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THE NORTHERN NATIVE GRASS SEED INDUSTRY - SPRING 1992

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ABSTRACT

The use of native plants is often suggested as a potential answer to problems associated with revegetation in boreal, alpine and arctic regions. However, to date there has minimal use of native selections of grasses and legumes in reclamation of disturbed sites in western Canada. A major factor in the lack of utilization of native selections has been the shortage of available seed.

This deficiency has been recognized and in 1986 the first steps were taken to establish a native northern and alpine grass and legume seed industry in Whitehorse, Yukon. This industry has now progressed to the point where seed of some northern grasses will be available for purchase in the fall of 1992.

This paper is primarily intended as an information bulletin to the reclamation industry regarding the current status of the native seed industry. Long-term survival data from one northern Canadian revegetation trial site are also presented to show the potential of northern selections for reclamation of sites subject to severe climatic conditions.

INTRODUCTION

Native species are species indigenous to a given area. The term contrasts with "exotic species", which refers to species introduced directly or indirectly by man into any given area. A northern population, on the other hand, is a naturally occurring northern selection from within a species which may well have a continental or circumpolar range. The population specific to a northern region has evolved in response to its environment. Thus, when reference is made to "native species", most speakers or writers doubtless mean local populations of native species.

Native selections are often deemed optimal for revegetation of northern and alpine areas (Berger, 1977; Thirgood and Ziemkiewicz, 1978; Vaartnou, 1988) regardless of whether the objectives of revegetation pertain to erosion control, aesthetic enhancement, improvement of wildlife habitat, agricultural development or promotion of long-term ecosystem recovery. Native selections are favoured over exotic agronomic cultivars because:

- they have adapted to the winter climate and will less often winterkill;
- they have adapted to the local photoperiod and thus have a greater reseeding potential;
- they will blend in easily with the landscape, thereby allowing a more harmonious end vista;
- they often require less fertilization and allow for use of lower seeding rates.

Some grasses native to northern regions, such as polar grass (Arctagrostis latifolia [R.Br.] Griseb.) and bluejoint reedgrass (Calamagrostis canadensis [Michx.] Beauv.), are known to have a slow early growth rate. These are poor candidates to provide initial erosion control, but are useful for long-term soil stabilization. Others, such as violet wheatgrass (Agropyron violaceum [Hornem.] Lange) and fowl bluegrass (Poa palustris L.), which are among the primary invader species of disturbed areas, have a very rapid early growth rate and are extremely useful for initial erosion control. Both types of grasses are useful for successful revegetation if seed is available, while native legumes and other forbs also have a place in reclamation.

Despite acceptance of these factors there has been little use of northern or alpine native selections of grasses in field-scale reclamation in British Columbia to date. Some trials have been initiated by Parks Canada in the Rocky Mountains, and B.C. Parks personnel have used native species in Garibaldi Park since 1990. However, despite expressions of interest from many individuals in the industry, there has been no substantial use of native grasses and legumes by the B.C. Mine Reclamation Industry. The primary reasons for this have been the lack of readily available seed and the cost of any seed which was available.

In the past fifteen years there have been several attempts to

initiate a native northern grass seed industry in western North America. Unfortunately, with the exception of the work done in Alaska, this has not culminated in significant field-scale production of grass seed for use by the reclamation industry. However, since 1986, there has been an attempt in the Yukon to establish such an industry. This program has now reached the field-scale stage for some selections which will be available for purchase, in limited quantities, in the fall of 1992.

Thus, the primary objective of this paper is to inform the industry of the current status of the Yukon northern seed industry and to alert them of native seed possibilities for the future. However, in order to illustrate the potential for native northern grasses in revegetation, ten (10) year results are first presented from a revegetation trial site located in the Richardson Mountains near the border of Yukon Territory and the Northwest Territories.

FIELD TRIAL EXAMPLE

In the last fifteen years numerous revegetation trial sites which have included northern selections of grasses and legumes have been established in British Columbia and Yukon Territory (Vaartnou, 1982a; 1982b; 1982c; 1991). Long-term results have been similar at these sites; thus data from only one site is presented below.

Location and Methods

The site is located north of the Arctic Circle at approximately 67° N.Lat. It is in the Richardson Mountains on the south-east side of the Dempster Highway where the highway intersects with the Yukon-Northwest Territories border. The slope is level and the growth medium is the dark shale typical of overburden storage areas and borrow pits throughout the region. At the time of seeding, the vegetative cover was nil.

