Peat Inversion & Site Revegetation

A Peatland Restoration Method

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Outline

• Background
• Site Adjustment
• Vegetation Treatments
• Plants and System Response
Background

- Start in 2011
- Collaborators: Laval University, Shell Canada
- Site is located within a poor fen in the Peace River Region
- The site is 1.4 hectares
- Clay cap was 1.5m high
- The site was drilled but not operated
Study Objectives

Assist natural recovery of the site:
• Address the hydrology
• Initiate vegetation succession on the site

Test the transferability of the Moss Transfer approach to In situ wellpad
Site Adjustment - Hydrology

Pad Removal and Peat Inversion

- Complete pad removal
- Peat removed and piled along the strip

Half-fill the bottom with clay

Replace the peat on top of the clay
Pad Removal and Peat Fluffing

“Fluffing”: Use an excavator to ‘work-up’ or decompact the surface of peat.
Site Adjustment - Hydrology

- Restore surface hydrologic connectivity with the surrounding peatland
- Create a stable saturated - but not inundated – peat surface
Site Adjustment - Hydrology
Water Flow Connectivity

Critical points:
- Peat surface elevation
- Strips’ orientation
- Operator experience
Hydrology Monitoring

- Water table fluctuation and water chemistry have been monitored since 2013
- 50 wells installed on the pad and in surrounding peatland
- Level loggers installed in selected wells
The water table on the reclaimed site varies from +1 cm (i.e. above ground) to –43 cm (below ground).

<table>
<thead>
<tr>
<th></th>
<th>pH</th>
<th>Electrical Conductivity (µS/cm)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pad</td>
<td>6.3</td>
<td>1544.9</td>
<td>12.9</td>
</tr>
<tr>
<td>Edge</td>
<td>5.4</td>
<td>377.2</td>
<td>9.4</td>
</tr>
<tr>
<td>Natural</td>
<td>5.3</td>
<td>477.9</td>
<td>6.9</td>
</tr>
</tbody>
</table>
Topography Survey

• Elevation surveys performed twice in 2013
• Over 500 points surveyed
Relative Elevation Compared to Undisturbed Peatland (cm)

- Data presented are relative values to natural elevation of surrounding peatland (hollows)
- We were accounting for 10 cm peat rebound
Why Inverting the Peat?

• Test the *Moss Transfer* approach
  
  o Remove or break the geotextile under the clay cap
  o Use the underlying peat as a growing substrate

Vs.

Source: Dale Vitt
Site Re-vegetation: ‘Moss Transfer’
Re-Vegetation Treatments

**Treatments**

- 3 types of donor materials
- 2 controls
  - Bare
  - Bare + straw

Soil adjustment and donor material types are tested in a factorial design on approximately 3/4 of the study site.
Site Revegetation – Tree Planting

- Larch and Black spruce, 1:10 ratio
- Control zones as natural regeneration references
Vegetation Monitoring – Survey Layout

Vegetation monitoring being conducted by Gabrielle Prefontaine-Dastous, PhD Student
Plant Community Response

Vegetation cover in 2014

Donor sites

- Brown moss
- Polytrichum
- Sphagum
- Straw only
- Bare peat

Cover %

Vascular  Moss  Other
Plant Community Response

Vascular Plants Response to Treatments

Cover %

Bare peat  Straw only  Sphagum  Polytrichum  Brown moss  Bare peat  Straw only  Sphagum  Polytrichum

Peat inversion  Mixed clay inversion

- Woody species
- Sedges
- Grasses/Rushes
- Wildflowers
- Aquatics
- Horsetail
Plant Community Response

Moss Response to Soil and Vegetation Treatments

Cover %

- Bare peat
- Straw only
- Sphagnum
- Polytrichum
- Brown moss

Peat Fluffing

Peat inversion

Peat clay inversion

Sphagnum
Brown moss
Other
Vegetation Monitoring

June 2013

Vascular
Vegetation Monitoring

Vascular

June 2013
Vegetation Monitoring

Sphagnum

Polytrichum

July 2013
Vegetation Monitoring

Brown Mosses

July 2013
Recovery of Donor Sites

Cover of moss species, donor site 3

- Sphagnum
- Other Mosses

2012:
- 40% Sphagnum
- 60% Other Mosses

2013:
- 30% Sphagnum
- 70% Other Mosses
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