1. A coffee with two cream and two sugar

2. A wetland restoration bringing back ecosystem function and Canada’s rarest plant

“a Brier Island Double-Double”
local students:

GOMI

Samara Eaton
Environment
Canada

Craig Smith
NCC

John Brazner
DNR

Hydrogeologists John Drage & Gavin Kennedy, DNR Sherman Boates, Craig, Nick and Jonathan Price of U. Waterloo

Jess Tudor

Nick Hill, Fernhill

Chance
Geum peckii

G2  Imperilled = high risk extinction

a) very restricted range,  AND/OR
b) very few populations (<20), AND/OR
c) steep population declines ...yes to a, b, & c
CANADIAN POPULATION OF EASTERN MOUNTAIN AVENS = 6000 PLANTS IN:

a) old-field & ATV disturbed habitat (40%)
b) isolated, high integrity peatlands (20%)
c) marginal fens of Big Meadow Bog (40%)
wetland connections and Avens habitat types (a, b, c).

92% in wetlands
one wetland...multiple
connections across Camp and
GRR

a = old field
ATV
b= stable small
peatland
c = Big
Meadow
Big Meadow in 1928. Extant Geum populations overlaid. Intact lagg habitat zones below.
three impacts of 50 years of ditching

trees extend into lagg ↑

gull colony nesting ⇒

shrub overgrowth ↑
“..to save the plant we must restore the Big Meadow.”
ecosystem goal: pre-ditched landscape

Big Meadow Bog
Processes to restore:

a) lagg hydrology

b) ombrotrophy (high C:X ⇒ sequestration)

c) open metapopulation landscape for avens
Hydrology

wells monitoring:
-- degraded state
-- reference state
hydrological model
--predicts future states
(surface and groundwaters)
Results: Water Levels

- Water level depression due to central drainage ditch apparent
- Higher water levels at Transect 2 due to runway drainage?
## a. lagg hydrology and impact of ditching

<table>
<thead>
<tr>
<th>healthy/degraded</th>
<th>INFLOW water level</th>
<th>OUTFLOW water level</th>
<th>SHRUB &amp; GULL</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Runway bog”</td>
<td>- 5.6 cm</td>
<td>- 5.6 cm</td>
<td>low shrub few gulls</td>
</tr>
<tr>
<td>BM1</td>
<td>- 11.3 cm</td>
<td>- 17.6 cm</td>
<td>high shrub gull invasion</td>
</tr>
<tr>
<td>BM6</td>
<td>- 3.4 cm</td>
<td>- 18.7 cm</td>
<td>moderate shrub few gulls</td>
</tr>
</tbody>
</table>
overgrown northwest lagg with white spruce
What’s Driving *Geum* Distribution?

*Studies in Eight Adjacent Botanical Reference Wetlands*

- Water Level
- Water Temperature

**Key Factors?**
- Groundwater
- Level
- Fluctuation
- Temperature
- Adjacent slope
- Aspect
- Island geography
- Shading
- Plant Community
  - Sphagnum cover
  - Shading
  - Shrub height
Processes to restore:

a) lagg hydrology

b) ombrotrophy (high C:X $\Rightarrow$ sequestration)

c) open landscape for metapopulation dynamics
Ditching lowered water table and ushered in gulls. Nesting started in south, 1980, and is now in northern third of bog

Preliminary Classification of Big Meadow Bog
b. Ombrotrophy--indicator Ericaceae

other indicators: deergrass, hare’s tail, insectivorous plants, bakeapple
b. The War of the Roses: The Battle for Ombrotrophy!
Results: Water Chemistry

- Nutrient (nitrogen and phosphorus) concentrations increased from the upland areas of the wetland complex towards the central areas of BMB.
- Followed trend Transect 1 > Transect 2 > Transect 3, which corresponds with intensity of gull nesting activity.

<table>
<thead>
<tr>
<th>Location</th>
<th>Inorganic Nitrogen (mg/L)</th>
<th>Total Phosphorus (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transect 1 – Central Bog Wells</td>
<td>1.7 - 7.2</td>
<td>7.2 – 15.0</td>
</tr>
<tr>
<td>Transect 2 – Central Bog Wells</td>
<td>0.5 – 4.3</td>
<td>0.4 – 12.0</td>
</tr>
<tr>
<td>Transect 3 – Central Bog Wells</td>
<td>0.3 – 3.4</td>
<td>0.3 – 3.7</td>
</tr>
<tr>
<td>Margin Wells</td>
<td>0.2 – 1.2</td>
<td>0.1 – 0.8</td>
</tr>
<tr>
<td>Reference Site Wells</td>
<td>0.2 – 0.4</td>
<td>0.3 – 0.4</td>
</tr>
</tbody>
</table>
b. Short term fix = remove biomass save rare plants

..cutting shrubs, herbicide treatment, fire, grazing

e.g. Restoration of Garry Oak Prairie

1. cutting of broom

2. fire
restoration

1. consultation (Jonathan Price, Waterloo, Ft. Mac; Sarah Howie, Delta, BC: “the importance of the lagg”)

2. water retention
   a. phased approach?
   b. fit peripheral ditches with barriers at adjustable levels
   c. fill central ditch and partially the peripherals

3. vegetation management

4. nutrient concerns

5. safety net: manage old field Avens
time course

1. finish collecting benchmark data..2014-2015
   .....oh, and get some money

2. assess engineering options 2014-summer 2015

3. install regulation devices Fall 2015

4. monitoring feedbacks to adaptive management of regulation: 2015-2100
APPENDIX I. BMB--Succession with Depth

Gettysburg Quaternary Geology
Lab: Humification

Tom Neily: Sphagnum community depth succession

Sphagnum community

Bog Surface Wetness Index

BSW Index

 Depth (cm)

Frequency (%)

Peat depth (cm)

BOG  FEN  SWAMP
APPENDIX II

Avens Cover in Clipped and Control Plots--
Two Years after Treatment

![Bar chart showing the percent cover of avens in clipped and control plots at Big Pond, Camp, Runway, and BM1. The chart indicates that active management cannot fix gull areas.](chart.png)