COLLECTION, PROPAGATION AND DISPERSION OF SHRUBS AND NON VASCULAR SPECIES FOR RECLAMATION IN HARSH NORTHERN ENVIRONMENTS

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Introduction

Extraction of natural resources can leave large areas of disturbed land, partially or completely stripped of vegetation, making them unstable, erosion prone and unable to provide food or habitat for fauna. Shrubs and non-vascular species in biological soil crusts (e.g. lichens) are integral components of tundra ecosystems. Without reclamation, it could take hundreds to thousands of years for disturbed areas to recover naturally due to extreme environmental conditions.

Assisted revegetation is intended to accelerate plant establishment and growth on disturbed sites. Current reclamation practices are limited by lack of native plant material, harsh environmental conditions, high costs and lack of previous regulatory requirements. Many northern shrub species have low, unknown, or cyclic seed production, which creates challenges for collection and storage. Due to the lack of commercial seed suppliers in the north, propagation of shrub species by cuttings has high potential to create a consistent source of plant material to reclaim large areas, if timely root development can be promoted. Lichens, mosses and biological soil crusts play key roles in harsh environments as they stabilize soil, modify infiltration, increase soil fertility, and prevent erosion. However, only limited research has been conducted on their use in reclamation due to their slow growth rates and historical perception as being less important compared to vascular plants.

Researching innovative, cost effective and sustainable methods to reclaim disturbed northern land and develop self-sustaining communities will create techniques to restore disturbed land and assist with conservation of one of the few remaining natural environments worldwide. The objective of this research program is to develop and improve methods for collection, propagation and dispersion of native shrub and lichen species in harsh northern environments.

Methods

Shrub cuttings

Shrub cuttings were collected from eight dominant tundra species at Diavik Diamond Mine, Northwest Territories, located approximately 300 km northeast of Yellownife. Cuttings were collected from *Arctostaphylos rubra* (Rehder & Wilson) Fernald (red bearberry), *Betula glandulosa* Michx. (bog birch), *Empetrum nigrum* L. (crowberry), *Ledum* decumbens L. ssp. *decumbens* (Aiton) Lodd. ex Steud. (marsh labrador tea), *Loiseleuria procumbens* (L.) Desv. (alpine azalea), *Salix* sp (willow species). *Vaccinium uliginosum* L. (bog bilberry) and *Vaccinium vitis-idaea* L. (bog cranberry).

The effects of three common horticultural practices affecting rooting of shrub cuttings were evaluated. The main objectives were to determine if the concentration (0, 0.1, 0.4, 0.8 %) of a common growth hormone (indole-3-butyric acid (IBA)), soaking length (0, 1, 3, 5, 10, 20 days) and time of year of collection (spring, summer, fall) could promote root initiation and development in growth chamber experiments over 60 days to create a more consistent source of plant material available for reclamation of disturbed northern sites. Treatment choices were selected based on a review of scientific literature, common horticultural practices and ease of application.

Lichens

Lichens were collected at Diavik Diamond Mine for a multi year field experiment. Specific objectives are to determine the effects of substrate type (crushed rock, lake sediment, processed kimberlite), containment type (none, jute, erosion control material, erosion control material and jute, woody debris, woody debris and jute, tundra soil, tundra soil and jute), and placement type (none, slurry, dry placement) on growth and survival of lichens. One hundred grams of sieved lichen material was used per 50 x 50 cm plot.

Results and Discussion

Shrub cuttings

Cuttings from all eight species collected at Diavik have the capacity to produce roots, although cuttings with roots across all treatments in spring, summer and fall, ranged from 1 % for fall *Arctostaphylos rubra* cuttings to 88 % for spring *Salix* sp. cuttings. Time of year of collection had a strong influence on root development for *Salix* sp. and *Vaccinium vitis-idaea* cuttings. Effects of soaking length and IBA concentration were less clear due to limited root initiation for most species, and interactions with time of year of collection. While species specific factors play a role in root initiation and development, other factors including environmental conditions may also be involved.

Lichens

After one year, preliminary results indicate that lichen fragment retention was enhanced with jute, lichens were more frequently associated with micro topography, and all treatments with dispersed lichen fragments (dry or slurry) had similar species frequency. Plots with no lichens had very few lichens. Most lichen fragments appeared health. A final assessment of lichen plots will occur in August 2016.

Preliminary Conclusions

Cuttings from all eight shrub species have the ability to produce roots, but root initiation and development was species specific. Time of year of collection had the strongest influence on root initiation and development. Placement of lichen fragments on plots significantly increased presence of all species monitored, while type of placement (dry, slurry) did not appear to play a significant role in species survival or frequency. Plots with jute appeared to have the highest retention of lichen fragments across all treatments. On-going and future research will potentially lead to more informed northern revegetation guidelines.

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