Ecological restoration of shrubby-forested margins on cutover peatlands

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Peat extraction is an important economical activity in many rural regions in Canada and the northern United States, but, as often with natural resources extraction, is having its drawback on environmental impact.

The current mechanical peat extraction techniques, which require extensive peatland drainage and the complete removal of the superficial plant layer, considerably slow-down natural succession on the dry, decomposed and compacted peat remaining after extracting activities have ceased (Schlotzhauer and Price 1999, Rochefort et al. 2003). As a result, an ecological restoration technique has been developed, in partnership with peat-harvesting industries, to restore the cut-over areas into functional Sphagnum-dominated peatlands (Rochefort et al. 2003).

Yet, the margins of sites, with a thinner and nutrient-richer peat layer, have never been successfully restored because the residual peat of these sites is not appropriate for typical bog restoration using the Sphagnum moss layer transfer technique (Rochefort et al. 2003). From a review of the literature on the vegetation of natural peatlands in north-eastern United States, the swampy forested mire margins (also known as lagg zones) form a habitat that is totally different from the central rain-fed bog dome or the adjacent forests growing on mineral soils.

Figure 1: A typical mire margin of a raised bog dominated by Rhododendron canadense in New-Brunswick. Photo: Étienne Paradis

As seen in figure 1, these margins are often dominated by the tall-shrub layer (*Aronia melanocarpa, Ilex (Nemopanthus) mucronata, Ilex verticillata, Myrica gale, Rhododendron canadense, Vaccinium corymbosum,* and *Viburnum nudum* var. *cassinoides*), while the understory layer is habitually characterized by an abundance of ferns (*Osmunda cinnamomea, O. regalis* and *Woodwardia virginica*). Some of those "ecotonal species" are relatively uncommon in other habitats and are classified as threatened species or species of special concern in many states. As a result, these ecotones play a crucial role in maintaining a higher biodiversity across the landscape. Ecotones are also known to play a major role in regulating fluxes of energy, material and organisms between different ecosystems (Risser 1995). The goal of our project is to develop a method for the restoration of these shrubby ecotones on cut-over peatlands of eastern Canada to maximize the diversity of habitats in restored peatlands.

Our hypothesis is that abandoned peatlands are principally limited by seed dispersal and seedling recruitment. As a consequence, it should be possible to restore an "ecotonal community" by using seed addition and biological facilitation, i.e. using forest or bog

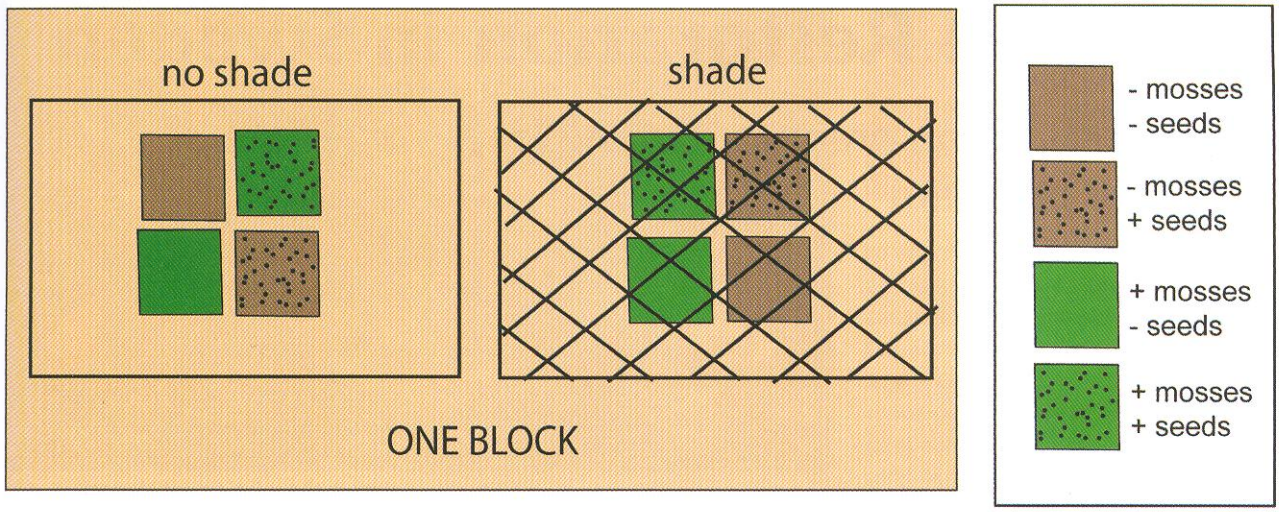

Figure 2: One block from a full-factorial experiment testing the effect of seed addition, artificial shade and mosses cover on seedling recruitment in a cutover peatland.

species as nurse-plants, to modify the environmental conditions that prevented the natural regeneration until now. For example, in the bog restoration method developed by Rochefort et al. (2003), biological facilitation by Polytrichum strictum, a pioneer moss, is used to enhance the establishment of Sphagnum mosses on abandoned peatlands by reducing frost-heaving and increasing substrate humidity (Groeneveld et al. 2007).

In 2009, a full-factorial experiment, located in north-eastern New Brunswick will be used to test different strategies to improve the microenvironment required for seed germination and seedling growth of the ecotonal species to be restored (see figure 2). One of the strategies will be to study the effect of artificial shade on the establishment of the sub-canopy species to determine if trees could be used as nurse-plants in large-scale restoration. A second strategy will be to study the importance of a bryophyte layer (*Polytrichum strictum, Dicranum* spp., *Pleurozium schreberi, Ptilidium ciliare, Sphagnum* spp.) to provide the micro environment needed for the germination and the growth of the seedlings of the targeted shrub species. Different bryophyte species will be used because they can create different microclimates required for different regeneration niches (Hörnberg et al. 1997).

In conclusion, the biological facilitation experiment will provide information on the regeneration niche of the ecotonal species and will uncover the main environmental constraints to natural lagg regeneration. Since the raised bogs of North America are relatively homogenous in their species composition across the continent (NWWG 1988), the knowledge gained from our study carried out in the province of New Brunswick should be useful for the management of abandoned cut-over sites across the continent.

The understanding of the different abiotic and biotic filters impeding the natural recovery of lagg zones (ecotone) in peatlands should greatly help managers to devise means to restore the biodiversity of peatland margins. The idea to restore ecotonal communities should be used in conjunction with the "Sphagnum moss layer transfer technique that restores Sphagnum-dominated peatlands" to diversify the peatland landscape and to improve the biodiversity not only in new restoration projects, but also in peatlands already restored.

Literature

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