of forests, mainly as whole trees. From the final cuts, logging residues and stumps mainly are utilized in energy production. The production of forest chips is to be increased from current 6 mil m<sup>3</sup>a<sup>-1</sup> to 13.5 mil m<sup>3</sup>a<sup>-1</sup> by the year 2020. Due to increasing demand and price of forest fuels also, establishing bio-energy plantations could become feasible. In central and northern Finland native species, especially downy birch (*Betula pubescens*), could be used on cut-away peatlands. We measured the biomass production of 10–26 years old naturally regenerated dense downy birch stands in one of the largest former peat production areas in Finland, Hirvineva at Liminka (64°42' N, 25°17' E). We inventoried the stands, determined their ages, took soil samples and measured thickness of the remaining peat layers. The density of the birch stands decreased with increase in age due to self thinning. At the same time breast height diameter, mean height and biomass of the stands increased. The leafless above-ground biomass of the 10-year-old stand was 18 t ha<sup>-1</sup> and that of the 26-year-old stand 76 t ha<sup>-1</sup>. The greatest plot-wise biomass was 91 t ha<sup>-1</sup>. The lowest annual growth (1.8 t ha<sup>-1</sup>) was recorded in the youngest, 10 years old stand and the highest (2.8 – 3.2 t ha<sup>-1</sup>) in the 25–26 years old stands. Most of the stands included in our study were fertilized. Other studies have shown that biomass yields on peatlands can be increased with PK or ash fertilization.

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\*Guest speaker and presenting autor

RECLAMATION OF CUT-OVER PEATLAND: AN EXAMPLE FROM ESTONIA

**Köpp, V., Triin Triisberg, H. Vahtra and M. Peetris**

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One quarter of Estonia is covered with bogs, 12 000 ha of which is exploited by peat works. The biggest peat producer has almost 2300 ha of peat production area in the Southern part of Estonia, in Lavassaare bog. The area has been exploited for almost 60 years and some parts of it are depleted. Reclamation opportunities are similar to those in other countries and include rewetting of the peatland, afforestation, development of farming land etc. An especially complicated task is to reclaim effectively the fringe of the production area so that it would fit with the long term aim. The long term aim of reclamation in cut-over peatland is wetland. But in the short term, the aim is to cover the aforementioned fringe area with a "green carpet" as quickly as possible and to minimise future reclamation work-processes for rewetting.

INCREASING SUBSTRATE STABILITY WITH ERICACEOUS TO IMPROVE PLANT DIVERSITY OF CREATED POOLS IN RESTORED PEATLANDS

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Restored peatlands are usually characterized by an even topography and uniform vegetation cover without open water bodies. Since pools are known to increase biodiversity in natural peatlands, their creation in the same purpose has been investigated in restored sites. So far, we cannot rely on spontaneous recolonization for these created microhabitats. Early trials with the moss transfer approach have shown that *Sphagnum* species associated with pools establish rapidly along created pool margin but this technique has failed to restore vascular plant communities associated with these microhabitats. Peat erosion and substrate instability around pool margins are factors affecting survival of seedlings.

The main objective of this research project was to facilitate *Sphagnum* and vascular plants establishment around pool margins created in restored peatlands. One way to achieve this was through substrate stabilization using two pioneer species of shrubs (transplants of *Andromeda polifolia* L. var. *glaucophylla* (Link) DC. and *Vaccinium macrocarpon* Aiton). A three-factorial experiment was carried out in a split-split-block design replicated six times. Results show that shrub cover increased survival of *Sphagnum* along pool margins. Indeed, at the water edge, *Sphagnum* cover was 18% under ericaceous and 5% without ericaceous. However, at 2m from the water edge, *Sphagnum* cover was 22 % and 21 % with and without ericaceous, respectively. Shrubs also reduced frost heaving by 35%, compared to the control. Finally, shrub cover did not influence germination rates or biomass production of herbaceous species sowed around pool margin. These results suggest that transplantation of Ericaceous species along pool margins can promote *Sphagnum* growth without compromising the establishment of herbaceous species.



SUCCESS OF REHABILITATION TRIALS IN A BOG PEATLAND IN QUEBEC

**Marchand-Roy, Mylène, J.P. Fortin and M.R. Nemati**

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Several rehabilitation trials were performed following peat extraction on a bog peatland in Saint-Bonaventure, Quebec, Canada and these were monitored in 2009. The trials included a short-rotation intensive culture of willows (*Salix viminalis* L.), two cultures of small fruits; black chokeberry [(*Aronia melanocarpa* (Michx.) Ell.] and northern highbush blueberry (*Vaccinium corymbosum* L.), as well as tree plantations of red maple (*Acer rubrum* L.), tamarack (*Larix laricina* (Du Roi) Koch.), black spruce (*Picea mariana* (Mill.) B.S.P.), jack pine (*Pinus banksiana* Lamb.) and hybrid poplar (*Populus* spp.). The willows were established in spring 2009 and tested for nutrient additions and optimal peat depth whereas the trials with small fruits and forest trees were established in 2000 and tested for the appropriate fertilization rate at planting. Plant performance, after 1 year (willows) and/or 9 years, was assessed by measuring survival, total height, annual growth, leaf nutrient concentration and when applicable, biomass or fruit yield. In almost all trials, adding nutrients increased survival and growth. Only the blueberry showed better survival without fertilization whereas the trial with hybrid poplar failed completely. After 9 years, tamarack and black chokeberry showed the best survival and growth when compared to conventional plantations. Otherwise, fruit yields were very low. The willows establishment was comparable to other intensive cultures, but only when peat depth was over 30 cm and nutrients were added. Further experiments are planned to assess the success of short-rotation intensive culture of willows on cut-over peatland.

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AMPHIBIAN AND AQUATIC BEETLE COLONIZATION OF MAN-MADE POOLS IN A RESTORED PEATLAND

**Mazerolle, Marc J. (1) and C. Lavoie (2)**

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As a component of a large-scale project aiming to study the success of peatland restoration techniques, we studied the colonization of man-made pools between 1 and 10 years following restoration. Specifically, we conducted call surveys to detect anuran males and funnel trapping to detect the presence of amphibians under all life stages (adult, juvenile, tadpole) as well as aquatic beetles (Dytiscidae). Results for amphibians indicate that the man-made bog pools had a greater number of individuals and species than natural bog pools, and that the difference increases with time following restoration. A greater number of aquatic beetle species occurred at bog pools in 2010 than during the earlier sampling periods. Though beetle bog specialists colonized pools both early and later after restoration, a species shift occurred and a number of non-bog specialists also colonized pools. These faunal patterns reflect the structure of the man-made bog pools, which are more akin to fen than ombrotrophic peatlands. Even 10 years following creation, man-made pools did not fully emulate the characteristics of natural bog pools.

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\*Guest speaker and presenting author

HYDROLOGICAL ASSESSMENT OF RESTORATION OF THE BOIS-DES-BEL PEATLAND, QUEBEC: A DECADE LATER

**McCarter, Colin and J. Price**

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Understanding the eco-hydrological processes occurring within both restored and undisturbed peatlands is an integral part of determining the success of the restoration and the current hydrological trajectory of a restored ecosystem; however it is currently unknown if restored peatlands will eventually behave in a similar way to un-disturbed peatlands. The Bois-des-Bel peatland was restored a decade ago (2000) and the eco-hydrological functions were assessed at the restored site along with un-restored (abandoned 30 years) and undisturbed sections of the peatland. Since restoration, a complete cover of *Sphagnum* moss (primarily *S. rubellum*) has developed at the restored site, while no *Sphagnum* regeneration has occurred at the control site. The control and restored sites had similar average water tables (-0.48 m), while the undisturbed site had an average water table of -0.36 m. In addition to higher water tables, the average volumetric water contents within the upper 10 cm of the *Sphagnum* was 0.20 - 0.25 cm<sup>3</sup>/cm<sup>3</sup> at the undisturbed site compared to 0.10 - 0.15 cm<sup>3</sup>/cm<sup>3</sup> at the restored site. Although Bois-des-Bel has complete *Sphagnum* cover, the water table does not yet fluctuate within the new moss layer. This sets limitations to the accessibility of water to the uppermost portion of the moss layer where the plants have physiological water supply requirements. The presence of a complete moss layer is one measure of success, but the divergent hydrological conditions indicate that the eco-hydrological function has not yet fully returned.

