

FINAL REPORT
GREEN'S CREEK MINE REVEGETATION
TEST PLANTINGS

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GREEN'S CREEK MINE REVEGETATION TEST PLANTINGS

Introduction:

In 1989, Green's Creek Mining Company began a cooperative program with the Alaska Plant Materials Center (PMC) to evaluate and select native plant species suitable for revegetation of mining related disturbances on Admiralty Island. Green's Creek Mining Company provided land for evaluation plots and the PMC provided seed and personnel to establish and evaluate the plantings. Cooperative efforts between industry and the PMC provide the PMC an opportunity to evaluate the performance of a variety of taxa at disturbed sites. At the same time, a specific revegetation seed mix is identified for the cooperator.

Methods:

Fifty taxa are usually planted in these evaluation plots, however at the Green's Creek site, the U.S. Forest Service restricted the plantings to taxa indigenous to Admiralty Island. As a result, 15 taxa were planted in each plot. Each plot measured 20 by 60 feet, and was subdivided into 16 smaller plots, each 4 by 10 feet. Each plot was broadcast seeded with a different accession at a rate of approximately 40 pounds to the acre. The spring plots were raked; raking increases the soil seed surface contact. Finally, the plot was fertilized with 20-20-10 fertilizer at an approximate rate of 450 pounds to the acre.

Plots are often established in the spring as soon as a site is accessible. In the last few years, fall plantings have also been tried. At Green's Creek, two spring plots were planted on May 24, 1989, and three fall plots were planted on October 6, 1989 (Figures 1, 2 and 3).

Of the evaluations, test plots are qualitative, based on a system which rates vigor on a scale from one to nine. One is the best rating and nine is the worst rating. When possible, this rating is determined by comparing different accessions of the same species. The rating is based on color, height, health, flowering and/or seed production, and on the evaluator's knowledge of the plant and its expected performance. If at all possible, evaluations are conducted annually for three growing seasons after the seedling year.

Plot Performance:

Although the spring plantings, Plots 1 and 2, were located adjacent to each other, Green's Creek personnel noted differences in plant growth between the two plots from the beginning (Tables 1 and 2). The plants in Plot 2 were not as vigorous as those in Plot 1. Later, Plot 2 was disturbed by heavy equipment and a portion of the plot was destroyed. The site is a former powder magazine and since Plot 2 occupies a more central location on the pad, the ground may have been more compacted than the Plot 1 site. Compact soils slow plant growth; however these sites can be scarified which will assist plant establishment and growth.

Figure 1. Green's Creek Mine Spring Plantings
Powder Magazine, Planted 5/24/89

Plot 1	Beach Wildrye <i>Elymus arenarius</i>	Gruening Alpine Bluegrass <i>Poa alpina</i>
	Norcoast Bering Hairgrass <i>Deschampsia beringensis</i>	Nortran Tufted Hairgrass <i>Deschampsia caespitosa</i>
	Sourdough Bluejoint Reedgrass <i>Calamagrostis canadensis</i>	Delta Bluejoint Reedgrass <i>Calamagrostis canadensis</i>
	Egan Sloughgrass <i>Beckmannia syzigachne</i>	<i>Calamagrostis inexpansa</i>
	Arctared Red Fescue <i>Festuca rubra</i>	Boreal Red Fescue <i>Festuca rubra</i>
	Highlight Red Fescue <i>Festuca rubra</i>	Pennlawn Red Fescue <i>Festuca rubra</i>
	Alyeska Polargrass <i>Arctagrostis latifolia</i>	Kenai Polargrass <i>Arctagrostis latifolia</i>
		Tilesy Sagebrush <i>Artemisia tilesii</i>
BREAK		
Plot 2	Beach Wildrye <i>Elymus arenarius</i>	Gruening Alpine Bluegrass <i>Poa alpina</i>
	Nortran Tufted Hairgrass <i>Deschampsia caespitosa</i>	Norcoast Bering Hairgrass <i>Deschampsia beringensis</i>
	Sourdough Bluejoint Reedgrass <i>Calamagrostis canadensis</i>	Delta Bluejoint Reedgrass <i>Calamagrostis canadensis</i>
	Egan Soughgrass <i>Beckmannia syzigachne</i>	<i>Calamagrostis inexpansa</i>
	Arctared Red Fescue <i>Festuca rubra</i>	Pennlawn Red Fescue <i>Festuca rubra</i>
	Plantings mixed repeated at end of plot	Highlight Red Fescue <i>Festuca rubra</i>
	Boreal Red Fescue <i>Festuca rubra</i>	Alyeska Polargrass <i>Arctagrostis latifolia</i>
	Kenai Polargrass <i>Arctagrostis latifolia</i>	Tilesy Sagebrush <i>Artemisia tilesii</i>
	Sourdough Bluejoint Reedgrass <i>Calamagrostis canadensis</i>	<i>Calamagrostis inexpansa</i>
	Nortran Tufted Hairgrass <i>Deschampsia caespitosa</i>	Pennlawn Red Fescue <i>Festuca rubra</i>