Twenty-one selections of grass seed were seeded to the site on June 7, 1979. Four were commonly used commercially available agronomic cultivars and the remainder were northern selections previously collected from northern British Columbia, northern Alberta, Yukon Territory or the Northwest Territories. Seed from the initial northern collections had previously been increased in northern Alberta (Vaartnou, 1977).

The candidate grasses were hand-seeded to microsites in rows. At each microsite from five to ten seeds were placed within a 1 cm^3 area into a small depression and were then covered lightly with soil. Each entry was seeded to ten microsites per row. Row order was by random selection and spacing between rows and between microsites within each row was 1 m. All seeding was replicated three times. Soil sampling had indicated a deficiency of nitrogen and phosphorus, but sufficient potassium, for growth of grasses. Thus, the site was fertilized with 16-20-0 fertilizer at the rate of 80 kg/ha at the time of seeding. The test site was not refertilized in subsequent years.

The entries were evaluated in 1979, 1980, 1981, 1985 and 1988 for emergence in the year of seeding; subsequent survival, plant vigour as expressed through gross morphology, and phonological development as expressed through production of seed. The field data have been previously presented for the 1979, 1980, 1981 and 1985 evaluations (Vaartnou, 1982b; 1985; 1988).

At this time only the data collected for the survival and emergence evaluations will be presented to demonstrate the long-term survival of some northern selections. These emergence and survival evaluations consisted of an exact count of all possible microsites which had a live plant. Totals were then converted to percentages.

Results

Emergence in the year of seeding (1979) was successful, as fourteen of seventeen northern selections and all four agronomic cultivars had plants in at least 93% of their microsites (Table 1). After one winter, the 1980 evaluation indicated that many entries were unsuited to this harsh environment as only 63% of the microsites contained live plants, in contrast to the original emergence of 93%. Plant mortality was near ubiquitous as the northern wheatgrasses (Agropyron spp.) decreased from 88 to 52%, the northern fescues (Festuca spp.) decreased from 100 to 86%, the northern bluegrasses (Poa spp.) decreased from 99 to 72% and the agronomic cultivars decreased from 99 to 47%. This downward trend continued in 1981 and by the time of the 1985 evaluation it was apparent that those selections which had high survival percentages and vigour ratings in 1981 continued to thrive while those which had experienced decreases in survival or vigour by 1981 had, in many cases, completely died out by 1985. The successful entries had increased through natural reseeding and, in most instances, were now approaching solid rows with minimal spacing between individual plants. Results from the 1988 evaluation were similar to those of the 1985 evaluation.

After seven (1985) and ten (1988) growing seasons the most successful entries were tickle grass (Agrostis scabra Willd.), hairgrass (Deschampsia caespitosa [L.] Beauv.), sheep fescue (Festuca ovina L.), alpine bluegrass (Poa alpina L.) and glaucous bluegrass (Poa glauca M. Vahl). These five entries were nearly solid rows by 1985 and remained so through the 1988 evaluation. By 1988, survival of the other entries ranged from 23% to total failure. In all, eleven of the twenty-one selections seeded in 1979 had been eliminated from the site by 1985 and five others were close to 100% mortality by 1988. The entries eliminated by 1985 included seven northern selections and all four of the agronomic cultivars.

Table 1. Emergence and Long-term Survival of Grasses Sown at the Richardson Mountains Revegetation Trial Site on June 7, 1979.

Species	Stock No.*	Emergence (%)	Survival (%)			
		1979	1980	1981	1985	1988
Agropyron cristatum	Fairway	96.7	10.0	0.0	0.0	0.0
Agropyron pauciflorum	159	30.0	16.3	10.0	10.0	6.7
Agropyron pauciflorum	Revenue	100.0	56.7	6.7	0.0	0.0
Agropyron riparium	209	100.0	86.7	76.7	20.0	6.7
Agropyron Smithii	9	100.0	86.7	36.7	0.0	0.0
Agropyron violaceum	103	100.0	66.7	53.3	33.3	20.0
Agrostis scabra	105	100.0	96.7	93.3	100.0	100.0
Alopecurus pratensis	5	100.0	80.0	60.0	30.0	20.0
Bromus inermis	Carlton	100.0	60.0	50.0	0.0	0.0
Bromus Pumpellianus	110	96.7	63.3	40.0	0.0	0.0
Deschampsia caespitosa	30	76.7	83.3	70.0	100.0	100.0
Festuca ovina	100	100.0	93.3	70.0	100.0	100.0
Festuca rubra	164	100.0	80.0	76.7	0.0	0.0
Festuca rubra	Boreal	100.0	70.0	63.3	0.0	0.0
Phleum pratense	17	93.3	16.7	10.0	0.0	0.0
Poa alpina	45	100.0	96.7	96.7	100.0	100.0
Poa compressa	177	96.7	23.3	20.0	0.0	0.0
Poa glauca	58	100.0	100.0	100.0	100.0	100.0
Poa palustris	74	96.7	56.7	40.0	0.0	0.0
Poa pratensis	178	100.0	83.3	70.0	53.3	23.3
Puccinellia Nuttalliana	195	66.7	36.7	26.7	0.0	0.0

