

Bioengineering And Reclamation To Stabilize A Lakeshore Slope*

Jim Schaefer M.Sc., Dr. M. Anne Naeth, Dr. David S. Chanasyk, University of Alberta

1.0 Introduction

There is little published scientific documentation on transplanting vegetation for slope stabilization in the Canadian Aspen Parkland. Limited published information and general practice garnered from anecdotal evidence suggest transplanting is most successful when plants are dormant. In the Aspen Parkland this corresponds to early spring (April, May) prior to new growth occurring or when plants are either dormant or are approaching dormancy after mid October. However, transplanting during these periods may be inopportune due to inaccessible, muddy sites in spring or frozen soil conditions in fall. Successful transplanting during nondormant stages would allow an increased time frame using this reclamation method.

Transplanting appropriate native vegetation to barren sites from local areas having similar biotic and edaphic conditions can introduce an adapted vegetation cover with genetic variation which requires little if any maintenance and integrates well with the surrounding vegetation. Providing a more hospitable growing environment by combining transplanted vegetation with stable moisture retaining soils and initially providing nutrients may expedite succession toward mid seral stages which in turn can encourage soil stabilisation by reducing soil erosion and anchoring the soil in place via plant root establishment. This revegetation method may reduce the effects of soil instability and add soil nutrients such as nitrogen by nitrogen fixing plants in a much shorter time period than when attempting to establish the same plant community by seeding. Seeds from most native forbs, grasses and shrubs are currently seldom commercially available. Incorporating a bioengineering technique such as terracing with transplanting can potentially increase slope stabilization. Terracing can reduce soil erosion by slowing and collecting surface runoff while providing an environment conducive to plant growth. Bench terraces virtually eliminate the effect of slope caused erosion thereby allowing nutrients to remain in situ without being transported to lower slope positions.

2.0 Site Description

The severely degraded lakeshore slope is located in Elk Island National Park, Alberta. This site, approximately 60 m long by 13 m high is situated on a west facing, sparsely vegetated, steep, eroded slope located above Astotin Lake and has been eroding for at least 30 years. It is situated on predominantly Orthic Gray and Dark Gray Luvisolic soils and consists of 3 gullies and 3 slopes eroded to the C horizon. Portions of the upper slopes are vertical, naturally devoid of vegetation and continually exfoliating and

* Presented at the 24th Annual Meeting of the Canadian Land Reclamation Association held jointly with the Saskatchewan Environmental Industry and Managers Association, Saskatoon, Saskatchewan, September 28-30, 1999.

slumping soil due to water erosion. The sparsely vegetated, less steep sections vary in inclination between 28 and 38 degrees.

3.0 Methods

The 28 to 38 degree slopes were initially terraced to provide a level growing area. A spent mushroom compost amendment (25% by volume) was added to the worked (20 cm deep) C horizon to increase soil organic matter, soil nutrient content and improve water retention capability.

During the first two weeks of August 1997, vegetation islands approximately 20 cm in diameter and 10 to 20 cm deep were removed by shovel from previously chosen donor sites within 2 kms of the terraced site and transplanted. The chosen donor areas predominantly contained native shrubs, forbs and grasses. An estimated 30 to 50% of the vegetation was either in bloom or fruiting when removed in the nondormant state. Daytime ambient air temperatures on the slope varied from 27 to 32 °C during the nondormant transplanting time.

Dormant transplanting was initiated October 13, 1997. Morning temperatures were -6 °C with day time highs of 6 °C. The terraced slope soil was frozen in isolated small areas (approximately 1 m long) up to 4 cm deep making transplanting conditions difficult. All vegetation on the donor area was considered dormant with no sign of green nondormant foliage; all leaves were either coloured or desiccated and fallen.

In June and August 1998 all plant species within the vegetation islands (average size 0.3 m²) were identified and counted. Overall vegetation island vigour was categorised into 3 classes. Percent mortality of vegetation in each island was determined as the percent vegetation that appeared dead expressed as a percent of the total visible vegetation. The quantity of islands were then categorised into seven arbitrary mortality categories.

4.0 Results

There was a significant difference in mortality between dormant and nondormant 20 cm diameter vegetation islands transplanted. Nondormant islands had significantly lower vegetation mortality (10% or less) than did dormant islands on both slopes and gullies. Initially in June, slopes had significantly more islands with 10% or less vegetation mortality than did gullies. However, by August there was no significant difference in island vegetation mortalities between gullies and slopes.

Vigour was significantly greater in June than August, with more vigorous (healthy appearing) plants on nondormant islands. However, by August there was no significant difference between dormant and nondormant transplants. There was a high percentage of both healthy dormant and nondormant islands. There were significantly more healthy, vigorous islands on slopes compared to gullies throughout the study. Species diversity

increased between June and August 1998. During this time only grass and sedge species density increased while forb and shrub/tree species densities diminished in all situations.

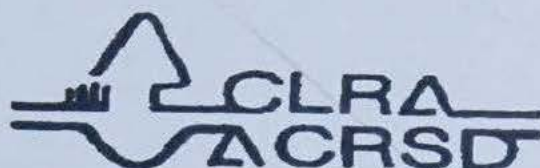
5.0 Conclusion

The results from this study provide evidence that transplanting nondormant vegetation islands on a terraced Aspen Parkland site is successful in establishing plant communities and can provide an essential component when reclaiming a relatively barren site.

If these results are repeatable on a broader scale, reclamation using vegetation islands could proceed throughout the growing season rather than be restricted to early spring and late autumn when working conditions are often less than ideal.

Perspectives in Land Reclamation and Restoration

Presented by:



Canadian Land Reclamation Association/
Association Canadienne De Réhabilitation Des Sites Dégradés



Including the Canadian Land Reclamation Association's
24th Annual Meeting

This document may be cited as:

Zeister, A.M. (compiler), 1999. Perspectives in land reclamation and restoration. 24th meeting of the Canadian Land Reclamation Association held jointly with the Saskatchewan Environmental Industry and Managers Association, Saskatoon, SK. 175pp.
-5927

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7:00 - 9:00 Registration Booth Open

Tuesday, September 28th

7:15 - 7:45 AM Registration

7:45 - 8:00 AM Bus Loading from Saskatoon Inn Lobby

8:00 AM Field Tour Departure (no delays)

7:00 - 10:00 PM Wine and Cheese, Registration

Wednesday, September 29th

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7:30 Registration

8:00 - 8:05 Introductory Remarks – Saskatchewan Room ‘B’
Tracy Patterson (CLRA) and Theresa Salamone (SEIMA) n/a

8:05 – 8:25 Opening remarks from Saskatchewan Environment and
Resource Management n/a

8:25 – 10:05 Saskatchewan Policy – Saskatchewan Room ‘B’
Session Chair: Lorne Veitch – Saskatchewan Agriculture and
Food, Lands Branch, Swift Current

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Todd Han, Saskatchewan Energy and Mines..... n/a

8:45 – 9:05 Saskatchewan upstream petroleum sites remediation guidelines.
Todd Han, Saskatchewan Energy and Mines..... n/a

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Session Chair: Darlene Howat – Department of Renewable Resources, University of Alberta

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Lotfi Haji, Cameco..... n/a

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the 1998 Foothills Pipe Lines Expansion Project.)
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Awards

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Dr. Bob Russell, Department of Sociology, University of Saskatchewan n/a

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