RESTORATION IN NORTHERN ENVIRONMENTS

USE OF SEA LYME GRASS

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ABSTRACT

Following Hydro-Quebec's decision not to proceed with a hydroelectrical project near the Hudson Bay, it was further decided to improve the bare site of the exploration camp and to restore it to its original state by planting green plants that harmonize with the local vegetation.

This called for a special technique, since the area is situated on the shoreline and has the following distinctive characteristics: a northern location, proximity to the sea, vulnerability to wind erosion and a particular soil texture and composition.

Therefore, when formulating a method for restoring the area to its natural state, we sought the most economic technique and took into consideration the characteristics of the terrain.

The first step was to determine the kind of plants that could be introduced at such a location. A review of the existing literature and an inventory of the local vegetation led us to the conclusion that sea lyme grass (*Elymus arenarius*) would be the best plant for restoring the terrain to its natural condition.

The technique selected for our work on the site was transplantation which we felt was the most suitable and effective method for a northern environment. Plants growing in a similar environment were dug up and replanted in the area to be restored, using the following three types of replanting: the replanting of clods, of individual plants and of clumps or tufts.

The transplantation was carried out in Summer 1983 and assessment of the results was made during the Summers of 1984 and 1985.

The operation seems to have been highly successful with more than 95% of the plants surviving transplantation. Examination of individual plants showed excellent development of the root systems and, in several cases, propagation by the rhizomes had begun.

This experience enables us to envisage the improvement of other disturbed areas in the north. For example, there are frequent problems with unstable sand near native villages. Although different plant species might be introduced, depending on the constituents of the environment, the principal replanting techniques could nevertheless be used.

INTRODUCTION

Because construction work inevitably causes soil disturbance, appropriate mitigation measures must be planned to restore the site after it closes.

Hydro-Quebec has developed a site-restoration technique for use in northern environments, which uses the fast-spreading plant known as sea lyme grass (*Elymus arenarius*) and the method of replanting.

This technique allows labour to be hired locally, and thus reduces the costs. Both the technique and its success rate have proved significant.

We are convinced that this technique could be adapted to other plants specific to Canada's northern regions.

THE PROBLEM

Hydro-Quebec has several active hydroelectric development projects in northern Quebec that involve the construction of power stations and of dikes modifying the normal course of rivers. These major projects inevitably disturb the initial soil structure and appropriate mitigation measures are therefore planned from the start of work: minimizing wood clearing, reducing disturbance to sensitive soil areas such as river banks and erodible zones, and conserving the existing organic matter. In order to speed up the reconstitution of the disturbed areas, the sites are restored and replanted after closure.

The environmental problem is compounded if the territory lies north of the 50th parallel. This distribution of the plants Hydro-Quebec generally uses for restoration and landscaping in the south is such that they cannot be used for replanting in the north. Most of the several million plants put into the ground at James Bay were green alder (*Alnus crispa*), planted to restore borrow pits, camp sites, erosion-sensitive zones, and sectors in which visual impact was noticeable. The replanting technique was well developed and its results were very significant.

Hydro-Quebec frequently has to perform restoration work in small areas in northern or very disturbed environments far from suitable plant production centres. Today, it is my intention to discuss one such case in particular.

THE WORK

The Site

The sector I wish to discuss is near the coast of Hudson's Bay at the Inuit village of Kuujjuarapik. Prior to 1983, Hydro-Quebec had carried out some work towards setting up a camp. There was no organic matter, as the site lay immediately on Hudson's Bay and the ground covering consisted almost entirely of sand.

A suitable technique for restoring this site and a type of plant had to be chosen in light of the location's particular features: its northern situation, its closeness to the sea, its exposure to high winds, its sensitivity to erosion, the texture and composition of the soil, the distance from plant production centres, and finally the fact that access was by plane only. It was also obviously necessary to find a restoration method that was economically acceptable.

Choosing a Restoration Method

The first step was to identify species that could be planted in this environment. Review of the literature and an inventory of vegetation in the area indicated that sea lyme grass (*Elymus arenarius* L.) would be suitable for our purpose.