* Stock No. refers to number in the M. Vaartnou & Associates botanical collection.

DEVELOPMENT OF THE SEED INDUSTRY

General

The long-term goal of this program is development of licensed northern cultivars for use as reclamation, turf and forage grasses for northern and alpine/subalpine sites. However, certification is a lengthy procedure, and there is a need for seed of native, northern and alpine species, prior to eventual certification of the northern selections as licensed cultivars.

Thus, to meet this demand, a northern and alpine/subalpine grass and legume seed industry was initiated in 1986. The industry has progressed to the stage that some seed will be available for purchase by the fall of 1992. Nonetheless, it must be emphasized that, until more seed is available in the mid 1990's, to increase chances of any specific order being filled in 1992, considerable advance notification is prudent.

Inquiries regarding the price and availability of any given selection can be addressed to:

Mr. Randy Lewis
Arctic Alpine Seed Company
c/o Decora Landscaping (1980) Ltd.
105 Granite Road
Whitehorse, Yukon
Y1A 2V8
403-667-2756

Alternatively, detailed provenance and adaptability information can be obtained by contacting the developer of the seed:

Dr. Manivalde Vaartnou M.
Vaartnou & Associates
11520 Kestrel Drive
Richmond, B.C. V7E 4E2
604-271-2505

Selection Nursery

In 1986, a selection nursery of northern grasses and legumes was established 30km west of Whitehorse. The initial entries in this nursery were selections previously collected by M. Vaartnou & Associates personnel from northern British Columbia, northern Alberta, Yukon Territory or the Northwest Territories. In some cases, seed from the initial northern collections had previously been increased in northern Alberta (Vaartnou, 1977).

The selections were seeded, using a Planet Junior seeder, into rows 100m long, if there was sufficient seed. For selections for which there was insufficient seed for a 100m row, the rows were as long as possible. A portable irrigation system was installed and

the site was fertilized with 17-34-0 at 400kg/ha. In subsequent years new entries have been added as seeds or plants of promising selections were collected by the author, and some of the initial entries which failed to live up to their promise have been deleted. Also, some potentially useful northern wildflowers such as Jacob's ladder (Polemonjum pulcherrimuro L.), have been subsequently added to the nursery. Maintenance, consisting of weeding, fertilization and irrigation, has been continued on an annual basis and seed has been hand harvested.

In general, seed production of the grasses has remained high from 1987 to 1991, while vigour and seed production of legumes and wildflowers has increased. The field plan of the nursery, as of spring, 1992, is presented in Appendix A.

Breeder's Seed Plots

In 1988, 0.5ha breeder's seed plots were established using seed harvested in 1987 from the most successful entries in the selection nursery. The plots were seeded to rows 1m apart to facilitate cultivation and were fertilized and irrigated as necesssary. In 1990, some of the initial plots were deemed unsuccessful. These were replaced with another seeding of the same entry or a different selection. By the fall of 1991, the breeder's seed plots consisted of the following species.

Deschampsia caespitosa
Poa glauca
Festuca ovina
Festuca saximontana
Puccinellia Nuttalliana
Agropyron pauciflorum
Phleum commutatum
Bromus sp. cv. Polar

Descriptions of all selections which have been in breeder's seed plots over the last five years are found in Appendix B. Sufficient seed has been retained to establish new breeder's seed plots of these selections if there is an apparent demand for any of them.

