Final Report on the Evaluation of Advanced Herbaceous Conservation Species at the Premier Coal Mine Near Palmer, Alaska 1983 - 1986

Prepared by

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April, 1987

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Introduction:

The Conservation Plant Project at the Alaska Plant Materials Center (PMC), a section of the Alaska Department of Natural Resources, is responsible for developing new plant varieties (cultivars) for land reclamation, habitat enhancement, and erosion control. In addition to the development of new plant varieties, this project also is responsible for developing techniques for erosion control and reclamation, and to provide technical assistance to industry so that this technology is used properly. In order to accomplish these goals, it is beneficial for the PMC to work with industry. Resource extraction industries usually have disturbances on which these new varieties or techniques can be tested and demonstrated.

Purpose:

Mining and Industrial Evaluation Plots are usually designed for reclamation and/or erosion control and are located in diverse geographical and ecological locations. The plots are developed in a manner consistent with the cooperators' intended final management practice, i.e., "Fertilize it once and forget about it." The practice of minimal maintenance is generally necessary for industry to eliminate costly yearly maintenance programs. Therefore, the plots are established with minimal surface preparation and are fertilized only at the time of planting. The plantings are then evaluated for their ability to survive on these harsh sites with no maintenance. Top soil is not used, and the plantings are made on the substrate that is expected to be available when reclamation occurs.

These plots also serve as an advanced evaluation of plant materials that have been selected at the PMC for their outstanding performance. In addition, the program also evaluates new techniques for planting and maintenance which may make the entire reclamation or erosion control process more cost effective.

The cooperator is allowed to set some of the parameters in the testing procedures, so that the test will provide useful data for the cooperator's particular conditions or regulatory guidelines. These plots also allow the PMC to make meaningful recommendations when similar conditions are encountered by someone other than the original cooperator. This class of evaluation plots probably provides the most important and useful information to the Conservation Plant Project.

Methods

On June 30, 1983, 48 accessions of advance test plant material were planted at the request of Hawley Resources at or near the Premier Mine Site. The two blocks of the 1983 array of accessions (Figure 1) were planted without Glaucus Bluegrass T08867 and Alpine Bluegrass 236491. Seed supply for those two species was limited, and therefore they were not included in the planting.

One block was planted at the Exploration Camp Site. This area contained highly compacted gravel and served as a parking and staging area. The other block was planted on a newly cleared exploration drill pad. This site's surface material consisted of tightly compacted, loamy soil. Each plot, was hand-seeded with pre-measured amounts of seed. The seeding rates of each plot were approximately 40 pounds per acre.

Typical Plot Layout

Figure 1.

Following seeding, the entire plots were fertilized with 20-20-10 fertilizer at a rate of 450 pounds per acre (90 pounds actual nitrogen, 90 pounds actual phosphorus, and 45 pounds actual potash). After each plot was seeded and fertilized, the area was raked by hand to incorporate the seed and fertilizer.

In addition to the two herbaceous plots, 75 dormant willow bundles were planted at the Premier Mine to test the feasibility of using this technique on mined land. These bundles represented four species: Feltleaf willow, Barrenground willow, Barclay willow and Scouler willow.

These willow were planted on a slope adjacent to Moose Creek. Unfortunately, the slope failed, destroying the planting. This slope was recontoured and replanted with rooted willow and dormant bundles on July 16, 1984.

The final herbaceous plot to be planted at the Premier Mine site was established on May 29, 1984. This two-acre seeding consisted of a mix of native species, composed of the following varieties. The following proportions are based on weight:

Siberian Wild rye 345600	56%
'Arctared' Red Fescue	25%
'Norcoast' Bering hairgrass	12%
'Alyeska' Polar Grass	6%
Artemesia tilesii T12052	.75%
Bluejoint 'Common'	.25%

This mix was seeded at the rate of 40 pounds per acre, and fertilizer (20-20-10) was applied at the rate of 450 pounds per acre. Both the seed and fertilizer were applied with hand operated broadcast seeders. Neither the seed nor fertilizer was incorporated into the soil after application.

Advanced evaluation plots are evaluated at least once a year. The Drill Pad site was not evaluated in 1985 because trail conditions to the site did not permit access. The accessions are rated for vigor, percent stand, and numerous other factors such as hardiness, disease resistance, and related characteristics. However, we have found that vigor and percent stand are reliable indicators of how the different accessions compare with each other.

