

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

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February 1987
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Index

	<u>Page</u>
Introduction	1
Purpose	1
Methods	2
Results	7
Conclusions & Recommendations	9
Appendix	
Costs	11

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 25, 1983, 49 accessions of advance test plant material were planted. The complete 1983 array of accessions (Figure 1) was planted minus *Glauca* Bluegrass T08867 and *Alpine* Bluegrass 235491. Seed supply for those two species was low, and therefore they were not included in the planting. Each plot, was hand-seeded with pre-measured amounts of seed. The seeding rates of each plot were approximately 40 pounds per acre. 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.

Typical Plot Layout

←-----> 10' ←----->	
Nugget Kentucky Bluegrass	Merion Kentucky Bluegrass
Park Kentucky Bluegrass	Banff Kentucky Bluegrass
Sydsport Kentucky Bluegrass	Fylking Kentucky Bluegrass
Poa ampla	Troy Kentucky Bluegrass
Sherman Big Bluegrass	Canbar Canby Bluegrass
Tundra Bluegrass	Reubans Canada Bluegrass
NOT PLANTED	NOT PLANTED
Poa glauca T08867	Poa alpina
Agropyron subsecundum 371698	Sodar Streambank Wheatgrass
Nordan Crested Wheatgrass	Agropyron subsecundum Canada
Fairway Crested Wheatgrass	Agropyron violaceum
Summit Crested Wheatgrass	Agropyron boreal
Critana Thickspike Wheatgrass	Agropyron yukonese
Fults Alkaligrass	Vantage Reed Canarygrass
Climax Timothy	Engmo Timothy
Elymus arenarius	Elymus sibiricus 34560
Elymus sibiricus 1966	Elymus sibiricus 2144
Norcoast Bering Hairgrass	Tufted Hairgrass
Sourdough Bluejoint	Calamagrostis canadensis Delta
Meadow Foxtail	Alopecurus geniculatus
Garrison Creeping Foxtail	Arctared Red Fescue
Boreal Red Fescue	Festuca scabrella
Beckmannia	Pennlawn Red Fescue
Durar Hard Fescue	Highlight Red Fescue
Covar Sheep Fescue	Manchar Smooth Brome
Alyeska	Carlton Smooth Brome
Tellesy Sage	NOT PLANTED
	Pumpelly Brome

Figure 1.

In addition to the advanced evaluation block, a hydroseeded demonstration planting which included 16 varieties recommended by the state, university, and Usibelli, was planted on June 26, 1984. Fourteen varieties were planted in 1/10 acre plots and two in 1/20 acre blocks. Fertilizer (20-20-10) was applied to each block at the rate of 450 lb/a. The seeding rate for each block was 40 pounds per acre. The hydroseeded plots are intended to compare Usibelli seedmix components with state and university recommended plant material. They also permitted larger scale planting of material that has performed well.

Advanced evaluation plots are evaluated at least once a year. 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 and can be found on page nine. 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.

	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
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52										52

Figure 2. Sample Advanced Evaluation Page

Results

By September 12, 1983, all of the accessions in the advanced evaluation plot had germinated and produced measureable stands. The plots were again evaluated on May 24, 1984, and as expected some accessions had winterkilled. By September 12, 1985, the weaker survivors of the previous years had died out.

By the final evaluation on June 13, 1986, 'Tundra' Bluegrass, two Alaskan collections of Wheatgrass; 'Sourdough' Bluejoint, 'Norcoast' Bering Hairgrass, and 'Egan' American Sloughgrass performed the best. 'Arctared' and 'Boreal' Red Fescue both exhibited excellent performance as well.

Other accessions that performed very well were Tellesy Sage, 'Nugget' and 'Park' Kentucky Bluegrass, and Big Bluegrass 387931. Figure 3 shows percent cover and vigor for each accession during the evaluation period.

The hydroseed demonstration planting of recommended varieties planted in June, 1984, was destroyed when mining plans changed during the winter of '84-'85. Although all the varieties produced very good stands during the summer, winter survival is necessary in order to gain useful information on plantings and that information was impossible to obtain before that plots were destroyed.