Field-scale Seeding

In early June, 1990, 4 selections were seeded to larger plots in order to increase the amount of seed available for the market by 1992. The plots were fertilized with 17-34-0 fertilizer at the rate of 400kg/ha at the time of seeding. The selections which were seeded to field-scale plots are:

Poa alpina	3 ha & 2 ha
Festuca saximontana	2 ha
Agropyron violaceum	2 ha
Poa glauca	3.5 ha

The alpine bluegrass, fescue, and violet wheatgrass have proven very successful and seed from these selections will be available in the fall of 1992. Emergence in the glaucous bluegrass plot was less successful and this plot may be replaced in the future with another seeding of the same species. However, this decision will not be made until the fall of 1992, and there will be some glaucous bluegrass seed available in 1992.

DISCUSSION

The data from the Richardson Mountains trial lead to three major conclusions regarding the long-term utility of the agronomic cultivars and northern selections seeded to the site. These are:

1) The four agronomic cultivars included in this trial are not adapted to northern Yukon Territory.
2) Most northern native selections are equally ill-adapted for survival in northern Yukon Territory.
3) Five native northern selections; two bluegrasses (Poa alpina L. and P. glauca M. Vahl), hairgrass (Deschampsia caespitosa [L.] Beauv.), tickle grass (Agrostis scabra Willd.) and sheep fescue (Festuca ovina L.) are adapted for long-term survival and can be considered suitable candidates for northern revegetation projects.

The fact that the 1985 and 1988 survival percentages of the very successful entries were, in most cases, higher than the 1979 original emergence percentages is attributable to two concurrent factors. The minor portion of these increases is a function of natural delayed germination, but the major component is a result of the prolific seed production and emergence of progeny of the original plants. While the original planting allowed for 1 m gaps between plants to avoid confounding of results, the extremely high seed production rates of the successful entries have resulted in a near block plot effect on many sections of the site. Thus, the survival values of the original plants are confounded, but, from a practical aspect, long-terra ground cover maintenance by the five successful entries has been even more dramatically emphasized.

These data confirm the results of a shorter study done in the MacMillan Pass area of Yukon Territory. Brown (1985) used twelve northern selections, eleven agronomic cultivars and one agronomic cultivar mixture as candidate grasses. In the year of seeding (1982), of the ten grasses with the highest emergence percentages, eight were agronomic cultivars. However, after four years (1985), of the ten grasses which now had the highest survival percentages, seven were northern selections.

Two other considerations are of prime importance if native, northern selections are to be used in large-scale reclamation programs. These are the viability of seed, and the economics of seed production and concomitant cost of seed.

Since the Richardson Mountains study was undertaken only to assess survival, vigour and amount of seed production in a natural environment, seed germination percentages could not be ascertained from these data. Regardless of germination percentages achieved in controlled test conditions, plant emergence in the field will only be a small fraction of germination achieved in the laboratory. Brown (1985), in his count study, found that only 19% of 37,200 seeds produced plants in the year of seeding. After four years, only 2.6% of the seeds had produced plants which were still alive. From this data, one can infer that site-specific environmental conditions are the major factors which will determine the amount of seedling emergence, not a laboratory germination percentage difference of 1 to 5%.

Nevertheless, eight lots of seed of entries successful at various northern revegetation trials were sent to Agriculture Canada for germination testing. Of the eight, six can be deemed suitable for multiplication as four were graded as eligible for Canada No.1, one for Canada No.2 and one for Canada No.3. Thus, while it is clear that each northern selection considered for seed increase should be tested for germination and purity of seed, it is also clear that seed having high germination percentages can be obtained from progeny of carefully chosen northern stock material.

The economics of northern seed production are also dependent upon choice of appropriate selections. Experience with northern grass selections indicates that seed production difficulties and quantity of seed produced vary tremendously. Problems associated with northern native seed production have included limited seed production (Klebesadel, 1974; Mitchell, 1972), inappropriate growth form (Mitchell and McKendrick, 1975), and seed harvesting problems (Klebesadel et al. 1962). Other difficulties may include hairs and awns, seed shattering, intermittent flowering, low fertility and uneven flowering. Some of these difficulties can be overcome by research developments in agricultural engineering technology or by genetic improvement (Walker et al. 1977). Nonetheless, the most practical method is by appropriate selection, thereby minimizing the above difficulties through their avoidance.