Figure 2 is an example of the evaluation sheets that will be presented in this report. The following numbers, followed by brief explanations, correspond to numbers on the example evaluation sheet:

1. Location and title of evaluation plot.

2. Number of evaluation blocks--This number may range from one to three blocks.

3. Year of Record--the year that evaluation data was collected.

4. Vigor--this number can range from one to nine. One is best and nine is the worst rating. If possible, this rating is determined by comparison with other 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 more than one block is planted, this number will be an average of the ratings for each block.

5. Percent Stand--this number represents the percentage of the ground that is covered by the accession. Only live plant material is included; litter from previous year's growth and other species are not included. If more than one block is planted, this number will be an average of the ratings for each block.

6. The accession that is being rated. The accession is identified by its varietal and common name or its common name and its accession number.

1	3									
	2 # of Blocks	4	5							
1	6									1
2	'Merion' Kentucky Bluegrass									2
3	'Banff' Kentucky Bluegrass									3
4	'Park' Kentucky Bluegrass									4
5	etc.									5
6										6
7										7
8										8
9										9
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51										51
52										52

Figure 2. Sample Advanced Evaluation Page.

Results

Year by year evaluation results for the evaluation blocks can be seen on pages 9 and 10 of this report. This data will suggest to the reader that certain species or varieties are not at all suitable for use in this area. This conclusion is only partially true. Both sites were used as parking areas during hunting seasons. This activity probably explains the poor performance of some suitable accessions, and may have caused the destruction of others. Also, the Drill Pad plot showed signs of heavy grazing by horses.

By July 18, 1986, the best performance of all the grasses in the evaluation blocks, were recorded for the following accessions:

Camp plot - 'Alyeska' Polar grass
'Manchar' Smooth Brome
'Sourdough' Bluejoint
'Engmo' Timothy
'Arctared' Red Fescue

Drill Pad - 'Arctared' Red Fescue
'Norcoast' Bering Hairgrass
'Engmo' Timothy

Valley Coal Drill Pad Site		83		84		86				
	1 Block of Plantings	vigor	% stand	vigor	% stand	vigor	% stand			
1	'Nugget' Kentucky Bluegrass	3	90	7	70	5	90			1
2	'Merion' Kentucky Bluegrass	5	85	5	50	–	–			2
3	'Banff' Kentucky Bluegrass	5	80	7	33	–	–			3
4	'Park' Kentucky Bluegrass	7	40	9	30	–	–			4
5	'Sydsport' Kentucky Bluegrass	3	95	7	80	–	–			5
6	'Fylking' Kentucky Bluegrass	1	95	5	25	–	–			6
7	'Troy' Kentucky Bluegrass	7	50	7	60	–	–			7
8	Big Bluegrass 387931	5	60	7	30	–	–			8
9	'Sherman' Big Bluegrass	1	100	3	20	–	–			9
10	'Canbar' Canby Bluegrass	3	80	7	75	–	–			10
11	'Reubans' Canada Bluegrass	1	100	3	60	–	–			11
12	'Tundra' glaucus Bluegrass	7	80	7	20	–	–			12
13	Glaucus Bluegrass T08867									13
14	Alpine Bluegrass 235492, 236892									14
15	'Sodar' Streambank wheatgrass	3	75	–	–	–	–			15
16	Bearded wheatgrass 371698	7	75	3	40	–	–			16
17	Bearded wheatgrass 236693	5	40	7	20	–	–			17
18	'Nordan' Crested wheatgrass	3	50	7	10	–	–			18
19	'Fairway' Crested wheatgrass	1	90	7	30	–	–			19
20	'Summit' Crested wheatgrass	3	75	5	60	–	–			20
21	Violet wheatgrass T12050	7	50	3	20	–	–			21
22	Boreal wheatgrass T12048	7	60	5	25	3	60			22
23	Yukon wheatgrass T12051	7	60	5	45	–	–			23
24	'Critana' Thickspike wheatgrass	5	40	7	30	–	–			24
25	'Fults' Alkaligrass	3	50	9	20	–	–			25
26	'Vantage' Reed Canarygrass	1	100	1	75	7	50			26
27	'Engmo' timothy	1	100	3	75	5	75			27
28	'Climax' timothy	–	–	–	–	–	–			28
29	Beach wildrye 345978	–	–	–	–	–	–			29
30	Siberian wildrye 345600	7	90	7	30	5	40			30
31	Siberian wildrye 2144	5	50	7	45	5	30			31
32	Siberian wildrye 1996	3	80	3	75	3	60			32
33	'Norcoast' Bering hairgrass	3	85	3	50	1	80			33
34	Tufted hairgrass 372690	1	85	–	–	1	100*			34
35	Bluejoint	7	50	7	40	5	40			35
36	'Sourdough Bluejoint	1	80	7	50	7	100			36
37	Meadow foxtail	3	100	5	70	–	–			37
38	Geniculated foxtail 314565	1	100	7	25	–	–			38
39	Garrison Creeping foxtail	3	90	7	50	–	–			39
40	'Arctared' Creeping red fescue	3	85	3	60	3	80			40
41	'Boreal' Creeping red fescue	1	100	4	80	7	70			41
42	'Pennlawn' Creeping red fescue	1	100	5	40	5	80			42
43	Rough fescue 236849	3	90	5	50	7	90			43
44	American Sloughgrass T12053	7	95	5	30	–	–			44
45	'Durar' Hard fescue	5	85	7	40	7	80			45
46	'Highlight' Sheep fescue	1	100	5	80	9	100			46
47	'Covar' Sheep fescue	1	50	7	10	–	–			47
48	'Manchar' Smooth Brome	1	90	5	50	7	80			48
49	'Carlton' Smooth Brome	3	90	5	70	–	–			49
50	'Alyeska' Polar grass	5	50	5	20	–	–			50
51	Tellesy Sage T12052									51
52										52
	* Possibly Norcoast from adjacent plot.									

