

Research in peatland restoration has been developed in close partnership between the Canadian Peat Industry and the Peatland Ecology Research Group (PERG). Researchers from many universities forming this group have diverse and complementary backgrounds.

Content of the presentation:

- Short history of research on peatland restoration
- Overview of the Canadian restoration techniques
- Some measures to evaluate restoration success
- How peatland restoration has influenced the way Canadian Peat industry manages the resource



First important point is to define the goal of restoration.

In Canada, the goal that we defined is to bring back a **peat accumulating peatland** and a functional ecosystem.

By functional, we mean an ecosystem that has the same functions as a natural peatlands (stores and filters water, wildlife habitat, carbon sink, ...).

However, this goal is a long-term goal as these functions can't be recovered and measured over a short period of time. Short term objectives have also been defined, which are:

- To help re-establishment of typical peatland plants, with an emphasis on Sphagnum mosses
- To restore hydrology (rewetting)



The challenge that we face after peat harvesting: to bring back huge dry lands to wet lands.

- Many studies have shown that natural revegetation of harvested peatlands is very slow, and some species like *Sphagnum* mosses are not able to establish and grow back again without active restoration measures. (at least in the short term of 50 years).

Restoration of a moss layer

- Research focused at first on the biology of *Sphagnum* mosses
 - Key plants for the ecosystem
 - High regeneration capacity

History of research:

Research in peatland restoration began in 1992 through a partnership of scientific researchers from different universities (Peatland Ecology Research Group), the Canadian peat moss industry and diverse governmental agencies. At that time, the common objective was the integrated sustainable management of Canadian peatlands.

- Everything began with a restoration workshop held in 1992, in Fredericton, NB.
- Research first started with small scale experiments (growth chamber and greenhouse trials) with the emphasis on *Sphagnum* regeneration.
- The experiments progressed from small to large-scale restoration with the first site of 8 ha restored mechanically in 1997 (Inkerman-Ferry, NB).
- Restoration at the ecosystem level in 1999 (Bois-des-Bel - will be presented later in this presentation).
- In 2000, it was estimated that 350 hectares were under "industrial" restoration.
- In 2008, approx. 1000 ha were under restoration.

Since then, industry and government have spent nearly \$4 millions through different fundings (NSERC Cooperative Research and Development grants)

Industrial Research Chair in Peatland Management



- Ecological restoration of peatlands
- Other reclamation options
- *Sphagnum* farming



<http://www.gret-perg.ulaval.ca/>

In 2003, the Industrial Research Chair in Peatland Management was established and was renewed in 2008 for another 5 years of funding.

It brings together many industrial and scientific collaborators. This chair represents a total investment from the government and the industry of over \$3 millions over 5 years.

3 research avenues are explored within the industrial Chair:

- Ecological restoration: which includes, for example, restoration of different types of peatland (bogs, fens, pools, wet meadow), long-term monitoring of ecosystem functions (Carbon capture and storage, biodiversity, ...), fine tuning of restoration techniques, ...
- Exploring other after-use or reclamation options when ecological restoration is not possible, for example Cloudberry production, afforestation, ...
- Developing sphagnum farming techniques: this option could bring the industry to produce sphagnum fibers in a renewable and sustainable way

This talk will focus on **ecological restoration** but for those who are interested to learn more about other research programs, you can find more information on the PERG web site.

Canadian Restoration Techniques



1- Preparing the field

2- Collecting *Sphagnum* mosses from natural peatlands



→ **Peatland Restoration Guide**

<http://www.peatmoss.com/pm-restguide.php>

Now, I will present the restoration technique developed by our research, which includes in 6 steps. A complete description of these 6 steps can be found in the Peatland restoration guide.

Canadian Restoration Techniques



GRET 1997

3- Spreading *Sphagnum* fragments



Peatland 2006

4- Protecting with straw mulch

→ **Peatland Restoration Guide**

<http://www.peatmoss.com/pm-restguide.php>

Canadian Restoration Techniques



GRET 2000

5- Fertilizing



GRET 2001

6- Blocking ditches to raise water table

→ **Peatland Restoration Guide**

<http://www.peatmoss.com/pm-restguide.php>



Here is the case of Bois-des-Bel (in the Rivière-du-Loup region, QC) where restoration has been done on 8,4 ha.

- 1999- here is what it looked like before. In fact, this site has been abandoned for 25 years, and it was still almost completely devoided of vegetation.
- 2000 - Restoration has been done in fall 1999 and 2000. In addition to usual steps, 6 pools were also constructed to improve habitat diversity and therefore flora and fauna diversity. It can be noted from that picture taken in spring 2000 that the site was already well rewetted.
- 2002- most of the area was already covered by plants, with mosses being dominant.

