

### **An Evaluation of Factors Influencing Spontaneous Vegetation Succession in Northern Latitude Disturbances**

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#### **Project Goals:**

The goal of this project is to provide field-verified information to help answer the following four questions:

1. What factors positively and negatively influence spontaneous revegetation and natural succession of disturbed sites in Yukon?
2. What are some of the key steps in spontaneous vegetation succession of disturbed sites in the Yukon? When do these typically occur and what conditions are linked to their evolution?
3. What are the similarities and differences between what is observed at i) Yukon sites, and ii) other areas of Canada and the world?
4. How can this information be applied to improve our restoration practices for disturbed sites in the Yukon?

#### **Overview:**

The information obtained from this study is intended to provide indication of the factors that positively and negatively influence spontaneous revegetation and natural succession rates of regeneration at large linear and access road-associated disturbances in Yukon. It is hoped that these results may then be used by both regulators and industry alike to: i) continue along the path of improving our restoration prescriptions particularly for northern environments, and ii) understand indicators of the advancement of ecological succession at a given site.

The research involves review of spontaneous revegetation and regeneration characteristics at a selection of decommissioned borrow areas and abandoned highway/access road sections in Yukon. Borrow areas and abandoned highway sections have been selected as the primary sites for the proposed research work because these sites are relatively numerous, easily accessible, span much of the Yukon, underwent a similar type of disturbance, and tend to have systematic records kept with respect to the last year of activity and any revegetation work completed. Nonetheless, the results of this study are intended to be readily applicable to other disturbance types including those from placer and quartz mining activities, and petroleum exploration and development. Furthermore, the study could be expanded to accommodate well-documented mining or petroleum disturbance sites.

This project is being carried out in collaboration with the University of Victoria Restoration of Natural Systems Program, Yukon Highways and Public Works, Altura Environmental Consulting, Northern Research Institute, and the Mining and Petroleum Environment Research Group (MPERG).

## **Outline of Methods:**

The research involves review of a selection of decommissioned borrow areas and abandoned highway sections in Yukon. Approximately 30 sites are being selected for the initial research, located in Yukon's Boreal Cordillera ecozone. This suite of sites is designed to span a large range of time since decommissioning (eg. in the order of 3 to 40+ years) and a range of altitudes. Both sites with and without revegetation/seeding activity are included.

Each of the selected sites is being visited at some time during the period of August through September 2009. The field review involves both qualitative observations (for example: location of highest and lowest density of re-growth, preferential growth patterns), and quantitative determinations using a combination of plots and/or transects. A table of parameters measured or observed is given in Table 1. Data from at least two plots/transects are typically recorded at each site. Little post-field laboratory analysis is anticipated, unless additional analytical information at certain sites is deemed necessary. Plant inventories are recorded on paper and through photographic record, and vegetation samples are collected as required for subsequent identification by a botanist. One or more site photo points are established at each site using prominent site features.

Data from the surveys will be tabulated and plotted in order to observe obvious tendencies. Multivariate analysis may also be incorporated to assist in analyzing the data tendencies, as used in Řehouňková and Prach (2008) to analyse spontaneous vegetation information at gravel-sand quarries in Czechoslovakia. A final report will be compiled that includes all field data obtained, and key conclusions with respect to answering the four key questions listed in the 'Project Goals' section.

Depending on the information yielded from this initial study, further work in subsequent project stages may be warranted in certain aspects or in other regions not covered in the initial sites selected.

Field measurements with respect to spontaneous revegetation at other sites and studies is being sought, and will be incorporated as possible into the analysis for this study. Please contact the author.

## **Project Timeline for 2009:**

Field Work (August to September 2009): Visit selected sites. Estimate 10 to 15 field days. August to September 2009.

Post-Field Work (Winter 2009-2010): field data compilation and analysis; incorporation of supplementary data from other sites and analyse data. Follow-up meeting(s) with stakeholders, issue final report.

## **Background of Principal Researcher:**

Diane Lister was born and raised in Whitehorse, and has a B.A.Sc. in Geological Engineering. She was active in the exploration industry in Yukon and Northern B.C. for several years before returning to complete an M.A.Sc. in Mining Engineering in 1994, with a research focus on acid rock drainage studies. After graduating, she worked from 1994 to 1996 as environmental engineer then supervisor at Teck Corporation's Quintette Coal Mine in Northern B.C., and then until 1999 as environmental coordinator at Viceroy's Brewery Creek Mine near Dawson City. As a result of the operation's proactive revegetation program, Brewery Creek Mine was recognized in 1999 with the inaugural Robert Leckie Award for Outstanding Reclamation Practices.

Since 1999, Diane has worked as an independent environmental consultant for numerous projects in Canada, South America, and Central America. In 2008 Diane began part-time coursework towards a certification in Restoration of Natural Systems through the University of Victoria. She hopes to graduate from the program by mid-2011, and is focusing her course-related research in the areas of natural succession and native plant propagation.

## Acknowledgements:

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University of Victoria Restoration of Natural Systems Program

Stu Withers (plant taxonomy) and Bruce Bennett (invasive species)

## References:

Řehouňková, K., and Prach, 2008. Spontaneous Vegetation Succession in Gravel-Sand Pits: A Potential for Restoration. *Restoration Ecology*, Vol. 16, No. 2, June 2008, pp. 305-312.

*Table 1. List of Parameters Measured or Observed at Selected Sites*

Pre-Fieldwork Information	<ul style="list-style-type: none"><li>• Historic Use of Site</li><li>• Date of site's last use</li><li>• Physical re-contouring or other site preparation work performed</li><li>• Revegetation activities performed</li></ul>
Regional Information	<ul style="list-style-type: none"><li>• Ecozone / Ecoregion</li><li>• Mean annual precipitation</li><li>• Mean annual temperature</li></ul>
Qualitative Field Observations	<ul style="list-style-type: none"><li>• Location of highest and lowest density re-growth</li><li>• Preferential growth patterns</li></ul>
Survey Information – Physiochemical	<ul style="list-style-type: none"><li>• Elevation</li><li>• Aspect</li><li>• Slope</li><li>• Distance to interface(s) with undisturbed surroundings</li><li>• Distance from active highway</li><li>• Other active facilities within 1 km</li><li>• Soil texture</li><li>• Soil pH</li><li>• Soil electrical conductivity</li><li>• Moisture regime (location of water table with respect to surface)</li><li>• Evidence and degree of erosion, surface induration, and compaction</li></ul>
Survey Information – Biological	<ul style="list-style-type: none"><li>• Species Inventory (native and non-native species), vertical structure, cover, richness, and relative frequency</li><li>• Exotic and/or Invasive Species</li><li>• Presence of cryptogamic layer</li><li>• Evidence of mechanisms of plant colonization</li><li>• Evidence of wildlife use</li></ul>



Borrow area clearing at approximately km 7 of the Dempster Highway in central Yukon.



*Dryas drummondii* (yellow or drummond's mountain aven) colonizing the floor of a closed gravel pit along the Dempster Highway in central Yukon.



*Saxifraga tricuspidata* (three-toothed saxifrage) and fern (*Dryopteris* sp., pending identification) colonizing a dredge tailings pile (from 1966 and older) south of Dawson City, central Yukon.