Figure 2. Green's Creek Mine Fall Plantings
Lower Site, Planted 10/06/89

Green's Creek Mix	Tilesy Sagebrush <i>Artemisia tilesii</i>
Boreal Red Fescue <i>Festuca rubra</i>	Highlight Red Fescue <i>Festuca rubra</i>
Pennlawn Red Fescue <i>Festuca rubra</i>	Arctared Red Festuca <i>Festuca rubra</i>
Kenai Polargrass <i>Arctagrostis latifolia</i>	Egan Sloughgrass <i>Beckmannia syzigachne</i>
<i>Calamagrostis inexpansa</i>	Alyeska Polargrass <i>Arctagrostis latifolia</i>
Delta Bluejoint Reedgrass <i>Calamagrostis canadensis</i>	Sourdough Bluejoint Reedgrass <i>Calamagrostis canadensis</i>
Nortran Tufted Hairgrass <i>Deschampsia caespitosa</i>	Norcoast Bering Hairgrass <i>Deschampsia beringensis</i>
Gruening Alpine Bluegrass <i>Poa alpina</i>	Beach Wildrye <i>Elymus arenarius</i>
Upper Site *	
Tilesy Sagebrush <i>Artemisia tilesii</i>	Green's Creek Mix
Highlight Red Fescue <i>Festuca rubra</i>	Boreal Red Fescue <i>Festuca rubra</i>
Arctared Red Fescue <i>Festuca rubra</i>	Pennlawn Red Fescue <i>Festuca rubra</i>
Egan Sloughgrass <i>Beckmannia syzigachne</i>	Kenai Polargrass <i>Arctagrostis latifolia</i>
Alyeska Polargrass <i>Arctagrostis latifolia</i>	<i>Calamagrostis inexpansa</i>
Sourdough Bluejoint Reedgrass <i>Calamagrostis canadensis</i>	Delta Bluejoint Reedgrass <i>Calamagrostis canadensis</i>
Norcoast Bering Hairgrass <i>Deschampsia beringensis</i>	Nortran Tufted Hairgrass <i>Deschampsia caespitosa</i>
Beach Wildrye <i>Elymus arenarius</i>	Gruening Alpine Bluegrass <i>Poa alpina</i>
* Some seed has mixed with other seed because water was flowing in the troughs that were formed when the site was scarified.	

Figure 3. Green's Creek Mine
Waterline Planting, 10/6/89

Tilesy Sagebrush <i>Artemisia tilesii</i>	
Highlight Red Fescue <i>Festuca rubra</i>	
Pennlawn Red Fescue <i>Festuca rubra</i>	
Boreal Red Fescue <i>Festuca rubra</i>	
Arctared Red Fescue <i>Festuca rubra</i>	
Egan Sloughgrass <i>Beckmannia syzigachne</i>	
Kenai Polargrass <i>Arctagrostis latifolia</i>	
<i>Calamagrostis inexpansa</i>	
Delta Bluejoint Reedgrass <i>Calamagrostis canadensis</i>	
Nortran Tufted Hairgrass <i>Deschampsia caespitosa</i>	
Norcoast Bering Hairgrass <i>Deschampsia beringensis</i>	
Gruening Alpine Bluegrass <i>Poa alpina</i>	
Beach Wildrye <i>Elymus arenarius</i>	

In 1991, no data was recorded for two species in Plot 1, however, data was recorded for those species in 1992. The plantings in question were adjacent to disturbed areas noted in 1990. Since these plantings are all red fescue cultivars, it is impossible to distinguish one cultivar from another, and by 1992 the fescues were growing well. Data from other sites suggest that 'Arctared' red fescue may be the cultivar that is growing the best. 'Gruening' Alpine Bluegrass has also done well; although cover has declined over the evaluation period, vigor is high and the plant has spread by seed from the original planting. All of the plantings have been overseeded with the Green's Creek seed mix.