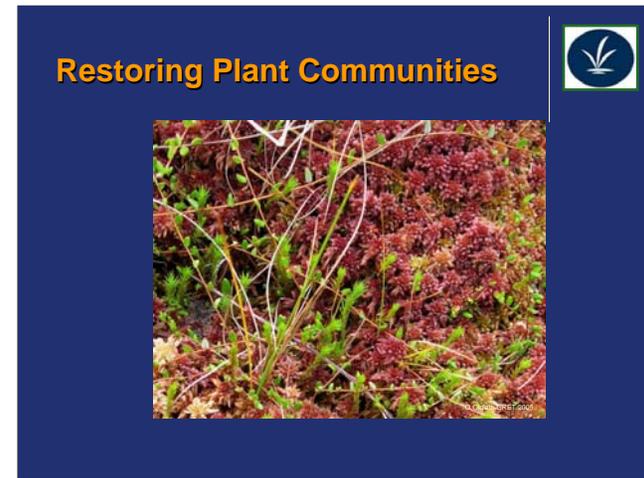


Here is what it looked like after 5 years.

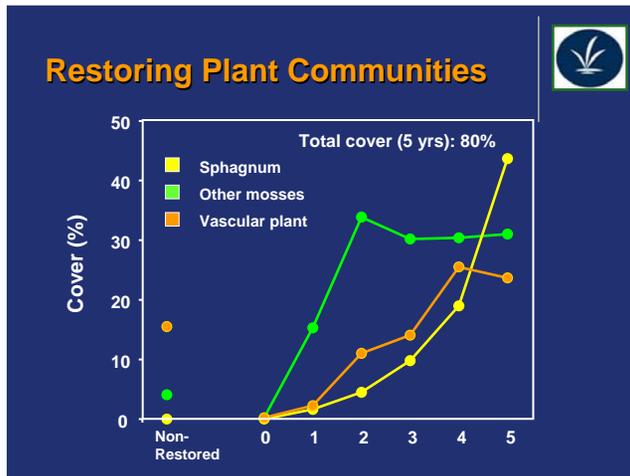
- Great diversity, both for flora and fauna
- Productivity... The Sphagnum carpet had a mean thickness of 25 cm



2006: non-restored site to the left and restored site to the right. You can see Dr. Rochefort holding a dense moss cushion.



Here are some results of the restoration success at Bois-des-Bel:



In this graph, you have the cover in percentage of Sphagnum, other mosses like *Polytrichum strictum* and vascular plants, over a 5 years period.

- *Sphagnum* mosses (yellow) are more and more abundant. Cover doubled from year 4 to year 5.
- Other mosses (green) established quickly and reached a stable cover after 2 to 3 years following restoration. It can be seen from other measurements (biomass accumulation – data not shown) that these mosses are not covering more space but are constantly accumulating vertically.
- The cover in vascular (orange) increased until year 4. It seems from these results that a stable cover of vascular plants has also been reached, but more time is needed to confirm this observation.
- Compared to this, the plant cover in the non-restored site (where no restoration has been done) was very low and did not increase over the study period.

From this, it is clear that short term objectives were met because the site is well rewetted and typical peatland plants are well established on the site.



Now, we are still monitoring other functions of the ecosystems

- Plant and wildlife biodiversity (for example, we are looking at the importance of pools for the biodiversity of peatland, resilience to invasion, ...)
- Hydrology is studied over the entire site and within the new moss layer
- *Sphagnum* productivity and decomposition are measured in order to look at peat accumulation
- Carbon fluxes are measured to see if the peatland can become a carbon sink again
- Microbiology, nutrient cycling, ...

Impact on Peat Industry Reclamation Policy

- Before harvesting



- During Harvesting



- After harvesting

➤ The policy promotes restoration as a primary goal, when possible



Peatland restoration research has influenced the Canadian Peat industry in its way to manage the resource:

All Canadian peat producers abide by the reclamation policy adopted in 1999.

- The policy emphasizes on the importance of planning for restoration, even **before** harvesting begins. For example, they welcome input from environmental groups when choosing bogs to set aside as reserves.

- **During** harvesting, the policy addresses some points like: Minimizing acreage, leaving buffer zone, leaving layer of peat and designing drainage so hydrology can be restored more easily afterwards

- **After**, the policy promotes restoration as a primary goal and when unpossible other options of reclamation (wildlife habitat, forestry, agriculture, ..)

Impact on Peat Industry – Provincial Peat Mining Policy



- The New Brunswick example
Provincial Peat Mining Policy

“To ensure that peatlands used for peat extraction are, after cessation of activities, restored to natural wetland habitats.”



http://www.gnb.ca/0078/minerals/PDF/Peat_Mining_Policy-e.pdf

Application of Wise Use Principles



- Wise use of peatlands adopted by:
 - International Peat Society (IPS)
 - International Mire Conservation Group (IMCG)
- Promoted by the Ramsar Convention on Wetlands
- Important element of wise use is wise after-use
- Online DVD at www.peatsociety.org



"The use of peatlands for which reasonable people either now or in the future will not attribute blame."



Success of restoration has arisen from excellent cooperation between scientists, industry and government. Moreover and more importantly, it also raise the awareness about the importance of peatlands, their values and functions especially as carbon sink, and the importance of wise-use of peatlands. Thank you very much for your attention.