The necessity for judicious choice of northern selections for economic seed production is illustrated by the wide range in seed yield from three registered cultivars chosen from native Alaskan populations. Seed production of 300-1000 kg/ha is reported for Tundra bluegrass (Poa glauca M. Vahl) (Mitchell, 1980a), 125-200 kg/ha for Alyeska polar grass (Arctagrostis latifolia (R. Br.) Griseb.) (Mitchell, 1980b) and a meager 20-35 kg/ha for Sourdough bluejoint reedgrass (Calamagrostjs canadeflsis (Michx.) Beauv.) (Mitchell, 1980c).

Our own experience with northern seed production for the proposed Alaska Highway Natural Gas Pipeline reclamation program confirmed this situation. Some northern selections produce only minimal amounts of seed and should be omitted from reclamation programs because of their cost unless they are the only solution

to a site-specific problem. However, in northern Alberta, we achieved seed production rates as high as 800 kg/ha with some wheatgrasses (Agropyron spp.) and most bluegrass (Poa spp.) seed production rates ranged from 300-500 kg/ha (author's unpublished data).

Comparable production rates in Yukon Territory would allow for competitive marketing. However, at the present time the cost of the northern native selections which will be available in the fall of 1992 will be somewhat greater than that of commercially available southern agronomic cultivars. This will be necessary because the northern industry is still at the "fledgling" stage. Minor seed production problems have been overcome and the area seeded to field-scale plots can easily be increased if the market demand warrants an increase. However, optimal harvesting methods for each selection have yet to be ascertained and a seed cleaning facility has yet to be built in the Yukon. Thus, in addition to the lack of economies of scale, seed harvesting and cleaning is very labour intensive, and costs are considerably higher than at more southerly locales.

If these problems can be surmounted the price of seed will decrease. However, when one considers that the cost of seed and fertilizer can be as small as 5% of a total northern reclamation package (D.M. Wishart* pers. com.), it is easy to see that the cost of seed could be increased without substantially affecting the economics of northern/alpine reclamation. Also, it is quite conceivable that total seed and fertilizer costs may decrease with the use of adapted native selections if their use results in less touch-up seeding and less frequent fertilization.

In conclusion, it is necessary to remember that the phrases "native species" and "northern selection" do not constitute a panacea which guarantees revegetation success north of the 60th parallel or in harsh environments at lower latitudes. However, the data presented herein indicates that several native northern selections have outstanding potential for use on sites subject to severe climatic conditions. Therefore, while some currently available agronomic cultivars developed from northern stock are likely to be useful at some southern subalpine sites or north of the 60th parallel, the preferred strategy must be the inclusion of native northern grasses in northern/alpine revegetation seed mixtures. Through the use of this strategy, the instant green-up followed by rapid vegetation disappearance, such as has occurred on the banks of the Alaska Highway in the vicinity of Whitehorse, may be minimized in the future. The ongoing development of the Yukon grass and legume seed industry allows such an approach for the first time.

* Environmental Manager, Interprovincial Pipeline Company Ltd, at time of construction of the Norman Wells pipeline.

LITERATURE CITED

Berger, T.R. 1977. Northern Frontier Northern Homeland. The Report of the Mackenzie Valley Pipeline Inquiry. Volume Two, Terms and Conditions. Ministry of Supply and Services. English Edition CP32-25/1977-2: 268pp.

Brown, G. 1985. Results of Revegetation Experiments 1981-1985 MacMillan Pass, Yukon Territory. Prepared for Northern Affairs Program, Yukon. 42pp.

Klebesadel, L.J., C.I. Branton and J.J. Koranda 1962. Seed characteristics of bluejoint and techniques for threshing. Journal of Range Management, 15(4):227-229.

Klebesadel, L.J. 1974. Sweet holygrass, a potentially valuable ally. Agroborealis, 6(1):17-20.

Mitchell, W.W. 1972. Adaptation of species and varieties of grasses for potential use in Alaska, pp 2-6 In Proceedings of the Symposium on the Impact of Oil Resource Development on Northern Plant Communities. Occasional publications on northern life No. l. Institute of Arctic Biology. University of Alaska, Fairbanks. 95pp.

Mitchell, W.W. 1980a. Registration of Tundra bluegrass. Crop Science, 20(5):669.

Mitchell, W.W. I980b. Registration of Alyeska polargrass. Crop Science, 20(5):671.

Mitchell, W.W. 1980c. Registration of Sourdough bluejoint reedgrass. Crop Science, 20(5):671-672.