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VEGETATION RESPONSE IN A CUT-OVER BOG 8 YEARS AFTER RESTORATION: THE USE OF PRINCIPAL RESPONSE CURVES TO EVALUATE SUCCESS

**Poulin, Monique (1)(2), R. Andersen (1)(3) and L. Rochefort (1)**

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Following large-scale restoration of a cut-over peatland in Eastern Canada, vegetation was monitored bi-annually over 8 years. One of the criteria for successful restoration is the recovery of biodiversity, for instance, of a plant community which falls within the range of natural variation expected under a similar climate and in the same geographical region. So far, most of the studies looking at vegetation change following restoration in various ecosystems have been using general indices of diversity. We advocate that biodiversity components need to be dissected into functional groups to provide a more complete picture of success of establishment and trajectory of various components of the ecosystem. In this study, we evaluated restoration success using principal response curves (PRC) applied on plant species grouped by life forms or preferred habitat, comparing restored sites and non-restored sites to a natural reference. We show that whereas total diversity and richness do not differ between any of the sites after 8 years when all species are considered equally, there are clear distinctions between the sites in terms of functional groups of species, with forest and ruderal species more prominent in non-restored areas, and peatland and wetland species dominant in restored areas. The PRC revealed that the restoration method is particularly successful at re-instating a typical ground layer (mosses, particularly *Sphagna*, and hepatica) but that some differences remained between the restored and the natural species pool, the former having more herbaceous species associated with wetlands, the latter having a more diverse Ericaceous shrub cover.

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\*Guest speaker and presenting autor

PRIMARY PRODUCTION AND DECOMPOSITION OF THE VEGETATION OF A RESTORED CUTOVER PEATLAND IN QUEBEC: 10 YEARS AFTER

**Salvador, Flor and L. Rochefort**

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We present the preliminary results of the evaluation of the peat-accumulating potential of the vegetation in the restored cutover peatland of Bois-des-Bel (Quebec) 10 years after the restoration work. The objectives were to assess production and decomposition rates of vegetation in restored, non-restored and natural peatlands. The net annual primary production (NPP) for *Sphagnum* was measured by the cranked wire method. NPP of *Sphagnum* was estimated at 105 g m<sup>-2</sup> yr<sup>-1</sup> and 135 g m<sup>-2</sup> yr<sup>-1</sup> on the restored and natural peatlands, respectively. The annual aboveground biomass for vascular plants production was measured using the destructive sampling method. Annual above-ground net primary production (AGNPP) was estimated for the shrubs and herbs from published relationships between above-ground biomass and NPP. In the restored and natural peatland AGNPP was 182 g m<sup>-2</sup> yr<sup>-1</sup> and 270 g m<sup>-2</sup> yr<sup>-1</sup>, respectively. For comparison, at the adjacent non-restored peatland the AGNPP was significantly lower, with mean of 9.1 g m<sup>-2</sup> yr<sup>-1</sup>. The annual belowground production of fine roots (<2 mm in diameter) was measured using the ingrowth bag method. Below-ground production averaged 21.7 g m<sup>-2</sup> at the restored peatland, compared with 23.3 g m<sup>-2</sup> at the natural peatland and 2.7 g m<sup>-2</sup> at the non-restored peatland site. The litter-bag technique was used to determine the mass loss from decomposing tissue (*Sphagnum* and above-ground biomass of vascular plants) over 1 year. Decomposition rates were highest for the *Picea mariana* litter type (leaves) and lowest for the *Sphagnum* litter types. Decomposition rate did not differ between the restored and the natural peatland sites. Consequently, our data suggest that after 10 years following peatland restoration, net primary production and decomposition of the vegetation have been re-established in the site of Bois-des-Bel.

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CARBON DYNAMICS 10 YEARS POST RESTORATION AT THE BOIS-DES-BEL PEATLAND

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Peatlands are an important contributor to the global carbon cycle; as a sink of atmospheric carbon dioxide, a source of atmospheric methane, and also as a store of soil carbon. Some 25% of the world's soil carbon is stored in peatlands which cover 2% of the world's surface area. When peatlands are harvested as a horticultural or as an incendiary resource this stored carbon is released to the atmosphere. While it is known that restoration can limit carbon losses, the time required to restore the carbon sink function of a peatland is unknown. In Bois-de-Bel, Quebec (N47.9671°, W69.4285°) 11.5 ha of peat-bog was harvested between 1972 and 1980. After twenty years of abandonment 7.5 ha of the 11.5 ha site was restored according to the North American restoration guidelines. To address whether carbon is stored or released, measurements were made ten years post-restoration at the Bois-des-Bel peatland to determine CO<sub>2</sub> exchange, methane (CH<sub>4</sub>) efflux, and the amount of dissolved carbon exported.

Carbon dioxide flux analysed when photosynthetically active radiation was above 1000 µmol m<sup>-2</sup> d<sup>-1</sup>, showed significant differences between the un-restored section, restored section, and the nearby natural section at 3.4 g C m<sup>-2</sup> d<sup>-1</sup> released, to 4.6 g C m<sup>-2</sup> d<sup>-1</sup> stored, and 4.2 g C m<sup>-2</sup> d<sup>-1</sup> stored, respectively. On average over the growing season, the un-restored site was a small CH<sub>4</sub> sink with uptake of 0.16 mg C m<sup>-2</sup> d<sup>-1</sup>. Methane flux remained low at the restored site where efflux from restored fields was 0.68 mg C m<sup>-2</sup> d<sup>-1</sup> compared to 30.9 mg C m<sup>-2</sup> d<sup>-1</sup> at the natural peatland. Efflux of CH<sub>4</sub> from ditches was 41.9 mg C m<sup>-2</sup> d<sup>-1</sup> and is important to the total CH<sub>4</sub> of both un-restored and restored sites. Dissolved organic carbon concentrations were found to be greater in the un-restored discharge (101.1±16.4mg L<sup>-1</sup>) than the restored discharge (88.9±22.8mg L<sup>-1</sup>). DOC exported from the restored site (May-October) amounted to 0.9g m<sup>-2</sup> and 9.4 g m<sup>-2</sup> at the un-restored site.

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\*Guest speaker and presenting author

### Session 3 – Boreal Peatlands: Use, Management, and Conservation

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#### POTENTIAL REFERENCE MIRES FOR BIOSPHERE ASSESSMENT OF OLKILUOTO SITE

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Posiva Oy is responsible for implementing a repository programme for spent nuclear fuel from the Finnish nuclear power reactors. The spent nuclear fuel is planned to be disposed at a depth of between 400 and 600 metres in the bedrock at the Olkiluoto site in Finland. Olkiluoto is a large island (currently approximately 12 km<sup>2</sup>), on the coast of the Baltic Sea, separated from the mainland by a narrow strait. A site-specific safety case is being produced, and data have been acquired for the assessment models. The safety case includes all material presented by the repository implementer to the authorities and to other stakeholders in support of an application to site, construct, operate or close a disposal facility. The safety case is a key input to decision-making at several steps in the repository planning and implementation process. With the Olkiluoto site, there is additional challenge of post-glacial land uplift (currently 6 mm/y) continuously changing the landscape and ecosystems. Due to the ecologically very long time window for quantitative biosphere assessment, all the ecosystems characterisation has to be considered in the context of development from a coastal into an inland site. Terrestrial ecosystems play a significant role in the biosphere assessment and need to be characterised. Currently, mires are lacking from the Olkiluoto Island, and a larger Reference Area is needed to find suitable analogues for potential future conditions at the site. This work has been started through collating literature information, as summarised in this presentation.

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#### DEVELOPMENT OF A PEATLANDS CONSERVATION NETWORK APPROACH BASED ON ECOSYSTEM SERVICES MAINTENANCE

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The peatlands in the northern region of the province of Quebec are still barely undisturbed by human activity. The impending increase in environmental pressure caused by future industrial development and natural resource extraction may degrade or even convert these key ecosystems. Recently, some studies have shown a need for the development of a conservation planning approach that will ensure the sustainable development of the northern peatlands with consideration for human welfare and biodiversity conservation. In order to conciliate these objectives, this study aims to adapt an approach that focuses on the valuation and the maintenance of ecosystem services. The assessment of the ecosystem services generated by peatlands will certainly provide us with some clues to identify and refine conservation priorities. While some ecosystem services are directly linked to biodiversity, it is still unclear if it is possible to achieve traditional conservation goals, namely maintaining biodiversity, by prioritising the peatlands that provide the highest amount of ecosystem services. To answer this question, conservation network selection algorithms will be used to generate a range of conservation scenarios according to different criteria, such as coarse and fine filters, the value and quantity of ecosystem services, and the representativeness of peatlands and their connectivity. These scenarios will then be compared to identify the best approach for selecting conservation areas.

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\*Guest speaker and presenting author

## Session 4 – Peatland Management in the Energy Sector

RESTORING PEATLAND ON DECOMMISSIONED WELL SITES: REGENERATION CAPABILITY OF FEN PLANT COMMUNITIES

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Large areas are being disturbed in Northern Alberta due to the oil sand exploitation. The majority of the province resources (80%) are recoverable only through in-situ extraction techniques, which necessitates the construction of well pads. Provincial legislations require that industrially disturbed sites should be returned to a state equivalent to the pre-disturbed ecosystem<sup>1</sup>. Peatlands are largely represented in the boreal landscape of Alberta<sup>2</sup>. However, provincial regulatory framework for peatland reclamation is not yet completed and reclamation practitioners of the province do not operate peatland restoration. Fundamental questions concerning regeneration potential of peatland plant communities remained to be answered. The goal of this study is to determine if fen plant communities can recolonize on well pad material after being transferred. We also want to know if certain types of soil amendment could favor plants regeneration success. In field experiments, the Sphagnum transfer technique<sup>3</sup> is used to establish fen plants on portions of well pads previously lowered to near the water table. Two types of fen plant communities (moderate-rich fen and poor fen) are harvested and transferred on five types of soil treatments (directly on pad material, decompacted pad material, mix sawdust + pad material, decompacted mix of sawdust and pad material and natural peat). The relation between plant survival and substratum type is further investigated in greenhouse experiments. Preliminary results will be presented.