Figure 3.

Valley Coal Camp Site		83		84		85		86		
	1 Block of Plantings	vigor	% stand	vigor	% stand	vigor	% stand	vigor	% stand	
1	'Nugget' Kentucky Bluegrass	3	20	5	40	7	70	9	5	1
2	'Merion' Kentucky Bluegrass	5	30	5	80	5	60	–	–	2
3	'Banff' Kentucky Bluegrass	3	90	3	95	3	80	–	–	3
4	'Park' Kentucky Bluegrass	1	100	5	70	5	75	–	–	4
5	'Sydsport' Kentucky Bluegrass	1	90	3	75	3	75	–	–	5
6	'Fylking' Kentucky Bluegrass	5	100	5	90	5	70	–	–	6
7	'Troy' Kentucky Bluegrass	7	60	5	25	7	30	–	–	7
8	Big Bluegrass 387931	5	50	5	75	7	30	5	90	8
9	'Sherman' Big Bluegrass	3	75	3	95	3	65	9	20	9
10	'Canbar' Canby Bluegrass	7	10	7	40	7	10	–	–	10
11	'Reubans' Canada Bluegrass	5	50	5	70	5	60	–	–	11
12	'Tundra' glaucus Bluegrass	3	75	5	55	9	10	–	–	12
13	Glaucus Bluegrass T08867									13
14	Alpine Bluegrass 235492, 236892									14
15	'Sodar' Streambank wheatgrass	3	95	3	80	7	30	–	–	15
16	Bearded wheatgrass 371698	5	65	5	70	5	40	3	40	16
17	Bearded wheatgrass 236693	7	20	5	45	7	25	7	20	17
18	'Nordan' Crested wheatgrass	3	100	5	65	5	50	–	–	18
19	'Fairway' Crested wheatgrass	1	100	3	90	3	80	–	–	19
20	'Summit' Crested wheatgrass	3	100	5	75	6	50	–	–	20
21	Violet wheatgrass T12050	5	85	5	50	5	50	–	–	21
22	Boreal wheatgrass T12048	5	80	6	35	7	25	–	–	22
23	Yukon wheatgrass T12051	3	100	3	80	50	40	–	–	23
24	'Critana' Thickspike wheatgrass	3	100	5	75	7	20	–	–	24
25	'Fults' Alkaligrass	5	50	7	60	–	–	–	–	25
26	'Vantage' Reed Canarygrass	7	50	5	60	7	20	–	–	26
27	'Engmo' timothy	3	100	4	80	7	60	3	80	27
28	'Climax' timothy	1	100	3	75	9	20	–	–	28
29	Beach wildrye 345978	7	10	–	–	–	–	–	–	29
30	Siberian wildrye 345600	5	80	4	90	6	35	5	40	30
31	Siberian wildrye 2144	3	80	5	75	3	50	–	–	31
32	Siberian wildrye 1996	7	70	7	50	5	30	–	–	32
33	'Norcoast' Bering hairgrass	5	65	5	45	5	35	–	–	33
34	Tufted hairgrass 372690	1	100	5	50	7	50	–	–	34
35	Bluejoint	3	75	4	65	7	40	5	30	35
36	'Sourdough Bluejoint	5	60	5	50	7	30	3	80	36
37	Meadow foxtail	5	100	3	85	5	50	–	–	37
38	Geniculated foxtail 314565	1	100	5	60	–	–	–	–	38
39	Garrison Creeping foxtail	7	60	5	50	–	–	–	–	39
40	'Arctared' Creeping red fescue	3	80	5	60	5	70	5	60	40
41	'Boreal' Creeping red fescue	3	85	4	50	7	40	–	–	41
42	'Pennlawn' Creeping red fescue	1	90	1	85	5	60	–	–	42
43	Rough fescue 236849	5	80	3	80	7	50	–	–	43
44	American Sloughgrass T12053	5	100	5	85	7	10	–	–	44
45	'Durar' Hard fescue	7	95	5	85	6	40	–	–	45
46	'Highlight' Sheep fescue	3	75	5	75	7	65	–	–	46
47	'Covar' Sheep fescue	7	80	4	90	7	25	–	–	47
48	'Manchar' Smooth Brome	5	25	3	75	5	50	3	90	48
49	'Carlton' Smooth Brome	3	90	3	85	3	90	–	–	49
50	'Alyeska' Polar grass	3	80	3	65	3	50	1	90	50
51	Tellesy Sage T12052									51
52										52

