Final Report
for the
Bank Revegetation Program
Bethel Small Boat Harbor

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INTRODUCTION

The Alaska Plant Material Center's (APMC) Conservation Plant Program screens plant materials for use in erosion control, revegetation, mine reclamation, windbreaks, and habitat restoration. Part of the advanced testing of the evaluation process involves testing promising species on a wide range of disturbed lands. Cooperative efforts between State and Federal agencies, private industry, and the APMC provides the opportunity to test these plant materials on small areas in need of revegetation.

The Alaska District, Corps of Engineers (COE) has constructed a small boat harbor in the Lousetown Slough area, just outside of Bethel's easterly limits. The slough area and harbor provides access to the Kuskokwim River and allows shallow-draft riverboats to be beached and secured along the flattened harbor banks. The harbor banks consist of a 1-vertical to 10-horizontal slope and are the primary area of consideration under this scope of work (Figures 1 and 2).

A cooperative agreement between the U. S. Army Corps of Engineers and the APMC regarding the revegetation of the Federal portion of the Bethel Small Boat Harbor (Figure 3) was to provide an opportunity to test the performance of selected plant materials suitable for shoreline revegetation as well as enhance the usability of the area.

Three major goals were outlined for the project; they included:

1. To enhance the usability and appearance of the shoreline by stabilizing it with vegetation.
2. To demonstrate the erosion control potential of three native grass species; Deschampsia beringensis, Bering hairgrass var. 'Norcoast', Beckmannia syzigachne, American Sloughgrass var. 'Egan', and Elymus arenarius, Beach wildrye.
3. To evaluate the suitability of approximately 36 species for use in the revegetation of water resource development projects in Alaska.

METHODS

The plantings at the small boat harbor provided opportunities to evaluate the performance of different grass species and planting techniques in a wetland environment subject to tidal influence. The two-acre site was divided into sections (Figure 3), each of which was planted using a different combination of species and techniques. The species and planting techniques used for each section follow.

Areas A, E, and F:

The substrate in the area was prepared for planting by raking the surface with a garden rake (Figure 4). After raking, the grass seed was broadcast with a cyclone seeder. Once the seed was sown, the surface was lightly compacted with a 30-inch wide lawn roller that was partially filled with water.

Area A was seeded with an equal mix, by weight, of 'Egan' Sloughgrass and 'Norcoast' Bering Hairgrass at a rate of approximately ten pounds to the acre.

Areas E and F were seeded with pure 'Egan' Sloughgrass and 'Norcoast' Bering Hairgrass, respectively. Areas E and F were also seeded at a rate of ten pounds to the acre.

Area B:

Area B was planted with 150 sprigs of Elymus arenarius, Beach Wildrye, on three-foot centers. The plant material was separated into sprigs at the Plant Materials Center in Palmer, transported to Bethel and planted. A sprig consisted of at least one shoot and some root mass. The sprigs were kept moist until planting. A sprig was planted by sticking it into the soft substrate, or by digging a small hole, placing the sprig into the hole, pulling soil back around the sprig, and then tamping it into place. Nothing was used to secure it in place. Afterwards, the area was broadcast seeded with the mix of 'Egan' Sloughgrass and 'Norcoast' Bering Hairgrass. The seedbed was not raked or compacted.

Area C:

Area C was selected for the evaluation planting. Thirty six species (Appendix A) were planted in twenty-foot rows, two feet on center. The rows were placed perpendicular to the water level. At mean water levels, approximately half of the row was under water and the other half was above water. The rows were prepared by making one half-inch deep trenches with a hoe, putting the seed in the trench, and then pulling the soil back over the trench and tamping it lightly into place.

Areas D, G, and H:

These areas were broadcast seeded with a 50-50 mix of 'Egan' Sloughgrass and 'Norcoast' Bering hairgrass at a rate of ten pounds to the acre. The ground surface exhibited sufficient cracking and microtopography to form microsites for seed germination and establishment. In a few small areas within area G where microtopographical variation was lacking, the ground was compacted with the lawn roller after the seed was sown.

The planting phase of the revegetation program for the Bethel Small Boat Harbor occurred from May 14 - 16, 1984.