## Session 5 – Rewetting of Peatlands

THE IMPACT OF PEATLAND DRAIN-BLOCKING ON DISSOLVED ORGANIC CARBON LOSS: RESULTS FROM A NATIONAL SURVEY

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Peatlands are important terrestrial carbon stores and consequently it is necessary to ensure they are well managed. Many peatlands were drained using open ditches and this has been associated with an increase in dissolved organic carbon concentrations, [DOC]. Therefore, recent peatland restoration schemes include blocking these drains. Previous studies examining the impact of drain-blocking on [DOC] are limited in their spatial and temporal coverage. Consequently, it is uncertain if drain-blocking consistently reduces [DOC] and the longer term impacts are unknown. This study combines a UK-wide survey across 32 study sites and intensive monitoring of six drains, three of which were unblocked and three of which were blocked seven years prior to data collection. The UK-wide survey indicated that [DOC] were significantly lower in blocked drains: the mean [DOC] of water sampled from blocked drains was 28% less than that sampled from unblocked drains. However, this pattern was not evident at all sites. Continuous monitoring of an unblocked and blocked drain at the intensive monitoring site indicated no significant differences in total DOC flux: the blocked drain exported 31,592 kg km<sup>-2</sup> yr<sup>-1</sup> and the unblocked drain 30,123 kg km<sup>-2</sup> yr<sup>-1</sup>. Fortnightly grab samples from three blocked and three unblocked drains at the intensively monitored site, however, did conform to the general national pattern of lower [DOC] in blocked drains. These results demonstrate that drain-blocking can be an effective management strategy for reducing DOC loss, however, that there will be a number of sites where no significant change will occur.

\*Guest speaker and presenting autor

PEATLAND REWETTING: APPROACHES FOR MAJOR DITCH BLOCKING

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The Grande plée Bleue peatland is an ecosystem of choice for conservation since it is one of the last large un-harvested bog (15 ha) in southern Québec located nearby a major urban center. A part of this projected ecological reserve has been drained in the mid-fifties as part of a scheme to condition more land for agriculture. Now that the land is back to government properties, managers have decided to invest in the rewetting of the peatland to assist the recovery of its ecological functions. Much knowledge is available for the blocking of small drainage ditches in peat soil, but for ditches of greater dimension, recommendations on dam building are scares. In this case, the main drainage ditch is about 6 m deep by 10 m wide. A variety of dams using different materials and different designs will be presented. Our aim is to find ways to build dams that will result in successful rewetting of the peatland, that will be time and cost efficient, durable and that we can build with low weight machinery.

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## Session 6 – Cultivation of Sphagnum and Biomass Production

PROSUGA - INDUSTRIAL PRODUCTION OF PEAT MOSS FOR THE PRODUCTION OF INNOVATIVE CULTURE SUBSTRATES FOR HORTICULTURE

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Its specific physical and chemical characteristics make peat difficult to replace as raw material for horticultural substrates. Peat extraction affects a limited resource, however, and has a negative impact on climate and biodiversity. The challenge is to find ways to preserve peatland ecosystems while at the same time securing jobs and economic interests in horticulture and peat industry. The cultivation of *Sphagnum* peat moss is a promising alternative to the extraction of fossil peat in this respect. To secure a permanent supply of fresh moss material as a raw material for the production of horticultural substrates, several cultivation techniques are currently being tested. The PROSUGA project focuses on moss cultivation on floatable vegetation carriers. Cultivation on floatable carriers has already been shown a viable option in a previous project. PROSUGA covers the whole range of the substrate production process, including propagation, cultivation and harvest of *Sphagnum* as well as the development, storage and industrial trials of moss-based substrates. Seven partners participate in the joint project PROSUGA, including three research institutes and four commercial partners. Project management rests with the Institute for Agricultural and Urban Ecological Projects associated to the Humboldt University of Berlin (IASP) ([www.prosuga.asp-berlin.de](http://www.prosuga.asp-berlin.de)).

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\*Guest speaker and presenting autor

EXPERIMENTS ON THE GENERATIVE AND VEGETATIVE PRODUCTION OF *SPHAGNUM* PROPAGULES: FIRST RESULTS

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A major bottleneck in *Sphagnum* farming is the scarcity of propagules for initial *Sphagnum* establishment. Collecting *Sphagnum* from natural bogs is hampered by the habitat being protected by law in many European countries. Furthermore large-scale cultivation of selected taxa ('cultivars') will require the massive production of suitable propagules. We tested propagation from spores (*Sphagnum fimbriatum*, *S. palustre*, *S. papillosum*) under controlled conditions. Plantlets of all species had developed after 8 weeks, independent of nutrient levels. Especially *S. fimbriatum* germinated abundantly. Germination was better on damped peat than on milled *Sphagnum* biomass. We tested vegetative propagation of *S. palustre* and a *S. magellanicum/papillosum* mix on artificial floating mats and on damped peat, using four fragment sizes. After 5 months the 1-3 mm fragments of *S. palustre* on peat had produced most capitula (mean 39.700 m<sup>-2</sup>). Larger (up to 10 cm long) fragments yielded better coverage but less capitula. Submerge (three-dimensional) vegetative propagation of *S. palustre* (capitulum and stem) resulted in sprouting and new capitula, particularly of the capitula fragments, under conditions of moderate shading in stagnant water. Cultivation in moving water, with a rotator providing input of air, led to mechanical stress and death of the mosses. Algal and bacterial growth hampered *Sphagnum* development in both experiments on vegetative propagation.

INDUSTRIAL PRODUCTION OF *SPHAGNUM* SPEC. BIOMASS ON SURFACE MINING LAKES WITH BUOYANT CARRIER SYSTEMS

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The future substitution of white peat in growing media depends heavily on the availability of sustainable produced *Sphagnum* biomass. Therefore, a diverse pool of cultivation methods is needed. One of our main emphases within our current network research project is to develop a low input production method which is described in the following. In summer of 2010 we were able to successfully establish a 1300 square meter production of *Sphagnum* on a surface mining lake 200 kilometers southeast of Berlin (Germany). In this region, there are to find a plenty of such waters. We are currently cultivating *Sphagnum palustre* on especially developed buoyant mats. The fabric shell of these mats provides a constant supply with water from the lake beneath. The chemical properties of the water suits well the physiological needs of *Sphagnum*. We established a moss carpet on the mats by using vegetative propagation. The moss stems were therefore cut into small pieces. To protect the moss during the initial phase of regeneration, we covered the carpet with a thin layer of organic mulch. Throughout summer and autumn we observed vital growth of the plants all over the mats. In spring of 2011 we will additionally setup 700 square meters production area. This promising cultivation system for *Sphagnum* biomass has a very low ecological footprint and concomitantly provides a new form of usage for the unenlivened lakes which follow open cast mining.

\*Guest speaker and presenting autor

A TOOL TO HEAL THE NOT SO FRAGILE *SPHAGNUM* WHEN INFECTED BY FUNGI IN THE GREENHOUSE

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A common problem when growing *Sphagnum* mosses in the greenhouse is the propagation of fungi. Since no clear procedure is available to correct the situation, the aim of this experiment is to give scientists and growers a tool to control fungi invasions in the greenhouse. First, eight fungicides and the effect of temperature were tested on Petri dish inoculated with two fungi commonly found in *Sphagnum*: *Lyophyllum palustre* (Peck) Singer and *Chaetomium* sp. Then, to assess *Sphagnum* tolerance to fungicides, the four most efficient treatments were tested on healthy *Sphagnum* carpet, at maximum and minimum dose. Finally, the most promising fungicide, Nova, was tested on *Sphagnum* carpets infected by *L. palustre* and *Chaetomium* sp. Since the concentration of this fungicide had no effect on biomass accumulation, maximum concentration (0.54 g/L) was tested. Because of the high absorbency of *Sphagnum*, Nova was applied at recommended dose (1L/10m<sup>2</sup>) and three times the recommended dose. Evaluation of infected *Sphagnum* stem was carried out after a frequency of two and three applications. The recommendation for controlling the invasion of *Sphagnum* by *L. palustre* and *Chaetomium* sp. in the greenhouse is the application of Nova fungicide three times the recommended dose (3L/10 m<sup>2</sup>). The frequency of applications had no significant effect.

