SELECTION OF NATIVE LEGUME SPECIES FOR RECLAMATION

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ABSTRACT

Natural habitat disturbances are increasing on the eastern slopes of the Rocky Mountains. At present, there is little choice for plant material to use in reclaiming these disturbances since many available grasses and legumes are not adapted to survive or reproduce in the harsh environment at high elevations. The introduction of adapted agronomic plants is a concern because these are often persistent and invasive; they hinder natural succession and can replace indigenous species in natural areas.

In 1990 Wild Rose Consulting Inc. and Alberta Environment Centre began a four year project to collect, evaluate, select, and multiply native legume species for use in reclamation seed mixtures. Fourteen legumes were collected from the mountains and grown in nursery plots in Vegreville. Data concerning establishment, growth and development, yield, and germination were recorded. These data were used to make preliminary selections of five legumes that have potential for use in reclamation seed mixtures. Final selection(s) will be made following one more year of data collection, and these will be tested at several mine sites in the mountains and foothills of Alberta.

Alpine milkvetch appears to have the best potential of the fourteen species studied. It survived well, grew vigorously, spread to cover relatively large areas, and produced large quantities of viable seed. It also emerged well in seeding trials. Other species that have some potential include purple milkvetch, reflexed locoweed, yellow locoweed, and showy locoweed.

Reclamation and revegetation of the numerous, large coal mine disturbances in the mountains and foothills of Alberta is a problem since there are few adapted plant species or varieties available for use in these areas.

Native plants are recommended for reclamation of these sites for several reasons;

i. they are adapted to the sites,
ii. they provide wildlife habitat,
iii. they are less persistent and invasive than some of the agronomic species, and
iv. they create a more natural looking landscape (since these sites are highly visible to tourists).

In 1990, Wild Rose Consulting, Inc. in collaboration with Alberta Environmental Centre began a program to collect, evaluate, select, and multiply native legumes for use in reclamation of high elevation sites. This project was funded by the Reclamation Research Technical Advisory Committee and Canadian Parks Service.

In 1990 and 1991 seeds of native legumes were collected at 34 sites in seven locations (Grande Cache, Jasper National Park, Cadomin-Cardinal River, Banff National Park, Kananaskis, Crowsnest Pass, and Waterton National Park) in the mountains and foothills of Alberta. Species which were collected include *Astragalus alpinus* (alpine milkvetch), *A. americanus* (American milkvetch), *A. vexilliflexus* (purple milkvetch), *Hedysarum alpinum* (alpine sweetbroom), *H. boreale* (northern sweetbroom), *H. sulphurescens* (yellow sweetbroom), *Lupinus nootkatensis* (Nootka lupin), *L. sericeus* (perennial lupin), *Oxytropis cusickii* (alpine locoweed), *O. deflexa* (reflexed locoweed), *O. monticola* (late yellow locoweed), *O. sericea* (early yellow locoweed), *O. splendens* (showy locoweed), and *O. viscida* (viscid locoweed).

Evaluation of species was carried out at a nursery located in Vegreville, Alberta approximately 100 km east of Edmonton. It was assumed that since these species were collected in the mountains and foothills they would be adapted to high elevation sites therefore evaluation was based on agronomic characters: establishment, survival, growth and development, and seed yield of these collections in a nursery.

Seedlings were grown in the winter in the greenhouse and placed in the field nursery in the spring and early summer. Primary evaluation criteria were: survival, vigour, seed yield, and germination of harvested seeds. Other considerations included growth habit (as related to the potential for mechanical harvest), and phenology (as related to harvest time). Data were collected in the first and second growing seasons.

Survival after two growing seasons (one winter) was over 95% for *Astragalus alpinus* and *Oxytropis cusickii*. *Astragalus americanus* had such poor survival in the first growing season that it was dropped form the program. High mortality was recorded for *Lupinus sericeus* over the first winter. *Astragalus alpinus* was the most vigourous species. *Lupinus sericeus*, *Hedysarum alpinum*, and *H. sulphurescens* were the least vigourous. Few plants produced seeds in the first season. In the second season, *Oxytropis deflexa* and *O. monticola* produced over 8000 seeds per plant. The three *Hedysarum* species along with *Oxytropis cusickii*, and *Lupinus sericeus* produced less than 100 seeds per plant. Germination of harvested seeds was excellent (98-100% after 30 days) for all species except *L. sericeus*. Germination of seeds of the latter species was significantly less than other species but in a separate study we found that if larger seeds were selected germination could be improved.

Based on results obtained over two growing seasons, legumes were assigned a rank order as follows:

Astragalus alpinus
Astragalus vexilliflexus
Oxytropis monticola
Oxytropis deflexa
Oxytropis splendens
Oxytropis viscida
Hedysarum boreale
Oxytropis cusickii
Hedysarum sulphurescens
Hedysarum alpinum
Oxytropis sericea
Lupinus sericeus
Astragalus americanus (dropped from program)
Lupinus nootkatensis (unranked due to insufficient data)

Astragalus alpinus is the species that looks most promising to date; it had good survival over two growing seasons, and produced vigourous plants that provide good ground cover. Seed was produced in both years. The seed stalks, however, were low growing and may present some problems for mechanical harvest.

Astragalus vexilliflexus had good survival and vigour and its prostrate growth provides good cover for controlling erosion. Seeds, however, were produced under the prostrate branches making harvest difficult and labour intensive.

Oxytropis monticola had high seed yield and particularly good seed production. Seeds were easily harvested since they were produced in capsules on stiff, erect stalks. An observed second flowering period may result in two harvests each year. Although this species is ubiquitous in Alberta, it does not spread vegetatively to cover large areas.

Seed increase plots were established using transplants in the first year and seeds were harvested annually. In 1992 a plot was seeded with six species for the purpose of multiplying seeds. *Astragalus alpinus* established well and produced small amounts of seed in the first year, and large amounts of seed in the second. *Oxytropis monticola*

and *O. splendens* did not establish as well as the *Astragalus* but did produce seeds in the second season. *Oxytropis deflexa, Hedysarum alpinum*, and *Lupinus nootkatensis* did not establish to any extent. Further tests are required to determine appropriate seeding rates.

Data for the third year are being collected at the field nursery in 1993 and following analysis of these data, final selections will be made. We hope to release the first species' in the spring of 1994 and have seed commercially available as early as 1995.

Laboratory and greenhouse studies have been designed to determine the effectiveness of various arctic and alpine rhizobia on establishment and development of the legume species selected. This study will begin this winter. Further work is planned in testing the selected legumes on various types of disturbances in the eastern slopes of the Rocky Mountains. Trials will be established at coal mine sites beginning in 1994 and selections will be included in a program to compare native seed mixtures with agronomic mixes now being used in forested areas of the mountains and foothills.

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