Evaluations of the plantings occurred at the end of the first growing season on August 22, 1984 and again on September 5, 1985 at the end of the second growing season. Usually the first season's growth is evaluated for vigor; percent cover, and general observations are noted. After the second season, measurements are repeated and the evaluation plot is also measured for height of foliage and inflorescence. The Bethel Small Boat Harbor was severely disturbed shortly after planting, so evaluations were limited to general observations.

RESULTS AND DISCUSSION

Bethel residents began using the small boat harbor within two weeks after the planting was completed (Figure 5). Although much of the planting was destroyed, some information was gained from the revegetation work.

Timing is an important component of any revegetation project and the small boat harbor project was no exception. Several aspects of timing were critical on this project: 1) the planting needed to be completed in sufficient time so that the plants could become well established before the site was used; 2) the planting needed to be completed before July 15 so that the plants would gain enough maturity to survive the winter; and 3) planting needed to coincide with a period of low tides so that the maximum surface area would be exposed for planting.

The planting dates were May 14 - 16, 1984, and May 14 also happened to be the official date that the Kuskokwim River broke up. Fortunately no flooding was associated with break-up. The seasonal timing selected for the planting was good. The Bethel Small Boat Harbor is affected by the daily tides. We chose the first period of low tides that occurred at the beginning of the growing season for planting. An unanticipated advantage of these early planting dates was that only the top two inches of the soft, mucky substrate were thawed and underneath was a solid layer of ice. The ice layer provided support and allowed us to walk on an area that otherwise would have been very difficult to walk on.

Unfortunately, the major failure in timing occurred because the harbor was opened for public use shortly after the planting was completed. The harbor had been completed in sufficient time in 1983, so that planting could have occurred before July 15, 1983 and have become well established before the harbor was opened.

As was described in the methods section, several planting techniques were used in different areas of the small boat harbor. Although it is difficult to compare the success of these techniques, it is possible to comment on the feasibility of the techniques.

Often a seedbed is scarified before the seed is broadcast. At Bethel, areas were raked before they were planted. Raking was not the best method for scarifying the soft, wet soil found in the small boat harbor. Raking the soil was difficult; the soil would stick to the rake and plug the teeth. The soil then needed to be knocked clear from the rake. The process was time consuming and inefficient. However, since the area was influenced by the tide and waves generated by boat traffic, some steps needed to be taken to ensure that the seed would remain in place long enough for it to germinate. An alternative method for scarifying the surface would be to run a three-wheeler or some other lightweight all-terrain vehicle over the area (Figures 6 and 7).

After the seedbed was prepared, seed was broadcast and then the surface was compacted with a lawn roller. Difficulties were also encountered using the roller. The substrate was so sticky that it would adhere to the roller. The roller had to be scraped clean every 100 feet or so. Again, an alternative worth consideration would be to use a three-wheeler to compact the site after seeding.

If microsites already exist, then scarification probably is not necessary. Area G was seeded using the cyclone seeder and cover was estimated to be 80 percent or more after two season's growth (Figure 8). Simply broadcasting the seed without scarification or compaction is the easiest revegetation method, but it may be risky if there is no assurance that the seed will remain in place.

Even in those areas where the ground was raked and compacted, some seed was picked up during high tide and left at the high tide line. Some movement of the seed is probably unavoidable. However, the soil was sticky enough that most of the seed appeared to remain in place, at least for the three days that the planting crew was at the site.

The shallow trenches prepared for the evaluation plot kept the seed in place. In August, 1984, small sections of the grass rows which had not yet been disturbed, supported grass that was a couple of inches tall. Markers outlining the plot and naming the rows had been destroyed so it was impossible to tell which species had survived the summer. No signs of the grass were visible in 1985. Planting seed in shallow trenches is very labor intensive, effective in keeping seed in place, and produces a specific pattern to the planting that may or may not disappear after several years. Other planting methods such as broadcast seeding and sprigging appear to be more suitable.

Sprigging is a planting method commonly used in many wetland restoration projects. Species that spread vegetatively and can be easily divided into small planting units are selected for this planting method. Sprigging is more labor intensive than broadcast seeding, but the plants are more likely to remain in place than seed, particularly in conditions with moderate wave energy.

