Urban Ecological Restoration in the North

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Objectives

1. Assess the role of biological soil crusts (BSC) applied at two different slurry concentrations in facilitating seed germination and seedling establishment.

2. Determine whether the concentration of the BSC slurry influences soil crust establishment and C and N fixation rates of crusts after a single growing season.

Background

Ecological Restoration Approach

Facilitate the recovery of disturbed sites by kick starting ecological processes which will direct the system towards its natural successional trajectory (Burton, 1991)

Biological Soil Crusts (BSC)

- Communities of primary successional species (cyanobacteria, mosses, liverworts, lichens) that form a thin layer at the soil surface
- Improve soil quality (N and C fixation, water retention) and provide microsites that may facilitate vascular plant germination and establishment (Bowker, 2007)

Modified brush layers

- Bioengineered structures, constructed out of live material that serve engineering (e.g. erosion control) and ecological functions
- Form flat benches where soil can be amended and on which seeds and BSC slurry can be applied to facilitate restoration

From Polster, 2003

Modified brush layers form flat benches facilitating vegetation establishment

Methods

- BSC will be applied as a slurry of concentration [X1] or [X5]
- Seed mix will be composed of species that are representative of the naturally occurring native species assemblage and serve specific functions (e.g. soil stabilization)
- Each modified brush layer is a block and contains 1 control and 2 treatments:
  - Control = Compost(C), peat (P), fertilizer(F), seeds
  - Treatment 1 = BSC [X1], C+P+F, seeds
  - Treatment 2 = BSC [X5], C+P+F, seeds

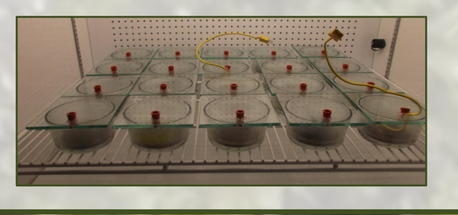
Measurements

Seed emergence and seedling survival will be measured by direct counts on a per species basis.

BSC establishment will be measured by estimating the % ground cover.

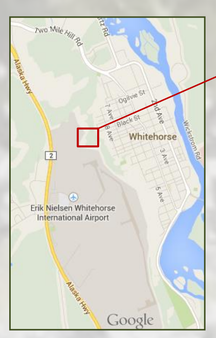
BSC N_2 fixation will be measured through acetylene reduction assays (ARA). The reduction of acetylene to ethylene ($C_2H_2 \rightarrow C_2H_4$) gives a proxy for nitrogenase activity.

BSC C fixation will be measured through changes in CO_2concentrations in an incubation chamber.



Study Design

Study Site: Black Street stairs clay cliff in Whitehorse, Yukon



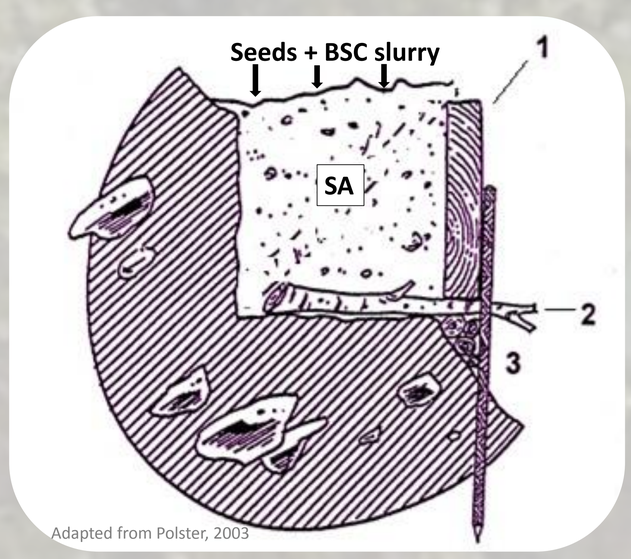
- Erosion issues
- Nutrient and organic poor soil
- Existing vegetation:

Salix spp.
Populus spp.
Artemisia spp.
Rosa acicularis
BSC

12 modified brush layers will be constructed from locally harvested *Salix* spp. (willow) and *P. balsamifera* (balsam poplar)

Soil amendments (i.e. compost, peat, and fertilizer) will be incorporated into the bench soil

BSC slurry and **seeds** will be applied on top



Adapted from Polster, 2003

A cross section of a modified brush layer to which the soil amendments (SA) have been incorporated (1 – a log acting as a retaining wall, 2- first live stake of the row , 3- rebar to hold the log in place).

Expected Outcomes

1. BSC will facilitate seed germination and seedling establishment
2. Increased concentration of BSC slurry will result in higher germination, establishment, and C and N fixation rates
3. Modified brush layers will reduce slope erosion

References

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Burton, P.J., 1991. Ecosystem restoration versus reclamation: the value of managing for biodiversity. Proceedings of the 15th Annual British Columbia Mine Reclamation Symposium in Kamloops, BC, The Technical and Research Committee on Reclamation.

Polster D. F., 2003. Soil bioengineering for slope stabilization and site restoration. Paper presented Sudbury 2003: Mining and the Environment III, May 25 – 28, 2003, Laurentian University, Sudbury, Ontario.

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