By 1992, the plantings in Plot 2 could not be identified. The stakes were missing or had been moved; the site had been overseeded and the only species that was recognizable was the Gruening Alpine Bluegrass that had escaped from the original planting.

Only one of the three fall planting sites, the upper site, became established. No plant growth was observed on the water line planting. The lower planting site had compact soils, appeared to have been overseeded with the Green's Creek Mix and only hairgrass, 'Nortran' and/or 'Norcoast' appeared to be growing at the site, although they are not vigorous plants. No evaluations were made at these two latter sites.

In contrast, the upper fall planting site grew very well. The site was wet at the time of planting. Water was running downslope in the furrows left after the recent scarification. Despite the mixing that occurred during seeding, the plots provided useful information (Table 3). Somehow in 1991, no evaluations were made for the two Bluejoint Reedgrasses ('Sourdough' and *Calamagrostis canadensis* Delta) and then evaluations were made in 1992. It is not clear why these accessions were overlooked in 1991. Several accessions were performing well in this plot when final evaluations occurred in 1992, including Gruening Alpine Bluegrass, Norcoast and Nortran Hairgrass, Arctared Red Fescue and 'Kenai' Polargrass.

Recommendations:

Table 4 summarizes the final results of the plot evaluations. The recommendations for future seed mixes for Green's Creek are based on these results. Kenai Polargrass will not be available commercially for one or two years, and should be used in small quantities when it is incorporated into a seed mix since it performed well at only one site over the evaluation period. The following species are recommended for a seed mix at Green's Creek mine: Norcoast Bering Hairgrass, Nortran Tufted Hairgrass (also available after the 1994 growing season), Gruening Alpine Bluegrass, Arctared and 'Pennlawn' Red Fescue.

Table 1.

Green's Creek Mine, Plot 1		1989		1990		1991		1992		
	Spring Evaluations, Planted 5/24/89	Vigor	% Stand	Vigor	% Stand	Vigor	% Stand	Vigor	% Stand	
1	'Gruening' Alpine Bluegrass	5	45	4	75	3	25	1	20	1
2	Beach Wildrye	5	1	5	25	-	-	-	-	2
3	'Norcoast' Bering Hairgrass	4	50	3	75	3	80	-	10	3
4	'Nortran' Tufted Hairgrass	3	70	2	80	5	20	3	60	4
5	'Sourdough' Bluejoint Reedgrass	5	40	6	25	7	40	-	-	5
6	<i>Calamagrostis canadensis</i> (Delta)	3	75	5	30	-	-	-	-	6
7	<i>Calamagrostis inexpansa</i>	3	50	4	45	-	-	-	-	7
8	'Egan' American Sloughgrass	7	50	6	30	-	-	-	-	8
9	'Arctared' Red Fescue	5	35	9	15*	1	90	1	90	9
10	'Boreal' Red Fescue	1	98	1	98	-	-	3	60	10
11	'Highlight' Red Fescue	3	65	3	7*	3	70	2	50	11
12	'Pennlawn' Red Fescue	2	90	2	95	-	-	3	50	12
13	'Alveska' Polargrass	5	40	7	7	7	<10	-	-	13
14	'Kenai' Polargrass	3	75	5	7*	-	-	-	-	14
15	Tilesy Sagebrush	5	25	-	-	-	-	-	-	15
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* Disturbed

Table 2.