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**Session 7 – Production of Berries in Bogs**

CHARACTERIZATION OF EFFLUENTS FROM CRANBERRY FARMS

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During the 2002 and 2004 growing seasons, drainage water was analyzed on four cranberry farms, two on peat soils and two on sandy soils. Different inorganic elements as phosphorus, ammonium nitrogen, and suspended solids and organic compounds as herbicides and pesticides were analyzed. Water was sampled in the drainage canal, the farm pond and at the upstream and downstream in the river near the farm. For each type of soil, there was one farm with water recycling (close system) and one farm without recycling (open system) in order to evaluate the efficiency of recycling on water quality in the river. Farms on peat soils leached more phosphorus in water compared with sand. Ammonium nitrogen (N-NH<sub>4</sub>) losses were low and under the criteria for aquatic life protection (1.22 mg/l) in all farms. Water retention may reduce the amount of total phosphorus found on the river particularly for farms on peat soils. Water retention also reduced the amount of diazinon found in river and the number of water samples containing diazinon. Frequency of water samples from the river containing diazinon was 80 % for the open system and 35 % for the close system. The results suggest that water should be retained in ponds for at least 15 days after the application of diazinon in order to minimize the risk of contamination.

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\*Guest speaker and presenting autor



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## Session 8 – Charbon and Climate Change

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THE IMPACT OF MICROCLIMATES INDUCED BY WIND TURBINES ON PEATLAND CARBON CYCLING

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Wind turbines reduce air flow over the lands surface and increase turbulence, thus creating site specific microclimates proposed to vary in terms of evapotranspiration rates and temperature. Therefore, given that water table depth and temperature are key drivers of carbon cycling, wind farms have the potential to influence the capacity of peatlands to sequester and store carbon. In order to investigate the resilience of peatland sites to hosting wind turbines we have instrumented multiple sites across a microclimatic gradient within a Scottish wind farm. At each microclimatic gradient site we are monitoring temperature, water table depth, soil moisture, soil water tension, gas flux (carbon dioxide, methane and nitrous oxide) and pore water dissolved organic carbon concentrations, accommodating differences in vegetation community compositions. Here we present preliminary results from this field research and explore if the measured parameters change across the microclimatic gradient.

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CARBON BUDGET OF A HIGHLY «AQUALYSED» PEATLAND OF THE NORTHEASTERN SECTION OF THE LA GRANDE RIVER WATERSHED

**Cliche Trudeau, Noémie, M. Garneau and L. Pelletier**

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Considered as CO<sub>2</sub> sinks and sources of CH<sub>4</sub> and DOC, peatlands are a major component of the carbon cycle. Their sensitivity to environmental changes place them at the center of climate change issues. In the Laforge region (subarctic Quebec), patterned poor fens show indications of recent water table rise such as physical degradation of strings, pool expansion and coalescence. This recent phenomenon of peatland flooding is defined as "aqualysis" and refers to a hydrologic disequilibrium where aquatic components (pools) expand to the detriment of the peatland's terrestrial compartments. The main objective of this project is to evaluate the impact of this water table rise on the C budget on the Abeille peatland and to develop a model to scale-up the C fluxes for the entire ecosystem. Fluxes results show important spatiotemporal variability. Seven intensive field campaigns over 2 growing seasons (2009-2010) show that fluxes follow the growing season differ from one year to another and vary between microforms. Fluxes respond to changes in the environmental variables such as water table fluctuations, peat temperature, vegetation assemblage, luminosity and hydrological dynamics.

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CUTAWAY BOGS IN IRELAND: INFORMING LAND USE MANAGEMENT FOR CARBON BENEFITS

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(1) Bord na Móna, Leabeg, Tullamore, Co. Offaly, Ireland

(2) Earthy Matters Environmental Consultancy

Globally, peatlands are significant stores of carbon and future management will have an influence on carbon emissions and potential carbon sequestration. In Ireland, peatlands account for up to 20% of the national land cover and Bord na Móna (the Irish peat company) owns up to 8% of this national peatland resource, approx 80,000ha. While the greater proportion of this land currently comprises heavily drained bare peat used for milled peat extraction, parts of the cutaway bogs (areas that are commercially exhausted) have been rehabilitated to re-create embryonic peatland communities – poor fen, rich fen, reed-swamp on peat, bog woodland and in some instances Sphagnum rich plant communities. While the biodiversity value of these new habitats on otherwise industrial landscapes is obvious, the potential carbon sequestration value has been shown to vary widely, with large annual losses of carbon reported for birch woodland on cutaways and a strong return of the carbon sink function in some of the rewetted cutaways. Given that the entire Bord na Mona land holding will come out of peat production within the next 20 years, management of these areas must be based on a clear understanding of biodiversity and carbon balances.

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CAPTURING THE ANTHROPOGENIC GHG IMPACTS OF WETLAND DISTURBANCE IN CANADA

**Hayne, Shari and D. Blain**

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Environment Canada has requirements to report anthropogenic emissions and removals of greenhouse gases (GHG) associated with Land Use, Land-use Change and Forestry (LULUCF) within Canada's national GHG inventory. These requirements stem from Canada's commitments under the United Nations Framework Convention on Climate Change (UNFCCC). The LULUCF sector includes emissions and removals associated with management activities and land-use changes among five basic land categories: forest, cropland, grassland, wetlands and settlements. In accordance with guidance from the Intergovernmental Panel on Climate Change (IPCC), emissions and removals from managed wetlands are restricted to those where human interventions have directly altered the water table, which includes flooded land (reservoirs) and peatlands drained for peat harvesting. The conversion of peatlands to agriculture is reported within the cropland category. Other disturbances affecting wetlands include; forestry management practices, urbanization, resource extraction, infrastructure and wetland restoration. There are significant challenges in developing estimates of the anthropogenic GHG impacts of wetland disturbance. First, it is difficult to document the spatial extent of historical and current disturbances within the landscape due to the scarcity of data and the sensitivity of wetlands to disturbances on adjacent lands. Second, there is limited availability of applicable methodologies at the appropriate spatial scales required for national GHG inventories. To improve the quality of wetland estimates work has been prioritized to improve the quality of input data and develop methodologies which more comprehensively assess the GHG impact of wetland disturbance.

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\*Guest speaker and presenting autor

MODELING CARBON DIOXIDE EXCHANGES IN FLOODED BOREAL FORESTS AND PEATLANDS DUE TO THE CREATION OF A HYDROELECTRIC RESERVOIR

**Kim, Youngil (1), N. Roulet (1), C. Li (2), S. Frolking (2), I. Strachan (1, 3), C. Peng (4), C. Teodoru (4), Y. Prairie (4) and A. Tremblay (5)**

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We developed a process-based reservoir model in order to project carbon dioxide (CO<sub>2</sub>) fluxes from flooded boreal forests and peatlands over the life-time of a hydroelectric reservoir in boreal biomes. The framework of the reservoir model was based on Forest-DNDC, a terrestrial biogeochemistry model that supports soil C processes under flooded environments. We modified this terrestrial model to represent the altered soil and vegetation C processes in the presence of a thick water column. This reservoir model was used to examine the changes of CO<sub>2</sub> emissions from water surfaces over the first four years and 100 years of inundation in the Eastmain-1 hydroelectric reservoir in Northern Quebec, Canada. During 2006 – 2009, simulated daily CO<sub>2</sub> emissions averaged 1.42 g C m<sup>-2</sup> d<sup>-1</sup> (ranging 0.75 – 3.24 g C m<sup>-2</sup> d<sup>-1</sup>) from the flooded forest and 0.74 g C m<sup>-2</sup> d<sup>-1</sup> (ranging 0.51 – 1.09 g C m<sup>-2</sup> d<sup>-1</sup>) from the flooded peatland, and the simulated CO<sub>2</sub> emissions decreased with time since flooding. In both the flooded forest and peatland, the 4-year simulations had smaller CO<sub>2</sub> emissions than the measurements at the water-air interface, but the patterns of the yearly change in the simulated annual emissions were similar to that from the water-air interface measurement. The 100-year simulations using the average climate in 2006 – 2009 showed that in the flooded forest and peatland, there was continuous reduction of CO<sub>2</sub> emissions, and the peatland included larger total emission of CO<sub>2</sub> for 100 years than the forest.

THE ROLE OF PALEOHYDROLOGY ON THE LONG-TERM CARBON DYNAMICS IN THE OMBROTROPHIC PEATLANDS OF THE NORTH SHORE OF THE SAINT-LAWRENCE, NORTHEASTERN QUÉBEC

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2) Université Laval, Québec, Québec, Canada

Ombrotrophic peatlands (bogs) are very abundant on the deltaic formations of the North Shore of the St-Lawrence. This study shows the role of paleohydroclimatic conditions on the long-term carbon dynamics in these oceanic peatlands. We present the long-term rates of carbon accumulation (LORCA) of 9 coastal bogs along the St-Lawrence Estuary and Gulf between Baie-Comeau and Blanc-Sablon. The paleohydrology of 4 peat bogs has been reconstructed using testate amoebae analysis and was compared to the carbon accumulation rates (CAR) during the past 7500 years. The mean rates of carbon accumulation were up to three times higher in the southwestern peatlands (Manicouagan delta) compared to the northeastern area (La Romaine delta). This probably reflects a paleoclimatic influence on carbon accumulation. The southwestern peatlands have been characterized by the maintenance of near-surface water tables throughout the Holocene that favoured carbon sequestration. The paleohydrological conditions and related vegetation successions seem to have played a prominent role on the long-term carbon dynamics in these peatlands.