	1 Block of Plantings	83		84		85		86	
		vigor	stand	vigor	stand	vigor	stand	vigor	stand
1	'Nugget' Kentucky Bluegrass	1	60	3	75	3	100	5	100
2	'Merion' Kentucky Bluegrass	5	25	7	40	7	80	7	80
3	'Banff' Kentucky Bluegrass	7	30	5	30	9	90	9	60
4	'Park' Kentucky Bluegrass	3	80	1	100	5	100	3	100
5	'Sydsport' Kentucky Bluegrass	5	80	5	80	5	100	3	95
6	'Fylking' Kentucky Bluegrass	3	50	3	70	5	100	5	100
7	'Troy' Kentucky Bluegrass	7	20	3	50	5	100	5	70
8	Big Bluegrass 387931	3	90	1	100	1	100	3	80
9	'Sherman' Big Bluegrass	1	60	-	-	-	-	-	-
10	'Canbar' Canby Bluegrass	3	60	7	75	-	-	-	-
11	'Reubans' Canada Bluegrass	5	70	9	45	-	-	-	-
12	'Tundra' glaucus Bluegrass	3	95	5	50	1	100	1	100
13	Glaucus Bluegrass T08867								
14	Alpine Bluegrass 235491								
15	'Sodar' Streambank wheatgrass	3	70	9	40	-	-	-	-
16	Bearded wheatgrass 371698	1	90	3	100	1	100	5	80
17	Bearded wheatgrass 236693	7	10	1	100	-	-	-	-
18	'Nordan' Crested wheatgrass	5	90	-	-	-	-	-	-
19	'Fairway' Crested wheatgrass	1	90	-	-	-	-	-	-
20	'Summit' Crested wheatgrass	3	60	-	-	-	-	-	-
21	Violet wheatgrass T12050	7	15	1	100	3	100	1	100
22	Boreal wheatgrass T12048	7	10	1	100	1	100	1	100
23	Yukon wheatgrass T12051	5	25	3	100	3	100	3	100
24	'Critana' Thickspike wheatgrass	3	83	7	85	9	65	-	-
25	'Fults' Alkaligrass	1	95	-	-	-	-	-	-
26	'Vantage' Reed Canarygrass	7	15	-	-	-	-	-	-
27	'Engmo' timothy	3	90	1	100	7	100	-	-
28	'Climax' timothy	1	100	5	10	-	-	-	-
29	Beach wildrye 345978	7	5	-	-	-	-	-	-
30	Siberian wildrye 345600	3	70	3	100	3	95	-	-
31	Siberian wildrye 2144	1	50	3	100	3	100	-	-
32	Siberian wildrye 1996	5	10	5	80	5	85	-	-
33	'Norcoast' Bering hairgrass	3	30	1	100	1	100+	1	100
34	Tufted hairgrass 372690	1	90	1	100	1	100	1	100
35	Bluejoint	5	10	3	100	1	85	3	100
36	'Sourdough Bluejoint	5	5	3	100	3	100	1	100
37	Meadow foxtail	5	90	3	100	5	100	-	-
38	Geniculated foxtail 314565	1	100	3	100	-	-	-	-
39	Garrison Creeping foxtail	5	60	5	100	7	80	-	-
40	'Arctared' Creeping red fescue	3	60	3	100	1	100	1	100
41	'Boreal' Creeping red fescue	1	90	1	100	3	100	1	100
42	'Pennlawn' Creeping red fescue	5	60	3	100	3	80	-	-
43	Rough fescue 236849	5	40	1	100	1	100	3	90
44	American Sloughgrass T12053	1	100	1	150	1	150	1	150
45	'Durar' Hard fescue	7	50	3	100	7	40	-	-
46	'Highlight' Sheep fescue	5	70	5	100	5	90	-	-
47	'Covar' Sheep fescue	5	80	7	50	9	20	-	-
48	'Manchar' Smooth Brome	3	80	3	100	3	100	Destroyed	
49	'Carlton' Smooth Brome	5	70	3	100	5	100	Destroyed	
50	'Alyeska' Polar grass	5	10	2	100	3	100	3	100
51	Telley Sage T12052			1	100	1	50	1	70
52									

Conclusions and Recommendations

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

Many species or varieties do survive in various degrees at Healy and may be considered for inclusion in seed mixes. The data obtained from this study suggests that the following commercially available species and varieties may be included in a seed mix:

<u>Species</u>	<u>Comments</u>
1. 'Nugget' Kentucky Bluegrass	on wetter sites
3. 'Tundra' Glaucus Bluegrass	excellent performance
4. 'Norcoast' Bering Hairgrass	" "
5. 'Sourdough' Bluejoint	very limited supply
6. 'Boreal' Red Fescue*	excellent performance
7. 'Arctared' Red Fescue*	" "
8. 'Egan' American Sloughgrass (T12053)	only on wet sites commercially available in 1989
9. 'Manchar' Smooth Brome	destroyed in 4th year
10. 'Alyeska' Polar Grass	very limited supply

* 'Boreal' Red Fescue appeared equal or slightly superior to 'Arctared' Red Fescue in this trial. There is no doubt that 'Boreal' Red Fescue is a very hardy cultivar but it has been reported to winterkill elsewhere in Alaska. No winterkill of 'Boreal' Red Fescue has been recorded by the PMC since systematic evaluation started in 1983. It has been noted in the statewide evaluations that 'Boreal' Red Fescue has not produced seed at all the sites. 'Arctared' Red Fescue did produce seed at all the test sites. Seed production may be an important consideration for variety selection. The Plant Materials Center will continue to encourage the use of 'Arctared' in the Interior and Arctic regions of Alaska as at least a component of a seed mix.

As stated earlier, there are many commercially available species or varieties other than those tested. It would be impossible to test each and every one. The species and varieties being tested by the PMC were considered at the time the plots were established, to be the hardiest and most readily available species and varieties, and therefore, the 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 or in a mix containing a large proportion of the listed species or varieties.

It is also recommended that evaluations be continued on species not commercially available at this time. Alpine Bluegrass 235491, released as 'Gruening' Alpine Bluegrass in 1987 was not tested at Healy because of 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 Healy would be advantageous. Since Violet Wheatgrass T12050, Boreal Wheatgrass T12048, and Tellesy Sage T12052 have performed so well, a larger scale evaluation, such as a hydroseeded plot is also recommended.

The final recommendation is that a continued cooperative effort exist between Usibelli Coal Mining, Inc. and the Conservation Plant Project at the Alaska Plant Materials Center. Hopefully, the continued efforts will result in rational and cost-effective reclamation and erosion control through the use of both herbaceous and woody species.

APPENDIX

Costs

<u>Date</u>	<u>Activity</u>	<u>Travel</u>	<u>Per Diem</u>	<u>Other</u>
6-25-83	Plant	150.00	0	75.00
9-12-83	Evaluate	0	0	0
5-24-84	Evaluate	0	0	0
6-26-84	Hydroseed	0	320.00	810.00
8-16-84	Evaluate	0	0	0
9-12-85	Evaluate	0	50.00	0
6-13-86	Evaluate	<u>0</u>	<u>0</u>	<u>0</u>
	Sub Totals	150.00	370.00	885.00

Total \$1,405.00