Green's Creek Mine, Plot 2		1989		1990		1991		1992		
	Spring Evaluations, Planted 5/24/89	Vigor	% Stand	Vigor	% Stand	Vigor	% Stand	Vigor	% Stand	
1	'Gruening' Alpine Bluegrass	5	30	4	50	3	20	-	-	1
2	Beach Wildrye	-	-	7	40	5	40	-	-	2
3	'Norcoast' Bering Hairgrass	5	25	2	50	4	40	-	-	3
4	'Nortran' Tufted Hairgrass	7	10	4	30*	5	15	-	-	4
5	'Sourdough' Bluejoint Reedgrass	-	-	-	.*	-	-	-	-	5
6	<i>Calamagrostis canadensis</i> (Delta)	-	-	-	.*	-	-	-	-	6
7	<i>Calamagrostis inexpansa</i>	-	-	-	.*	-	-	-	-	7
8	'Egan' American Sloughgrass	-	-	-	.*	-	-	-	-	8
9	'Arctared' Red Fescue	-	-	-	.*	-	-	-	-	9
10	'Boreal' Red Fescue	5	15	4	30	-	-	-	-	10
11	'Highlight' Red Fescue	5	60	3	70	-	¹	-	-	11
12	'Pennlawn' Red Fescue	-	-	-	-	-	-	-	-	12
13	'Alveska' Polargrass	5	20	5	20	-	-	-	-	13
14	'Kenai' Polargrass	9	10	4	15	-	-	-	-	14
15	Tulesy Sagebrush	7	10	6	<10	-	-	-	-	15
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17	Extra plantings for Plot 2:									17
18	'Sourdough' Bluejoint Reedgrass	-	-	7	40	-	-	-	-	18
19	<i>Calamagrostis inexpansa</i>	7	10	4	40	-	-	-	-	19
20	'Nortran' Tufted Hairgrass	7	15	4	30	4	30	-	-	20
21	'Pennlawn' Red Fescue	5	30	3	40	3	30	-	-	21
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23	¹ A fescue is present and appears to be growing well, but it is unclear which variety it is - Highlight or Pennlawn.									23
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* Disturbed

Table 3.

Green's Creek Mine, Upper Plot		1990		1991		1992		
	Spring Evaluations, Planted 5/24/89	Vigor	% Stand	Vigor	% Stand	Vigor	% Stand	
1	'Gruening' Alpine Bluegrass	1	80	1	100	1	30	1
2	Beach Wildrye	-	-	-	-	-	-	2
3	'Norcoast' Bering Hairgrass	1	100	1	100*	1	90	3
4	'Nortran' Tufted Hairgrass	3	50	1	100	1	90	4
5	'Sourdough' Bluejoint Reedgrass	3	40	-	-	3	50	5
6	<i>Calamagrostis canadensis</i> (Delta)	1	60	-	-	4	30	6
7	<i>Calamagrostis inexpansa</i>	3	30	-	-	-	-	7
8	'Alyeska' Polargrass	3	70	-	-	3	75	8
9	'Kenai' Polargrass	1	75	1	70	1	70	9
10	'Egan' American Sloughgrass	3	70	3	50	-	-	10
11	'Arctared' Red Fescue	2	35	3	70	1	65	11
12	'Pennlawn' Red Fescue	1	50	1	90	3	50	12
13	'Boreal' Red Fescue	2	30	2	80	4	40	13
14	'Highlight' Red Fescue	3	25	3	60	3	30	14
15	Tulesy Sagebrush	5	<10	-	-	-	-	15
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* Best of Hairgrasses.

Table 4.

Summary of 1992 Plot Evaluations		Spring Plot 1		Fall Upper Plot		
		Vigor	% Stand	Vigor	% Stand	
1	'Gruening' Alpine Bluegrass	1	20	1	30	1
2	Beech Wildrye	-	-	-	-	2
3	'Norcoast' Bering Hairgrass	-	10	1	90	3
4	'Nortran' Tufted Hairgrass	-	-	1	90	4
5	'Sourdough' Bluejoint Reedgrass	-	-	3	50	5
6	<i>Calamagrostis canadensis</i> (Delta)	-	-	4	30	6
7	<i>Calamagrostis inexpansa</i>	-	-	-	-	7
8	'Alyeska' Polargrass	-	-	3	75	8
9	'Kenai' Polargrass	-	-	1	70	9
10	'Egan' American Sloughgrass	-	-	-	-	10
11	'Arctared' Red Fescue	1	90	1	65	11
12	'Pennlawn' Red Fescue	3	50	3	50	12
13	'Boreal' Red Fescue	3	60	4	40	13
14	'Highlight' Red Fescue	2	50	3	30	14
15	Tulesy Sagebrush	-	-	-	-	15
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