HERBAL VEGETATION AS POTENTIAL SOURCE OF METHANE FLUX FROM DRAINED AND ABANDONED AGRICULTURE PEATLAND UNDER WET CONDITIONS

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Large area of peatlands previously drained and utilized for agriculture (directly or after partial cutoff) are left abandoned during last decades in Europe. In the European Russia alone, several million hectares of peatlands have been modified for these purposes and many of them are not used by economic reasons any more. Restoration of such sites through rewetting is the most urgent problem related to peatland wise use in these regions nowadays (Minayeva et al. 2009). Being considered as substantial source of CO<sub>2</sub> such dehydrated sites demonstrate intensive methane efflux from drainage ditches and sometimes considerable rates of methane emission from main drained surfaces (Sirin & Laine, 2008). During the studies conducted in Moscow region (European Russia) unexpected methane fluxes were observed at the inter-ditch spacing at both a milled peat extraction area and a hayfield (Chistotin et al., 2006). Microbiological studies showed not lower and near to twice higher genomic diversity of methanogens in extraction area and in a hayfield as compared to virgin mire. Well-developed plant roots at the grassland could provide a source of fresh organic material used for CH<sub>4</sub> production. To test this hypothesis, a pot experiment with mesocosms (bare peat, grass sowing, and developed grassland) under permanently high or fluctuating wetness was conducted. Under wet conditions all mesocosms demonstrate methane emission 1-2 orders of magnitude higher. Methane efflux from peat under developed grassland was higher as compared to the other treatments. The results showed that plant organic matter can be a considerable additional source of methane after rewetting of abandoned drained peatland sites. To mitigate the emissions, such management options as removal of the surface layer before rewetting could be applied. This practice could have additional technical and ecological benefits, as lowering the surface and making it more favorable for mire species.

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THE CARON (C): NITROGEN (N): PHOSPHORUS (P): POTASSIUM (K) STOICHIOMETRY OF BOREAL PEATLAND ECOSYSTEMS

**Wang, Meng and T. Moore**

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Boreal peatlands are considered to be important C sinks which are being impacted by increasing atmospheric N deposition due to anthropogenic activities and global climate change. C:N:P:K stoichiometry provides an integrative nutrient framework and allows an examination of the effect of changes, such as enhanced nutrient input and global change in peatland ecosystems. Preliminary work indicates that the plant growth in Mer Bleue, an ombrotrophic bog in Ontario, is probably co-limited by both N and P despite the high N deposition rate (ca. 0.8 g m<sup>-2</sup> yr<sup>-1</sup>), while there was no evidence of K-limitation. There was no significant difference in N:P ratio among four plant functional types (moss, shrub, forb and graminoid), with an average of 16.8. The dominant form of N in peat pore-water was organic (ca. 90%), the remainder being NO<sub>3</sub><sup>-</sup> and NH<sub>4</sub><sup>+</sup>. In contrast, over half of the P was in the inorganic form of PO<sub>4</sub><sup>3-</sup> (50-60%), which can be considered as an indication of fast turnover of P in the peat soil. Moreover, the peat stratigraphic profile data indicated that there was no strong increase of N concentration upwards in the profile, but both P and K showed higher concentrations in the surface layers, suggesting active biological uptake and faster turnover of P over N. Future work will focus on the effects of N, P and K fertilization on nutrient uptake, resorption and mineralization and hence the plant stoichiometry.

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\*Guest speaker and presenting autor

IMPACTS OF CONSTRUCTING A HYDRO-ELECTRIC RESERVOIR ON CO<sub>2</sub> CYCLING OF BOREAL ECOSYSTEMS IN NORTHERN QUEBEC WITH CHANGES IN CLIMATE

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Land use/cover changes, compounded with climate change, are considered as one of the key uncertainties in predicting global carbon cycling. Since 2005 construction of a hydro-electric reservoir in Northern Quebec (called EM-1 reservoir) has flooded a significant portion of Eastmain (EM) watershed, where land covers comprised boreal forest and peatlands. A big concern is how this changes carbon (C) cycling of EM watershed with climate change for the next 100 years. A well-evaluated ecosystem model, Forest-DNDC (Denitrification and Decomposition) which simulates carbon cycling of forest and peatland ecosystems, was applied to EM-1 for natural conditions but with changes in climate. The flooded version of Forest-DNDC was applied to the EM-1 reservoir for the flooded condition also with changes in climate. The CO<sub>2</sub> fluxes simulated from flooded condition were compared with those from natural condition based on two climate scenarios for the next 100 years (B1 and A2: Optimistic and pessimistic climate projection respectively). Our study shows that construction of a hydroelectric reservoir will release C to the atmosphere regardless of climate scenarios. The magnitude of C sources will reduce dramatically in the first 40-50 years after impoundments. After this, the net impact will gradually stabilize, but still contribute to a small C source (i.e. ~ 140 g C m<sup>-2</sup> yr<sup>-1</sup> and ~120 g C m<sup>-2</sup> yr<sup>-1</sup> by 2100 for A2 and B1 scenario respectively). This may indicate that impoundments in boreal ecosystems develop towards a similar ecological function to boreal lake ecosystems in the long run.

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**Session 9 – Future of Regulation and Certification of Growing Media Based on Peat and Other Materials**

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PEAT SWAMP FOREST MANAGEMENT MODEL BASED ON TOTAL ECONOMIC VALUE - (CASE STUDY IN LALAN PRODUCTION FOREST, SOUTH SUMATRA PROVINCE, INDONESIA)

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Peat swamp forest in its original form is a multi-functional resource at high level. In fact, the various economic potentials of the swamp forest were not considered in the change of forest to non-forest. This research aims to identify the total economic value (TEV) of the peat swamp forest in the *Lalan* Production Forest (LPF), South Sumatra Province, Indonesia and to examine the management scenarios based on the TEV concept.

The result indicates that TEV of peat swamp forest in the LFP is approximately US\$ 89.54 million per hectare per year. The largest component of the TEV is derived from the value of carbon (42%). Non-timber value (value of the fish, water for household, water for transportation, carbon, environmental protection, option and existence value) has the larger proportion (56%). Without calculating the forest TEV components as part of the concession cost, the financial analysis of the timber estate scenario or the oil palm plantation concession shows that the scenarios are feasible. When the financial analysis taking into account the lost value of forest TEV component (by taking into account environmental factors) as part of the cost, the scenarios are not feasible. For carbon pool scenarios, the financial analysis shows that the carbon pools are feasible either with or without taking into account the lost of forest TEV components as part of the cost.

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\*Guest speaker and presenting author

### Session 10 – Compost and Alternative Substrates

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STANDARD NURSERY GROWING MEDIA FROM A SIMPLE COMPOSTING PROCESS FOR LOCALLY-GROWN AND RENEWABLE TREE BIOMASS IN ARID REGIONS

**Bakry, Mustapha (1), M.S. Lamhamedi (2), J. Caron (3), H. Margolis (1), Z. El Abidine Abdenbi (4), M. Bellaka (5) and D.C. Stowe (1)**

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A major problem in modernizing forest nurseries in arid regions is the lack of locally available, low cost, standardized growing media for plant production. Our objective was to produce compost from shredded branches of the fast-growing leguminous tree species, *Acacia cyanophylla*, *A. cyclops* and *Eucalyptus gomphocephala*, which are widely used in reforestation programs in arid regions. The composting process covered three different periods of approximately 4 months each over the course of a year. Pile temperatures were monitored daily and the composts were routinely sampled and analyzed for 19 chemical variables. Our results showed that composting is feasible year-round in an arid climate such as Morocco. However, compost produced in the humid cool season reached the maturation phase more quickly than compost produced under hot, dry summer conditions. It also required less turning and less water, the latter being a scarce resource in arid environments. We found that compost dynamics and quality can be monitored using three easily measured variables (C/N, pH and electrical conductivity), which is very important in countries with limited resources. Seed germination rates in three types of compost were similar to that in a peat: vermiculate substrate. Although the two acacia composts allowed the production of high quality forest tree seedlings, their shoots and roots were significantly smaller than those produced in the standard peat substrate. Principal components analyses showed that the quality of compost was reproducible over time and that its final chemical composition could be predicted from the characteristics of the initial organic material. The results of this project are promising but should be tested in other countries with similar situations.