Figure 4.

The two-acre native seed mix plot produced a very healthy and vigorous stand. This plot did not receive the recreational abuse that occurred at the other plots. The plot will continue to be monitored, but at this time, all the components of the mix are performing well. Bluejoint's performance may be difficult to measure, because it comprised a small proportion of the mix. At this time, this seed mix appears to be well suited for the site.

No final conclusions for the willow evaluations will be presented in this report. Willow evaluation requires a longer period of time and these results will be presented within two years. Thus far, however, performance has been acceptable.

Conclusions and Recommendations

The conclusions drawn in this report are based on non-replicated plots and will apply most specifically to the local conditions found at the mine site.

Many species or varieties will survive in various degrees at this mine site and could be considered for inclusion in a seed mix.

However, the data in this report suggests that the following varieties should be included in a seed mix:

1. 'Alyeska' Polar Grass
2. 'Manchar' Smooth Brome
3. 'Engmo' timothy
4. 'Norcoast' Bering Hairgrass
5. 'Arctared' Red Fescue
6. Siberian Wildrye 345600

There are many commercially available species or varieties other than those tested. It would be impossible to test each commercially available variety. At the time the plantings were established, the hardiest and most readily available species were included in the plots. These species and varieties, therefore, are the ones most likely to be used by someone attempting erosion control or reclamation seedings. A land user may elect to use other varieties, but these should be equal or superior to those listed as being acceptable or in a mix containing a large proportion of the listed species or varieties.

The PMC also recommends that evaluations be continued on species not commercially available at this time. For instance, Alpine Bluegrass 235491, released as 'Gruening' Alpine Bluegrass in 1987 was not tested at the mine site because there was insufficient seed at the time of plot establishment. Performance of this cultivar on other disturbed sites has been very good. A larger scale planting of Alpine Bluegrass at this mine site would be advantageous.

Because Boreal Wheatgrass T12048, and Tellesy Sage T12052 performed fairly well, a larger scale evaluation of these accessions are also recommended.

The final recommendation is that evaluation continue on both the willow plantings and the two-acre native seed plot. Hopefully, continued cooperation between the mining industry and the Conservation Plant Project at the Alaska Plant Materials Center, will result in rational and cost-effective reclamation and erosion control through the use of both herbaceous and woody species.

APPENDIX

Valley Coal

Date	Activity	Travel	Per Diem	Other
06/28/83	Plant	0	0	75.00
10/05/83	Evaluate	0	0	0
05/29/84	Seed 2 Acres	0	0	25.00
09/05/84	Evaluate	0	0	0
08/02/85	Evaluate	0	0	0
07/18/86	Evaluate	0	0	0

Total $100.00