Mitchell, W.,W. and J.D. McKendrick 1975. Tundra rehabilitation research: Prudhoe Bay and Palmer Research Centre, 1973-4 Summary Report to Alyeska Pipeline Service Co., ARCO, Canadian Arctic Gas Study Ltd., Exxon, Shell Oil and Union Oil. Institute of Agricultural Science, University of Alaska, Fairbanks. 84 pp.

Thirgood, J.V. and P.P. Ziemkiewicz 1978. Reclamation of coal surface-mined land in western Canada. In Reclamation of Drastically Disturbed Lands. (F.W. Schaller and P. Sutton, Eds.). ASA, CSSA and SSSA. Madison, Wisconsin, USA. pp 537-552.

Vaartnou & Sons Enterprises Ltd. 1977. Native seed multiplication. A progress report on work accomplished in multiplying seed stock of native ecotypes useful for northern revegetation. Prepared for Foothills Pipe Lines Ltd. 20pp.

Vaartnou, M. 1982a. Pipeline revegetation research: Alaska highway test sites progress report 1981. Prepared for Foothills Pipe Lines (Yukon) Ltd. 70pp + appendices.

Vaartnou, M. 1982b. Pipeline revegetation research: Dempster lateral test sites progress report 1981. Prepared for Foothills Pipe Lines Ltd. 64pp + appendices.

Vaartnou, M. I982c. Pipeline revegetation research - northern B.C. test final report. Prepared for Foothills Pipe Lines Ltd. and Westcoast Transmission Ltd. 41pp.

Vaartnou, M. 1985. Dempster highway revegetation. Prepared for Department of Community and Transportation Services and Department of Renewable Resources, Yukon Territorial Government. 131pp.

Vaartnou, M. 1988. The potential of native populations of grasses in northern revegetation. In Northern Environmental Disturbances. (P. Kershaw, Ed.). Occasional Publication Number 24. Boreal Institute for Northern Studies, University of Alberta, Edmonton, Alberta. Original paper presented at the 25th Anniversary Conference of the Boreal Institute of the University of Alberta, Edmonton, Alberta; November 20-22, 1986.

Vaartnou, M. 1991. Yukon revegetation demonstration project. Prepared for Department of Renewable Resources and Department of Community and Transportation Services, Yukon Territorial Government; and Arctic Alpine Seed Company. 39pp.

Walker, D., R.S. Sadasiviak and J. Weijer 1977. The utilization and genetic improvement of native Alberta grasses from the eastern slopes of the Rocky Mountains. Department of Genetics, University of Alberta, Edmonton. 52 pp.

APPENDIX A

FIELD PLAN OF THE SELECTION NURSERY

Field Plan Of Selection Nursery (Spring 1992)

ROW	Botanical Name	Comments
1	Deschampsia caespitosa	Richardson Mts. test Also in breeders
2	Poa alpine	North Ogilvie Mts.
3	Deschampsia sp. (1) Trisetum spicatum (1) Calamagrostis sp. (1) Deschampsia brevifolia (5) Alopecurus aequalis (11) Deschampsia brevifolia (4) Poa alpigena (2) Agropyron pauciflorum (1)	This entire row was collected from the Richardson Mountains and points north.
4	Empty	
5	Agrostis scabra (15) Agrostis scabra (41) Agrostis tenuis (1) Bromus inermis (7) Bromus Pumpellianus (40) Poa alpigena (15)	Haines Road Klondike Highway Whitehorse Klondike Highway Carcross Haines Road
6	Poa sp. (glauca?) (9) Poa sp. (pratensis?) (9) Agrostis gigantea (8) Deschampsia caespitosa(S) Hierochloe alpina (7) Agropyron violaceum (12) Deschampsia sp. (18) Festuca altaica (6) Poa sp. (glauca) (11) Trisetum spicatum (3) Polemoniura acutiflorum(7) Hedysarum Mackenzii (3)	Not pratensis seed All but end of row was collected from the Haines Road (alpine and subalpine) from Alaska (white) Whitehorse (white)
7	Poa compressa Festuca rubra	High Level Haines Junction
8	Agropyron violaceum	5 acres field scale
9	Poa pratensis	Haines Junction
10	Festuca ovina	Also in breeders
11	Agropyron yukonense	Alaska Highway

Field Plan Of Selection Nursery (Spring 1992) (Cont.)