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SAWDUST/SPHAGNUM PEAT AS GROWING MEDIA FOR GREENHOUSE TOMATO

**Boily, Carole (1), J. Caron (1), G. Létourneau (1), S. Pépin (1), R. Naasz (3) and M. Dorais (2)**

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Canada is a leader in production of greenhouse tomatoes. However, it faces increasing competition, especially from Mexico and Southwest United States. The quest for low cost sustainable growing media, has pushed research towards the use of forest by-products and intermediate quality peat as growing medium. Low-cost organic growing media were used in greenhouse tomato experiments, investigating plant productivity and aeration in these different substrates. Two substrates made of spruce-fir sawdust and sphagnum peat with air-filled porosities of 25 and 40%  $\text{cm}^3 \text{cm}^{-3}$  were compared to production on rockwool and coir. Measurements of photosynthesis at different substrate water potential were performed to identify the range of ideal substrate soil water potential achieving the highest rate of photosynthesis and fruit yield. These measurements showed that it was possible to achieve yields with sawdust-peat substrates equivalent or better than those obtained with rockwool and coir, especially with a substrate having 0.25  $\text{cm}^3 \text{cm}^{-3}$  air-filled porosity. A sawdust-peat substrate with increased photosynthetic activity has been developed through several greenhouse experiments. However, the study also showed that the appropriate ideal substrate water potential varied with substrates and should be controlled adequately to achieve these top yields.

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**Session 11 – Properties of Organic Soils and Growing Media**

AMINOPOLYCARBOXYLIC ACID (APCA) CHELATE EXTRACTION OF MICRO- AND MACRO-NUTRIENTS IN SOILLESS PEAT-BASED HORTICULTURAL SUBSTRATES

**Albano, Joseph (1), J. Altland (2) and J. Owen (3)**

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Aminopolycarboxylic acid (APCA) chelates like ethylenediaminetetraacetic acid (EDTA), diethylenetriaminepentaacetic acid (DTPA), and ethylenediaminedisuccinic acid (EDDS) are commonly used in horticultural soluble fertilizers to supply micronutrient metals. Additionally, standard soil testing protocols utilize chelating agents, particularly DTPA, to estimate extractable metals from peats and mineral soils. Of lesser extent is the use of chelating agents in protocols for estimating non-transitional metal macronutrients. The objective of the study, therefore, was to assess EDDS and DTPA extraction of both micro- and macro-nutrients (could be an indirect affect for the later) from a commercial soilless peat-based medium commonly used in the production of floricultural crops. Treatments consisted of EDDS or DTPA at 2, 4, or 6 mM incubated for 15, 30, 45, or 60 minutes utilizing one-part soilless peat-based medium and two-parts unbuffered chelate solution. As a mean of all chelate concentrations and incubation times, EDDS extracted significantly less micronutrients: Cu (43%), Fe (77%), Mn (53%), and Zn (38%); and significantly less macronutrients: Ca (75%), K (26%), Mg (12%), and P (43%); than DTPA from the peat-based medium. As a mean of all DTPA concentrations and incubation times, DTPA extracted micronutrients: Cu (0.11  $\text{mg}\cdot\text{L}^{-1}$ ), Fe (8.39  $\text{mg}\cdot\text{L}^{-1}$ ), Mn (4.75  $\text{mg}\cdot\text{L}^{-1}$ ), and Zn (0.17  $\text{mg}\cdot\text{L}^{-1}$ ); and macronutrients: Ca (154.27  $\text{mg}\cdot\text{L}^{-1}$ ), K (32.03  $\text{mg}\cdot\text{L}^{-1}$ ), Mg (52.17  $\text{mg}\cdot\text{L}^{-1}$ ), and P (3.12  $\text{mg}\cdot\text{L}^{-1}$ ) from the peat-based medium. These data indicate that APAC chelating agents may affect macronutrient extraction in soilless peat-based substrates and as such, should be considered when developing a nutrient management plan for crop production.

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\*Guest speaker and presenting autor

CHARACTERIZATION OF NUTRIENT DISORDERS OF *GOMPHRENA GLOBOSA* 'LAS VEGAS PURPLE'

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*Gomphrena globosa* 'Las Vegas Purple' plants were grown in silica sand culture to induce and photograph symptoms of nutritional disorders. Plants were grown with a complete modified Hoagland's all nitrate solution: (macronutrients in mM) 15 NO<sub>3</sub>-N, 1.0 PO<sub>4</sub>-P, 6.0 K, 5.0 Ca, 2.0 Mg, and 2.0 SO<sub>4</sub>-S, plus mM concentrations of micronutrients, 72 Fe, 18 Mn, 3 Cu, 3 Zn, 45 B, and 0.1 Mo. The nutrient deficiency treatments were induced with a complete nutrient formula minus one of the nutrients. Reagent grade chemicals and deionized water of 18-mega ohms purity were used to formulate treatment solutions. Boron toxicity was also induced by increasing the element 10× higher than the complete nutrient formula. The plants were automatically irrigated. The solution drained from the bottom of the pot and was captured for reuse. A complete replacement of nutrient solutions was done weekly. Plants were monitored daily to document and photograph sequential series of symptoms as they developed. Typical symptomology of nutrient disorders and critical tissue concentrations are presented. Based on this research, growers will be able to recognize and avoid nutritional disorders of gomphrena plants grown in peat based substrates.

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PHOSPHOROUS IN WATER ON OIL PALM PLANTATION ON TROPICAL PEAT SOIL

**Kho, Bessy (1), S.D. Kimura (1) and L. Melling (2)**

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For sustainable use of tropical peatland, improvement of the land for optimum crop yield without risking irreversible damage to the surrounding environment is required. The understanding of macronutrients' movement in peatland will provide insight on the significant causes of the nutrients' loss into water, and thereby more efficient use can be achieved. The aim of this study was to determine the major influence factors on the fluctuation of total phosphate in both surface water and groundwater within an oil palm plantation. The study site was a 10 000 hectare wide oil palm plantation on peatland soil, in Sibul, Sarawak, Malaysia. Monthly rainfall recording and monitoring of total phosphate concentrations in surface water and groundwater started in October 2008. Field studies on peat soil and pinnae decomposition rates started in March 2010. Information on agro-management practices was provided by the plantation manager. The results showed that rainfall of more than 300 mm per month is strongly correlated with the total phosphate concentration in surface water. On the other hand, the annual rate of rock phosphate application affects the nutrients' concentration in groundwater, instead of rainfall. This finding points out that phosphate compounds are easily subjected to surface runoff but not leaching into the groundwater during heavy rain events. The conclusion is that heavy rain and fertilizer application are affecting the total phosphate loss into the water. Other influence factors are still being investigated.

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\*Guest speaker and presenting autor



EFFECTS OF PEAT-BASED SUBSTRATE PHYSICAL PROPERTIES ON GROWTH AND MINERAL NUTRITION OF CONTAINERIZED WHITE SPRUCE SEEDLINGS

**Pépin, Steeve (1), S. Boudreault (1), I. Paiement (1), J. Caron (1) and M.S. Lamhamedi (2)**

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About 30 million white spruce (*Picea glauca* (Moench) Voss) seedlings are produced in Quebec annually, in containers with large (310 cm<sup>3</sup>) cavities. Yet, millions of seedlings (~14%) are rejected each year because of deficient root growth and root plug cohesion. Adequate substrate bulk density and aeration properties are known to be of critical importance for root growth and nutrient and water uptake. Hence, experiments were conducted in 2008–2009 and 2009–2010 under nursery conditions to determine the effects of substrate physico-chemical properties on seedling growth and mineral nutrition over two growing seasons (2+0). Seedlings were grown in 12 different substrates composed of coarse and fine (<0.5 mm) peat moss particles, perlite and vermiculite, covering a broad range of physical properties. Substrate properties had a significant effect on growth parameters (shoot and root dry masses, diameter, height) and nutrient uptake, but these effects differed between the first and second year of growth in both experiments. Seedling growth after one growing season was affected by water restriction in 2008 and by a reduction in pore effectiveness in 2009. These results were related to lower substrate bulk density and matric potential in 2008 than in 2009. Seedling growth at the end of the second growing season increased with bulk density in 2009 and with relative gas diffusivity ( $D_s/D_0$ ) and pore effectiveness in 2010. Minimal values of  $D_s/D_0$  were in the range of 0.005, in agreement with modeled anaerobic oxygen profile in the root plug. Our results suggest that substrate initial bulk density should be maintained between 0.10 and 0.11 g cm<sup>-3</sup> for best root growth.