Sea lyme grass is a large and very hardy stoloniferous plant found on the seashores of a number of countries. As it propagates by means of stolons, or runners, it invades and stabilizes the soil very rapidly. Although *Elymus arenarius* only grows in sea sand, other species such as *E. wiegandii*, *E. canadensis*, and *E. virginicus* that have similar properties could be used depending on the environment.

After debris was removed and the ground roughly levelled to prepare the site, several options were considered for introducing the sea lyme grass. One was to collect seeds at the appropriate time, conduct germination tests, keep the seeds, and produce young specimens under glass for planting the following year. Although valuable, this technique requires substantial financial outlay and a lot of time, while its results are almost entirely dependent on the plant's germination capacity.

Another solution was to reproduce the sea lyme grass vegetatively by using stolons to produce plants as hardy as those already growing at the site. Vegetative reproduction requires a sizeable infrastructure and significant amounts of time. Both techniques would be suitable for cases in which significant numbers of plants have to be produced.

However, given the restricted size of the sites to be restored, their northern location, the time constraints, and the machinery available, the most logical, most promising, and above all most economical technique was to introduce the sea lyme grass by replanting.

Work Methods

After debris was removed and the ground roughly levelled to prepare the site, three replanting methods were used:

- replanting clods
- individual replanting
- replanting clumps

Replanting Clods

A loader-type tractor was used to remove 2x2 m slabs of sea lyme grass from places where it was plentiful and where the impact of removing it would be minimal. These slabs were then hauled to the planting site in a trailer. Workers cut the slabs into clods about 30 cm in diameter before planting them approximately one meter apart.

This technique enabled us almost entirely to avoid damage to the roots during the transplanting operation, but the transportation from the extraction site to the replanting site and the handling proved limiting factors.

Individual Replanting

One crew removed plants from a site where the sea lyme grass grew in abundance, while pairs of employees replanted them one meter apart.

The plants were dug up individually to avoid damaging their roots, and kept in containers of water until replanting, so that the rhizomes would not dry out.

This technique can be performed very quickly, but requires great dexterity on the part of the employees digging up the plants, as the roots are very frail. The success of the transplanting operation obviously depends on the quality of the plants and the time lag between extraction and replanting.

Replanting Clumps

This operation is similar to that just described, except that the plants are planted in clusters usually consisting of three to five specimens.

Although a little slower than individual replanting, this technique minimizes error during extraction, and there is a greater probability that at least one plant out of a group will propagate.

Because it involves living material with bare roots, replanting of this type demands a relatively high level of care on the part of employees. Even though sea lyme grass is very hardy, a staff that works carefully and is aware of the potential problems can make all the difference between success and failure.

After the planting, the ground was covered with vegetable matter (straw) to stabilize the soil around the plants, and snow fences were erected on the windward side to minimize wind erosion. Notices were placed at strategic points to encourage local people to enter the site as little as possible.

Description of Work

The following data is offered as a guide only, as the work at

Kuujjuarapik was experimental in nature. It would be difficult to extrapolate from this project the level of productivity that could be achieved in large-scale projects.

Materials used - A loader-type tractor used to dig up the slabs of sea lyme grass and equipped with a trailer for hauling them to the planting site.

- Spades, buckets for transporting individual plants, straw, snow fences

The work was performed from July 12 to 19, 1983, over an area of about 2 ha.

Six native people were hired for the work period to dig up and replant the grass. One employee drove the tractor, and a foreman supervised the work.

RESTORATION RESULTS

Summer 1984 Results (1 year later)

A first evaluation in the summer of 1984 showed that the results of the restoration work were excellent. More than 95% of the plants had survived transplantation. Visual examination of individual plants showed excellent development of the root systems, and in several cases propagation by the rhizomes had begun. It is normal for the plant to develop a large root system during the first year rather than a stalk above ground.

Comparison of the three restoration techniques showed that none had a greater success rate than the others. There was a difference, however, in the visual effect: clods produced better coverage of the terrain than individual plants. On the other hand, wind erosion had tended to remove soil from the clods, and careful transplantation is therefore indicated.