ROW	Botanical Name	Comments
12	Astragalus alpinus	Alaska Highway
13	Festuca saximontana	Also in breeders 5 acres field scale
14	Oxytropis splendens (1) Oxytropis nigricans? (8) Oxytropis campestris (3) Oxytropis campestris (13) Oxytropis splendens (4) Hedysarum a 1 pi man (21)	North Ogilvie Mts. South of Eagle Plain
15	Oxytropis Maydelliana?	Becoming very healthy
16	Poa glauca	Also in breeders 9 acres field scale
17	Alopecurus pratensis	Smithers
18	Hierochloe odorata	Haines Junction
19	Agropyron violaceum	Eagle Plain
20	Poa palustris	Teslin
21	Phleum coramutatum	Haines Road
22	Festuca altaica (12) Puccinellia Nuttalliana	Alaska Highway Also in breeders Tends to lodge
23	Agropyron pauciflorum	Eagle Plain
24	Poa pratensis	Mountainview G.c.
25	Agropyron pauciflorum	Late seed production Also in breeders
26	Empty	
27	Astragalus eucosmus (2) Hedysarum alpinum (5) Astragalus tenellus (4) Astragalus williarasii(8) Anemone multifida (1) Lupinus arcticus (1) Astragalus sp. (10)	All transplants. Collected from the greater Whitehorse area. Becoming stronger

Field Plan Of Selection Nursery (Spring 1992) (Cont.)

ROW	Botanical Name	Comments
28	Agropyron subsecundum	Stewart crossing
29	Agropyron X (macrourum)	North Ogilvie Mts.
30	Agropyron yukonense	Highway 3
31	Hedysarum Mackenzii	Row filling in,
32	Elymus innovatus	Few but healthy
33	Alopecurus arundinaceus	
34	Astragalus alpinus	Alaska highway
35	Polemoniura pulcherrimum	Whitehorse
36	Hedysarum Mackenzii Mertensia paniculata Lupinus arcticus (1) Spiraea Beauverdiana Myosotis sp.	Stewart Crossing Whitehorse Whitehorse Eagle Plain Alaska
37	Poa glauca Poa arctica? Poa arctica? Poa glauca Beckmannia sp.	Carcross Eagle Plain North Ogilvie Mts. Whitehorse 30km west of W. horse
38	Setaria sp. Puccinellia sp. Puccinellia sp. Oxytropis campestris	Haines Road Whitehorse Whitehorse Whitehorse
39	Hedysarum Mackenzii	Whitehorse
40	Oxytropis campestris (17) Oxytropis maydel liana? (14)	Whitehorse Whitehorse
41	Polemonium acutiflorum	Alaska (blue)
42	Empty	
43	Agropyron violaceum	Selected from Row #8
44	Empty (tried to seed to Agrostis gigantea from #6)	
45	Puccinellia Nuttalliana	From Row #22

Field Plan Of Selection Nursery (Spring 1992) (Cont.)

Row	Botanical Name	Comments
46	Poa alpina	12 acres field-scale origin - Cassiar Mts.
47	Festuca saximontana	From Row #13 upright
48	Festuca saximontana	From Row #13 blueish
49	Poa glauca	From Row #16
50	Festuca scabrella (32)	Waterton
51	Poa arctica spp Grayana (56)	Elf in Lk (Garibaldi)
52	Agropyron Smithii (49)	Old Man River Dam
53	Koeleria cristata (73)	Waterton
54	Agrostis gigantea (75)	McLeod Meadows (Jasper)
55	Agropyron dasystachyum (44)	Mt. Assiniboine
56	Danthonia intermedia (35)	Mt. Assiniboine

APPENDIX B

DESCRIPTIONS OF MAJOR SPECIES

SHEEP FESCUE - FESTUCA OVINA L.
SELECTION # (identifier) - MV1

ORIGINAL COLLECTION LOCATION	Whitehorse, Yukon Territory
DISTRIBUTION OF SPECIES	Circumpolar
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (54 N Lat) to the Richardson Mountains of the N.W.T. (67:20 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Throughout northern hemisphere; alpine sites
PREFERRED HABITAT	Sandy and gravelly soil
GROWTH HABIT	Relatively short bunch grass
SEED PRODUCTION CHARACTERISTICS	From second year on; throughout its range of adaptation
USES	Reclamation in boreal and alpine environments
OTHER CHARACTERISTICS	This selection has done very well in trials throughout the north. It has survived in the alpine in the Ogilvie Mountains of the Yukon and in the N.W.T. (Richardson Mountains). Also very successful along the Alaska Highway in the Yukon. Seed production is promising. The selection has some alkalinity tolerance.
CURRENT SEED AVAILABILITY STATUS	This selection has been in a breeders seed plot since 1987. Some seed from the breeders plot is available and more will be available in the fall of 1991. This selection can be seeded to field-scale if the market indicates that there is significant demand for it.