BENEFICIAL EFFECT OF COCONUT FIBER AND PEAT ON PHYSICAL QUALITY OF NURSERY SUBSTRATE

**Sangaré, Mahamadou, M.R. Nemati and J.P. Fortin**

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During the production of nursery plants in summer, when the plants are well developed, the water requirements can be very high. This can result in high frequency of watering. The principal challenge for development of the high quality substrates is usually the establishment of an optimal rate of air and water in the substrate. The purpose of this study was to evaluate the impact of the coconut fiber and peat on physical quality of nursery substrates. The performance of several organic substrates under *Rudbeckia goldsturm* production was evaluated by adding different rates of coconut fiber and peat. The substrate composed from bark and peat moss resulted in a 15% increase in easily available water (EAW) compared to other substrates. The EAW's improvement did not affect the number of watering; however, it had a beneficial impact on the growth and development of rudbeckies. The affected parameters were growth index (10%), the shoot dry weight (14%) and the root dry weight (11%). Inversely, the increasing rate of coconut fibre application up to 30% improved by 33% the relative gas diffusivity compared to control with no important impact on EAW.

**Session 12 – Technology and Innovation**

NO POSTER

# SCIENTIFIC AND TECHNICAL EXCURSIONS OF THE INTERNATIONAL SYMPOSIUM

## 1 – PEATLAND RESTORATION

(organizers: Line Rochefort and Marie-Claire LeBlanc, Peatland Ecology Research Group, Université Laval)

**Schedule:** 2-day tour: departure at 8:00 on Friday, June 17, 2011, arrival at 22:00 on Saturday, June 18.

**Description:** Restoration of different types of peatlands in Canada will be visited and know-how explained. First, the group will visit the restoration site of a *Sphagnum* dominated peatland. The **Bois-des-Bel whole-ecosystem restoration project** is located nearby Cacouna, along the south shore of the St. Lawrence River. The 11.5 ha site was restored 11 years ago and shows an impressive recovery of bog vegetation. An assessment on the return of several key functions post 10-years restoration was done last years and recent analyses will be presented. Some key features of the site is the direct comparison of natural, restored and non-restored areas as well as a series of created pools enriching fauna and flora diversity. Second, a temporal series of bog restored sites as scaled up by the industry will be visited. Thirdly, vegetation changes of two former block-cut sites restored by a rewetting approach will be presented. On day 2, participants will visit an approach to **fen restoration in Eastern Canada** with dominant rewetting actions adjacent to the Bic beautiful rocky National Park. A 6 ha section of this peatland has been restored with the moss layer transfer method adapted for fen ecosystem. Other types of interventions including plant community reintroduction, fen species trials, and hydrological work still ongoing will be discussed along the tour. The visit will continue in the natural section of the peatland considered as an exceptional moderate rich fen ecosystem. A look at the donor site and a natural fen nearby will also be part of the day. Emissions of greenhouse gases of this field trip will be partially offset by planting shrubs in peatlands restored by the Peatland Ecology Research Group.

## 2 – SUBSTRATE PRODUCTION AND USES IN HORTICULTURE

(organizers: Andréanne Lafonds-Despins, Fafard et Frères Itée, and Jean Caron, Université Laval)

**Schedule:** One-day tour: Friday, June 17, 2011: departure at 8:00, arrival at 23:00.

**Description:** The main objective of this tour is to demonstrate the importance of close collaboration between growing media manufacturers and plant producers. Such collaboration ensures the success of both parties in implementing their respective projects. By visiting Fafard et Frères facilities, you will discover the processing of growing media from the harvest stage to after-sale techniques, through laboratory research and compost production. Finally, two producers will share their experience in their quest for the perfect growing media and a culture management optimizing irrigation, fertilization and energy consumption.

## 3 – DISCOVER THE PRODUCTION CYCLES OF GROWING MEDIA, FROM HARVESTING TO BAGGING, INCLUDING BOG RESTORATION AND MANAGEMENT

(organizer: Chantale Duchesneau, Premier Tech Horticulture)

**Schedule:** One-day tour: Friday, June 17, 2011: departure at 7:30, arrival at 23:00.

**Description:** Premier Tech Horticulture has been a strong player in the peat industry for more than 85 years now. Premier Tech Horticulture is constantly seeking innovative ways to be more responsible and efficient when harvesting and utilising the resource, and restoring the ecosystem afterwards. Come and discover why Premier Tech Horticulture is a North American leader of the industry in sustainable development and a class one manufacturer. Participants will see: 1) the **Chemin du Lac restoration site**: Premier Tech Horticulture was the first Canadian company to use the rehabilitation techniques on large peat bog surfaces; 2) the **St-Laurent plant**, a compressed substrate production plant and a state-of-the-art facility which offers a view on tomorrow's bagging equipment; 3) the **PRO-MIX® plant**: a mix production plant which offers rapidity and precision under a necessary rigorous production; 4) the **Président Ouest peat bog harvesting site**, in its natural state or at the beginning of its exploitation, and where harvesting operations have been practiced for fifteen years; 5) the **Sphagnum garden regeneration site**, where at the beginning of the last century, a traditional block-cutting approach was used. The dried peat blocks were then used as fuel for the steel industry. Discover one of the birthplaces of today's peat industry, as well as the stages that have led to the rehabilitation of this site.

## WORKSHOP ON SPHAGNUM FARMING

**Organizers:** Line Rochefort and Josée Landry, Peatland Ecology Research Group, Université Laval

**Description:** On **June 20 and June 21, 2011**, after the symposium held in Québec City, the Peatland Ecology Research Group organises a workshop on *Sphagnum* farming in New Brunswick province. It will be an interactive workshop, allowing the participants to exchange information and ideas on each aspect of *Sphagnum* farming. Participants would prepare two or three slides of results for a list of themes described below; each participant would have the possibility to present one or many short presentations generating group discussions. The first day of the workshop will be dedicated to general sessions. The morning will start with the evaluation of economical feasibility of *Sphagnum* farming and its potential to rapidly produce *Sphagnum* biomass. It will be followed by the different uses of *Sphagnum* fibre and living *Sphagnum*. In the afternoon, the presentations will focus on ways to optimize *Sphagnum* farming cycles either by choosing the right target species, adding growing structures, substrate conditioning or by a better control of the hydrology. In the morning of June 21<sup>st</sup>, another general session will take place, this time focusing on the challenges of *Sphagnum* farming, such as algae, fungi and control of invasive species. To close the workshop, a field trip will be organized at the Experimental *Sphagnum* Farming Station in Shippagan (New Brunswick) where the participants will be able to see production cycles initiated in 2004, 2006, 2008, 2009, 2010 and 2011.

Emissions of greenhouse gases of this workshop will be partially offset by planting shrubs in peatlands restored by the Peatland Ecology Research Group.

**Schedule:** 2 possibilities:

- 4-day tour (from Québec City to New Brunswick: 1400 km round trip): departure at 7:30 on Sunday, June 19, 2011, arrival at 20:00 on Wednesday, June 22. It is possible to combine Excursion 1 and Sphagnum Farming Workshop back to back.
- 2-day workshop (without transportation from and to Québec city): Beginning at 8:30 on Monday, June 20, ending at 17:30 on Tuesday, June 21.

## COMMERCIAL AND SCIENTIFIC EXHIBITIONS

Commercial and scientific exhibitions will be held in conjunction with the *IPS-ISHS International Symposium on Responsible Peatland Management and Growing Media Production*. This will take place primarily within the premises of the Loews Le Concorde hotel from June 14 to 16, 2011, with another static exhibition at the Van den Hende Gardens of Université Laval on June 15, 2011. This will be a key opportunity for interaction with the industry and scientific societies.

# PRACTICAL INFORMATION

## SERVICES

### Need help or information:

For any questions or concerns throughout the Canadian Workshop and the International Symposium, please ask to the registration desk for assistance.

### Internet:

Wireless Internet network is accessible in every room of delegates. Elsewhere in the hotel, you have to pay additional charges for the Internet access.

### Simultaneous interpretation:

The simultaneous interpretation service (English/French) is offered for the plenary sessions that will be held in the Suzor-Côté room. An identity card is necessary for the rental of headphones.

### Parking lot:

Parking lot is available to the hotel. The cost with "valet" is 23 \$CAD/day and without "valet" is 28 \$CAD/day. There is also an outdoor parking on the avenue Laurier.

## CULTURAL EVENTS

### Canadian Workshop Ice Breaker – Sunday, June 12, 18:30

All participants of the Canadian workshop are cordially invited to the Ice Breaker in the Galerie du Parc (Loews le Concorde Hotel)

### International Symposium Welcome Cocktail – Tuesday, June 14, 18:30

All participants of the International Symposium are cordially invited to the Welcome Cocktail in the Foyer (Loews le Concorde Hotel)

### Banquet – Wednesday June 15, 18:30

A banquet will offer participants from around the world the unique opportunity to network in a friendly atmosphere. The banquet will be held in the gorgeous desecrated Chapelle du musée de l'Amérique française (2, côte de la Fabrique, Québec City).

You must have reserved your place (95 \$CAD) to join us to the banquet.

By bus: Shuttle will run between the hotel and the chapel. Meet in the Lobby by 18:15 on Wednesday, June 15.

By walk: It is a 15 minute walk (1,4 km) from the Loews le Concorde Hotel. Walk on the Grande Allée and rue St-Louis.

### BBQ – Thursday June 16, 17:15

An outside BBQ will be hold at the Van den Hende botanical garden on the campus of Université Laval. This botanical garden hosts native species and is among the rare one to group plant according to their botanical families.

