RECLAMATION STUDIES ON INDUSTRIAL BARRENS IN THE SUDBURY REGION

- A PROGRESS REPORT -

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This slide presentation showed progress in revegetation research carried out under the sponsorship of the Ministry of Natural Resources, Sudbury Region, and the Regional Municipality of Sudbury, following the presentation made at the 1974 Cover Crops Committee Workshop. The following is a summary of the main points discussed:

1. Semi-operational grass seeding north of Coniston. Six acres of the almost barren valley of Coniston Creek, 2 miles north of Coniston, sown to Canada Blue Grass in August 1974, has developed a good sward in its first year of growth. This fine sandy soil, having a pH of approximately 4.0 at the surface and total copper and nickel contents of up to 450 ppm and 500 ppm, respectively, was treated with 2 tons per acre dolomitic limestone and sown to Poa compressa at 40 lb/seed acre. Three acres were fertilized with 1/2 ton/acre 7-7-7 and three acres with 1/2 ton/acre 5-20-10. Biomass determinations carried out in the summer of 1975 showed significantly greater yield on the area fertilized with 7-7-7.

A number of colonizing species were in evidence during the first summer. The following table shows the species arranged in descending order of Density/Frequency Index, as determined on the basis of 210 1 m^2 quadrats.

Species	Common name	Density/Frequency Index (%)
Salix spp.	Willows	50.0
Carex scoparia	Sedge	15.3
Agrostis gigantea	Redtop	8.9
Trifolium spp.	Clover (White & Alsike)	7.5
Agrostis scabra	Tickle Grass	3.2
Chenopodium album	Lamb's Quarters	2.5
Juncus bufonius*	Toad Rush	2.2
Melica smithii*	Melic Grass	1.6
Equisetum sp.	Horsetail	1.2

Species	Common name	Density/Frequency Index (%)
Glyceria canadensis**	Rattlesnake Grass	1.2
Chenopodium glaucum	Oak-leaved Goosefoot	0.8
Geranium bicknellii	Cranesbill	0.8
Rumex acetosella	Sorrel	0.8
Typha latifolia**	Cattail	0.8
Anaphalis margaritacea	Pearly Everlasting	0.4
Anthemis cotula*	Stinking Mayweed	0.4
Fragaria virginiana	Wild Strawberry	0.4
Gnaphalium sp.	Cudweed	0.4
Marchantia polymorpha	Liverwort	0.4
Prunus pensylvanica	Pin Cherry	0.4
Rosa sp.	Wild Rose	0.4

Species marked with an asterisk are not normally found in the area, and were probably present as contaminants in the seed supply. Species marked with a double asterisk became established on that part of the area bordering the creek. Willows became established most abundantly in the north-eastern section of the plot, the portion facing the prevailing wind. This phenomenon, not surprising in view of the wind-dispersed seeds of the willow, has been noted in a number of experiments. Another striking feature was the fact that establishment of adventives was best in areas where grass establishment was poor, so that the pioneers did not suffer from competition. This could be an important factor in cases where the initiation of natural succession is considered to be desirable.

2. Strip cultivation. On the Coniston site, cultivation of the fine sandy soil can give rise to the problems of wind erosion, though Canada bluegrass can cope quite well with low dune formation. However, a small plot was set up in 1974 in which strips of soil were cultivated with a rototiller and strips of equal width left uncultivated between them. Lime, fertilizer and seed were broadcast over the whole 10 m x 10 m plot. Establishment in the cultivated strips was excellent (the grasses in this case being a mixture of Agrostis gigantea and Agrostis scabra) and even in the first season there was some migration of grass into the uncultivated strips, particularly along cracks in the soil formed during wetting/drying cycles.

3. Tickle Grass (Agrostis scabra) as a species for reclamation.

Although this native species is outstanding in its ability to colonize the industrial barrens of the Sudbury area, particularly if minimal amelioration of pH or nutrient status is carried out, small scale trials suggest that it should be used with caution for primary sward establishment. On fertilized ground it gives a very lush growth in the first season, but tends to act more as an