The mulch did not give the results hoped for as it was quickly dispersed by the winds. The fences nevertheless appeared to have minimized the wind erosion and dissuaded the village residents from using the site.

Summer 1985 Results (2 years later)

A second assessment of the results, in the summer of 1985, revealed a number of points:

- The root systems of the sea lyme grass were becoming increasingly developed, especially in specimens planted individually or in clumps.

- Propagation by rhizome was more common among all the specimens. Up to ten secondary plants were found growing from one plant.

- There was a significant plant loss rate in one sector, the one most exposed to the dominant winds, and where vehicle traffic appeared to have been common. Future visits will show whether the plants are completely dead or whether only the stalks are affected.

This second visit once again showed the excellence of sea lyme grass in establishing itself and invading the soil. It did, however, also indicate that this plant is very sensitive to human activity: terrain restored by means of this grass should be kept free of traffic.

Other plants associated with sea lyme grass were also found to be present, indicating the excellence of the replanting. These were:

Bluebell (*Campanula rotundifolia* L.)
Common yarrow (*Achillea millefolium* L.)
Fireweed (*Epilobium angustifolium* L.)
Green alder (*Alnus crispa* Ait.)
Three-toothed cinquefoil (*Potentilla tridentata* Ait.)

These plants were all found near the specimens replanted in 1983.

RECOMMENDATIONS

This experiment indicates how a number of disturbed northern sites should be managed. The work performed near native villages causes soil instability problems (earthworks, borrow pits, etc.). Although the species of plant may vary depending on the local environment and how far north the site lies, the following recommendations can be made:

- When earthworks are performed, islands of vegetation should always be reserved to serve later as a source of suitable plants.

- Fast-spreading species should always be used in restoration work, if possible that are already present nearby.

- Replanting appears to be qualitatively and economically preferable for projects involving small areas of land.

With respect specifically to sea lyme grass, we recommend the following:

- Choosing the replanting mode that best suits the visual effect and speed of propagation required.

- Always performing the work at the beginning of the growth season.

- Ensuring that the workers are conscientious and are given the minimum training for this type of work (work techniques, awareness of how to handle living material).

- Banning traffic from the site of work.

CONCLUSION

The technique of using sea lyme grass as a fast-spreading plant could be adapted for several other species used in northern Canada. It requires very little machinery, can easily be performed by locally hired people, allows use of plants adapted to the local environment, can be performed at very reasonable cost, and above all has a very good success rate.

It obviously has limitations: some plants withstand the shock of transplantation very poorly, so the species must be chosen with care.

The technique of replanting is however very advantageous for small areas of land and for regions where plant supplies are difficult to obtain.

Hydro-Quebec hopes that the sea lyme grass technique it has tested will be used elsewhere in Canada, and would be happy to share the experience it has acquired in the field of environmental restoration in the north.

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TABLE OF CONTENTS

FOREWORD

The British Columbia Chapter of the Canadian Land Reclamation Association was formed in 1985 to provide a local public forum for the exchange of information and experience in land rehabilitation. Comprised of professionals from a wide range of backgrounds and interests, this organization pulled together quickly to host the 1986 Annual Meeting. The diverse membership in the B.C. Chapter was realized in a program that expanded the scope of the conference to include many fields that have not been represented in past programs. The quality of presentations and range of topics kept audience participation at a spirited level. It is our hope that we have initiated a trend to widen the scope of the annual meetings so as to not focus on traditional mining or energy development issues.

I wish to thank all speakers and attendees for making this first formal function of the B.C. Chapter a success. The enthusiastic support of chapter members in the planning and administration of the conference demonstrated a strong desire for a quality meeting. This drive bodes well for the future of our chapter.

A great deal of effort went into the publication of the proceedings of the 1986 Annual Meeting. Care was taken to accurately reproducce all papers, however minor errors may have escaped the review process. We hope that this will not detract from the information presented by the authors.

May the CLRA and all local chapters continue to grow and function as a focal point for land rehabilitation.