

ESTABLISHMENT OF TREES AND SHRUBS ON MINED LAND
IN THE GRANDE CACHE AREA

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ABSTRACT

The Terrain Sciences Department of the Alberta Research Council has been conducting a reclamation research program at the operations of Smoky River Coal Limited in the Grande Cache area since 1972. The revegetation work has involved research into the establishment of an initial erosion cover supplemented with trees and shrubs. It was demonstrated that a tree and shrub cover could be established by the use of conifer seedlings and cuttings of deciduous species. Trees and shrubs are also establishing in significant numbers by natural means. Results of direct seeding trials indicate that direct seeding may be a viable method for establishing trees and shrubs in reconstructed soil areas at the Smoky River site.

INTRODUCTION

The Terrain Sciences Department of the Alberta Research Council (ARC) has been conducting a reclamation research program in the Grande Cache in conjunction with the operations of Smoky River Coal Limited since May 1972. This paper provides a summary of the work undertaken and an assessment of the results obtained relative to the establishment of trees and shrubs in the area (Macyk, 1972 to 1982; Macyk and Widtman, 1983 to 1986).

Setting

The operations of Smoky River Coal Limited are located approximately 13 km north of Grande Cache in the Rocky Mountain Foothills. Elevations range from 1600 to 1800 m and the topography is steeply sloping. Climate can be considered one of the major limiting factors to revegetation success.

Objective

The overall objective of the program is to develop methods for the establishment of a long-term self-sustaining vegetative cover that is harmony with the adjacent undisturbed area.

MATERIALS AND METHODS

Coal production from the surface mine operations commenced in June 1971. The research program that emphasized soils and vegetation concerns began in May 1972.

Vegetation Establishment

A specific end land use was not developed at the time the project was initiated. Erosion control was one of the major initial considerations relative to establishment of a plant cover. This was to be followed by re-establishment of a tree and shrub cover with some capability for wildlife use.

The revegetation work was initiated with the establishment of 60 individual 6 m x 9 m plots to assess the suitability of 30 different agronomic grasses and legumes. Slopes ranged from 0 to 40 degrees.

Fertilizer trials were included to determine the most appropriate fertilizer types and analyses to be used, as well as timing and rate of application.

A major problem was encountered in the initial stages of tree and shrub establishment work. Seedlings suitable for planting above an elevation of 1100 m were unavailable at the time. Consequently, a cone collection program was undertaken and greenhouse space acquired to rear lodgepole pine (Pinus contorta var. latifolia), engelmann spruce (Picea engelmannii) and white spruce (Picea glauca). Different sizes and types of containers were utilized to determine those most suitable for use in

reconstructed soil areas and to get an appreciation of the relative costs associated with seedling production.

Cuttings of willow (*Salix* spp.), balsam poplar (*Populus Balsamifera*) and root cuttings of aspen (*Populus tremuloides*) were rooted in the greenhouse. Direct planting methods were also utilized for willow cuttings. Most of the materials produced were planted within areas having an established grass or grass/legume cover, the remainder were planted in areas where no vegetative cover existed.

During 1983 a direct seeding program to establish spruce and pine was undertaken. This involved the establishment of two 3 m x 3 m plots where pine seed was broadcast into the existing grass/legume and accompanying plant litter cover. In subsequent years soil scarification techniques were employed and 10 m x 10 m plots were established to assess the growth resulting from the seeding of spruce, pine, fir and alder.

RESULTS AND DISCUSSION

Erosion Control Cover Establishment

Most of the agronomics or introduced species that were planted initially survived and continue to thrive. Time and annual monitoring of growth resulted in the development of an appreciation of species suitability (desirability), stand composition and fertilizer requirements.

Tree and Shrub Establishment

Relatively good success was achieved in terms of tree and shrub establishment. It was demonstrated that trees and shrubs will thrive in areas initially seeded to grasses and legumes. This practice was questioned initially because of an anticipated competition for moisture. It became apparent that the protection afforded the seedlings by the grass and legume cover, especially in holding snow in the winter far outweighed the negative aspects of moisture competition during the growing season.

Furthermore, temperature data indicated that near surface soil temperatures in sparsely vegetated areas reached levels in excess of 46°C for six consecutive hours on three consecutive days in the latter part of July 1985 (Macyk and Widtman, 1986). Temperatures at the same depth under a more dense vegetative cover were 10°C lower.

The following summary provides general observations made five years after the initial planting of trees and shrubs.

- engelmann spruce has a higher survival rate than lodgepole pine
- container grown conifer seedlings are superior to bare root stock in terms of survival and growth rate
- larger size containers promote higher survival rates

Some problems were encountered relative to seedling survival and growth. Upon investigation of some of the seedlings that demonstrated poor growth it became apparent that root egress was relatively limited resulting in poor root development. In the case of some of the container seedlings it became apparent that the upper root mass surrounded by the peat from the original container was exposed at the soil surface. As a result the seedlings eventually died. This exposure or heaving of the seedlings is probably the result of frost heaving.

The problems described above combined with the difficulty in planting bare root and container seedlings in the reconstructed soils at the site and the cost of production and planting resulted in a desire to consider alternative methods for tree and shrub establishment.

Observations in the area indicated that spruce, pine, alder, willow and buffaloberry are becoming established in the area in significant numbers. This implied that direct seeding might be a viable technique for tree and shrub establishment. Results to date indicate that pine is superior to spruce, seeding into a grass/legume cover is effective, mixtures of tree and shrub seed provide good results and fall seeding is superior to spring seeding. In general, the results suggest that direct seeding can be a viable alternative to planting seedlings in certain locations.

CONCLUSIONS

This reclamation research program in the Grande Cache area has demonstrated that trees and shrubs can be introduced into a reconstructed area by various methods. The methods that are utilized for any specific location are dependent upon the end land use desired, the time frame allowed and specific site conditions. The options available in terms of techniques for establishment are as follows:

1. Trees

- container and bare root seedlings
- direct seeding
- natural invasion
- transplanting

2. Shrubs

- rooted cuttings
- direct planted cuttings
- direct seeding
- natural invasion
- transplanting

LITERATURE CITED

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PROCEEDINGS

ALBERTA RECLAMATION CONFERENCES

1985
Planning and Certification
of Land Reclamation
April 16-17, 1985
Edmonton Inn, Edmonton

1986
Reclamation in the
Eastern Slopes of Alberta
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