At the BBQ people will be given opportunity to visit the Botanical Garden, the greenhouses and Laboratory Research Facilities of the University used for research on substrates and on peat restoration.

Tickets are needed to attend the event (30 \$CAD). Food and beverages will be served. One free drink is included with your meal. Beers and pops will be sold on site. In case of rain, you will be invited to eat inside the Envirotron pavilion.

Shuttle will run between the hotel and the Garden. Departure time from the Concorde: 17:30.

# DISCOVER QUEBEC CITY

## QUÉBEC CITY

Québec City, the capital of the Province of Québec, is located on the shores of one of the largest rivers in North America, the St. Lawrence River. The city is at the heart of French culture in Canada and is recognized as a UNESCO world heritage treasure on account of its historic district since 1985. First settled in 1608, this walled city is one of the oldest and most scenic places in North America. Québec's historic walled section of town is full of Old World charm with its narrow, winding streets and profusion of boutiques, restaurants, museums, and special attractions that are complemented by a vibrant world port and business facilities.



*Place Royale | Quartier Petit Champlain*

For a whole host of information on the many attractions of the city of Quebec and the province, we invite you to visit the websites:

- [www.quebecregion.com/en](http://www.quebecregion.com/en)
- <http://www.bonjourquebec.com/>
- <http://www.quebecweb.com/tourisme/>

## LANGUAGES

Home to a population of 638,000 (Québec City area), 95% of them are French-speaking. However, many people, including the vast majority of hospitality industry workers, also speak English.

## WEATHER

Québec has a humid continental climate type. June is a beautiful month in Québec City; average daytime temperatures range from 10° to 27° Celsius during the day. As the temperature this time of year is changing, we suggest you bring a light sweater, a raincoat or an umbrella.

## TRANSPORTATION

We aim to make this symposium a green event. We encourage participants to use public transport (2,75 \$CAD)

## SOME ESSENTIAL PLACES TO VISIT

### **Aquarium du Québec**

Dive into the sea, in Québec City. Come and meet the 10,000 marine animals that inhabit the Aquarium: fish, reptiles, amphibians, invertebrates, and sea mammals. Among them, the famous polar bear, walruses, and seals will provide you with unique moments. Watch them when they're feeding or being trained. A fascinating experience for young and old alike! This huge site (16 hectares) has superbly laid out areas indoors and outdoors. Come for a picnic, cool off with the water games, and navigate the Tree-to-Tree pathway-safe and designed for kids. A great way to spend an exceptional day!

**Free shuttle from the Concorde: 2 departures time / day – 10:05 / 13:35    Arrival time to the Aquarium – 10:35 / 14:05**

### **Old City/Dufferin Promenade**

Since 1985, the Historic District of Old Quebec has been on the UNESCO World Heritage List. It includes the Chateau Frontenac and an architecture dating back several centuries. From the top of Cape Diamond, Dufferin Promenade offers a breathtaking view over the St. Lawrence and the surrounding area.

### **Parc de la Chute-Montmorency**

Montmorency Falls, at 83 meters high, is 30 meters higher than Niagara Falls. The ascent by cable car and walk on the paths that crisscross the park are ideal for taking in the magnificent panorama.



*Parc de la chute Montmorency, ja-dy.com*

### **Place Royale / Quartier Petit Champlain / Vieux-Port**

This district is the oldest in North America. Throughout its historical buildings and its streets paved with stone, one can find dazzling boutiques, art galleries and restaurants. It is also possible to visit the Museum of Civilization. To breathe the air of the River, nothing beats a visit to the Old Port of Quebec and its public market.

### **Plains of Abraham**

It was here in 1759 that the famous battle between the British and French armies took place. It is one of the largest and most prestigious urban parks in the world, which also hosted the performances by Celine Dion and Paul McCartney as part of the 400<sup>th</sup> anniversary celebrations in Quebec City.

### **Quebec Fortifications**

Quebec is the only walled city in North America. It is possible to walk on its walls and towering gates which cover a distance of roughly 4.6 km.

### **Shopping center – Laurier Québec**

Laurier Québec is the largest mall in eastern Canada, with its three floor of 350 shops and 40 restaurants.

**Free shuttle from the Concorde: 2 departures time / day – 10:05 / 13:35    Arrival time to the Laurier Québec – 10:25 / 13:55**

### **Shrine of Sainte-Anne-de-Beaupré**

This is the foremost place of pilgrimage for Catholics in North America. This place of worship attracts one million visitors each year, who come both for its fabulous basilica with its Romanesque Revival style and for its majestic scenery.

### **Wendake**

This ancestral site of the Huron-Wendat First Nation brings transports us back to the 17<sup>th</sup> century. A visit to the Wendat Museum will allow one to discover the fascinating skills and rich culture of these indigenous people. Website: <http://www.huron-wendat.qc.ca/>

## NOTES



## NOTES





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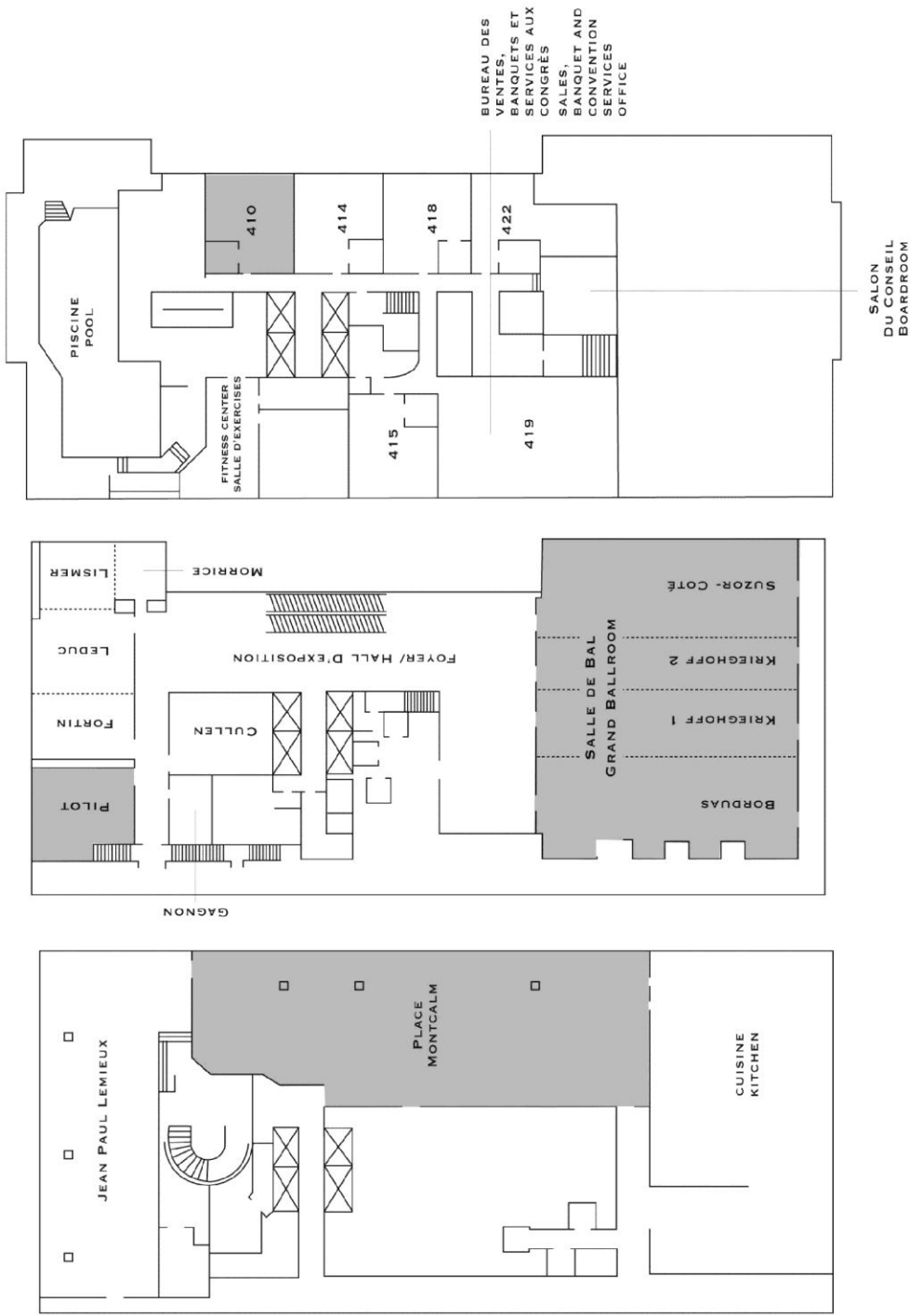
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ÉTAGE INFÉRIEUR  
LOWER LEVEL

TROISIÈME ÉTAGE  
THIRD FLOOR

QUATRIÈME ÉTAGE  
FOURTH FLOOR