annual than as a perennial. There is, therefore, rather poor growth of the species in the second season due to the heavy thatch formed in the previous year. In this way it differs from Poa compressa, which forms new shoots readily in the second season from rhizomes, Poa compressa also forming a more open stand than Agrostis scabra, allowing the establishment of other species. The most important secondary colonists moving into a Poa compressa or Agrostis scabra sward are Agrostis gigantea and Carex scoparia. It appears that it is not necessary to sow Agrostis scabra in an area so long as there is a seed source nearby, since it has a very efficient tumbleweed-type dispersal mechanism. Despite its shortcomings, Agrostis scabra is a valuable species as a temporary "space filler" which will eventually be replaced by more permanent species such as Agrostis gigantea. The use of Poa compressa on sandy soil is still recommended in view of its ability to tolerate blown sand accumulation. Once an open sward of Poa compressa is established on such a site, colonization by Agrostis gigantea and willows will follow, with Agrostis scabra acting as a temporary "space filler". In sites less prone to blowing sand, Agrostis gigantea may be used as the sown species.

4. Grass establishment on an open scrub-oak site near Skead.

Though most attention has been given to tree establishment on this site, it was felt that an attempt should be made to find a method of vegetating the barren areas between trees, previous experiments having indicated that tree establishment is more difficult in such exposed sites. The Skead soil, coarser textured than that at Coniston but with a similar pH, also differs from that at Coniston in its lower nickel content and its lower nitrogen content. A preliminary trial with several grass species indicated that nitrogen is a much more essential ameliorant at Skead than at Coniston. One of the native grasses tested at Skead was Deschampsia flexuosa (Wavy Hair Grass), a common species of dry, rocky sites in open woods of the Sudbury area. It was noted with interest that this species showed a definite growth response to N and P fertilizer, although it is normally considered to be a species of acid, low-nutrient soils.

5. Revegetation of barren stony slopes. Small scale trials set up in 1974 showed that it was possible to establish vegetation on a number of completely barren gravelly, stony and rocky slopes, provided that lime and fertilizer was applied. On such slopes, the stony surface, "deflated" by erosion, often tends to act as a seed trap and a mulch, and under the stones a considerable depth of soil may be found. Agrostis scabra and A. gigantea seem to be the best species on such slopes.

In August 1975, a group of primary school students were organized to

carry out manual revegetation measures on a barren area opposite their school. Germination was good and, based on the results of the small scale plot set up in 1974, a good stand of Agrostis scabra and A. gigantea should be achieved next summer.

The manual approach to revegetation of stony hillsides, without site preparation, has two potential applications. The first is the use of volunteer groups for the revegetation of small areas. The second is in the use of aerial fertilizing and seeding. However, some modification might be required for aerial work, particularly in lime application, since the large amount of lime normally required would make aerial lime spreading financially prohibitive. The use of coated seed with lime incorporated is, therefore, being explored, and coated seeds of Poa compressa and Agrostis gigantea are on order. It is hoped that the lime coating will ameliorate the immediate micro-environment of the germinating seed sufficiently to allow its establishment and survival, though it is not known whether further growth and establishment of new plants will follow.

6. Revegetation of barren bog areas. A number of barren bogs occur in the Sudbury area. These are areas of black peat in which vegetation is confined to the edges, though the remains of bog shrubs such as Leatherleaf may sometimes be found. Experiments on such a bog have shown that, not only can sown grasses such as Redtop be established if lime and fertilizer, or even lime alone, are applied, but that a limed unseeded plot will develop a complete cover of vegetation within one season, the dominant adventive species being Typha latifolia, Scirpus cyperinus, Salix spp., Populus tremuloides and Juncus brevicaudatus.

7. pH dynamics in limed and unlimed soils. An intensive pH study has been carried out in the Coniston experimental plot area, aimed at determining how effective liming is in ameliorating pH and how long-lasting the results of such amelioration are. However, even before comparisons between limed and unlimed plots were made, it became clear that there has been a distinct pH shift in the Coniston plot area since work was begun there in 1969. Unlimed soil, which in 1969 had a pH in the range of 3.0 - 3.5, now lies between pH 4.0 and 4.5. This probably reflects the fact that the low pH encountered in 1969 was due to free sulphurous and/or sulphuric acids in the soil resulting from intense fumigation from Coniston and Falconbridge, whereas the closing of the Coniston smelter and the Falconbridge pyrrhotite smelter in 1972 has brought about a considerable reduction in fumigation in the Coniston plot area, so that free acids are presumably leached out.

The comparison between pH of limed and unlimed plots indicates that plots limed at a rate of 2 tons per acre maintain a pH differential of up to 1.0 unit even after four years.

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Table of Contents

(continued)

Table of Contents (continued)