In May, 1984, 150 Beach Wildrye sprigs were planted and by August only five could be found. No sprigs were located in 1985. The area that had been selected for planting sprigs was used heavily for parking boats. Although the performance of Beach Wildrye could not be evaluated, we can state that planting the sprigs proceeded quickly and smoothly. The substrate at the boat harbor was soft and easy to plant and the sprigs were easy to work with.

Fertilizer was not broadcast over any of the planting area because it would wash away before the seed could germinate and the young plants could benefit. Fertilizer spikes could have been placed adjacent to the Beach Wildrye sprigs, but they were not used. Fertilizer spikes or tablets should be used in the future when vegetative material is planted.

Although the federal portion of the small boat harbor was severely disturbed shortly after planting, the seeding effort did appear to enhance revegetation of the area (Figures 8 and 9). Native populations of Sloughgrass had been observed at the site before planting and during the first growing season. These Sloughgrass populations increased, particularly along the upper and drier portions of the shoreline. Hairgrass had also been observed, but to a lesser extent in the area before planting. Hairgrass was also found in increased numbers at the site after two growing seasons, but it was not nearly as widespread as the Sloughgrass. Both Sloughgrass and Hairgrass appear to have been excellent grass choices for revegetating this site.

Native sedges, Carex sps., willows, particularly feltleaf willow, Salix alaxensis and a small mat-forming rush, Juncus sp., were reinvading the site in some of the lesser disturbed areas (Figure 10).

The revegetation, both natural and seeded, that occurred over two growing seasons helped to stabilize the shoreline. The vegetation did appear to be able to tolerate some stress caused by foot traffic and boats being drug upon the shore (Figures 10, 11, and 12). Vegetation usually did not provide a continuous cover, but frequently was widespread enough to provide some stability to the shoreline and improve the ability to walk on the shoreline (Figures 10, 13, and 14).

CONCLUSIONS AND RECOMMENDATIONS

The most valuable lesson to be learned from the Bethel Small Boat Harbor revegetation project is that an area must be revegetated and the plants allowed to become well established before the area is opened for public use. Planning at the outset of a project, should provide sufficient time for the revegetation aspect of the project. If time constraints exist that would not allow an entire area to remain undisturbed while the plants become established, then revegetation should occur in sections with each newly revegetated area blocked from public access until the plants have become well established.

Although it was impossible to effectively compare broadcast seeding and sprigging planting techniques; two planting methods, broadcast seeding and sprigging, appeared to be most suitable for the small boat harbor. Traditionally, sprigging or some technique using vegetative plant material, has been the preferred planting method for wetland areas. However, the Bethel Small Boat Harbor had sufficiently low enough wave energies that broadcast seeding, appeared to also be a satisfactory planting method. With broadcast seeding, the seed does need to be incorporated into the soil and some means other than raking and compacting the substrate would be preferred. Using a three-wheeler to go over the seedbed appears to be a good alternative. The tires on the three-wheeler provide microtopographical variation and lightly compact the surface.

Sprigging is a labor intensive planting method. Plant material must be harvested, separated into planting units, transported from harvest site to the planting site, and then planted. The time involved in each of these steps can vary depending upon the species of plant material and the site.

However, sprigging can provide vegetative cover quickly and could reduce the time needed to revegetate an area. Planting sprigs of a fast-growing species at relatively high densities, one to two feet on centers, may be the preferred method for planting a site that needs to be revegetated quickly.

In addition to planting sprigs of Beach Wildrye at the small boat harbor, a native rhizomatous sedge, Carex sp., was found growing at the end of one of the fingers. It would have also been a good candidate for the revegetation plan.

'Egan' American Sloughgrass and 'Norcoast' Bering Hairgrass were excellent choices for the broadcast seeding portion of the small boat harbor. Both are well adapted for the site. The wetter areas favored the establishment of Sloughgrass, while the drier areas favored Hairgrass. If a revegetation project were conducted again, Sloughgrass and Hairgrass would be selected for broadcast seeding, in addition to sprigging with native rhizomatous sedges.