NORTHERN SHEEP FESCUE - FESTUCA SAXIMONTANA RYDB.
SELECTION # (identifier) - MV2

ORIGINAL COLLECTION LOCATION	High Level, Alberta
DISTRIBUTION OF SPECIES	Boreal, arctic and alpine sites in North America
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (58 N Lat) north to the Eagle Plain of Yukon Territory (66 N Lat)
OTHER PROBABLE SUITABLE REGIONS	More southerly alpine sites; maybe successful in arctic and Europe
PREFERRED HABITAT	Xeric and semi-xeric sandy soils
GROWTH HABIT	Very short, attractive bunch grass
SEED PRODUCTION CHARACTERISTICS	Slow to produce seed in the north (may take three years). No difficulties in handling seed if cultivated plants tall enough to machine harvest. Prolific seed producer once established.
USES	Reclamation of northern xeric, sandy soils. Well-adapted for pure sand.
OTHER CHARACTERISTICS	The species is native adjacent to the Carcross sand dunes. Despite its lack of stature it may be useful as a forage crop on pure sandy soils - both alpine and boreal sites. This selection is well-adapted to alkaline soils.
CURRENT SEED AVAILABILITY STATUS	The selection has been in a breeders plot since 1987. Field-scale seeding occurred in 1990. Minimal seed is available and more will be obtained from the breeder's plot in 1992. As field-scale production was successful, there will be large amounts of seed available starting in the fall of 1992 or 1993.

ALPINE BLUEGRASS - POA ALPINA L.
SELECTION # (identifier) - MV3

ORIGINAL COLLECTION LOCATION	Cassiar Mountains, Yukon Territory
DISTRIBUTION OF SPECIES	Circumpolar
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	From the southern Yukon (60 N Lat) as far north as the Richardson Mountains of the N.W.T. (67:20 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Alpine regions throughout the northern hemisphere
PREFERRED HABITAT	Unshaded, alpine sites
GROWTH HABIT	Very attractive, short bunch grass
SEED PRODUCTION CHARACTERISTICS	Often produces only minimal amounts of seed until the third growing season; Some seed cleaning problems.
USES	Argumentatively, the major reclamation species for seeding alpine sites in the northern hemisphere. Possibly successful in the true arctic also.
OTHER CHARACTERISTICS	If the project requires a long-term non-maintenance, but somewhat slow-developing ground cover in an alpine environment; which is also pleasing aesthetically , this selection is optimal. While initially successful, it fares poorly at lower elevations if competitors can survive; it does not do well in shaded environments. This selection has over 96% survival in all northern/alpine trials.
CURRENT SEED AVAILABILITY STATUS	This selection has been in breeder's seed plots since 1987. Limited seed was available but most was sold. It was seeded to two field-scale plots in 1990 and large quantities of seed will be available by the fall of 1992 if seed harvest is successful.

GLAUCOUS BLUEGRASS - POA GLAUCA M. VAHL
SELECTION # (identifier) - MV4

ORIGINAL COLLECTION LOCATION	Whitehorse, Yukon Territory
DISTRIBUTION OF SPECIES	Circumpolar
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (58 N Lat) to the Richardson Mountains in the N.W.T. (67:20 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Comparable latitudes throughout the northern hemisphere
PREFERRED HABITAT	Lightly shaded and open semi-xeric sites
GROWTH HABIT	Relatively short bunch grass
SEED PRODUCTION CHARACTERISTICS	Produces seed throughout its range of adaptation.
USES	Reclamation uses at low elevation and in alpine environments.
OTHER CHARACTERISTICS	A very hardy selection which can tolerate limited moisture. This selection can tolerate mildly alkaline soils. It has performed well in all trials in the Yukon, regardless of latitude or elevation. A major reclamation species for linear project disturbed area revegetation and on alpine sites.
CURRENT SEED AVAILABILITY STATUS	This selection has been in a breeders seed plot since 1987. Some seed is available and the selection was seeded to field-scale in June, 1990. This seeding was only partially successful and the field will likely be reseeded in 1992.

FOWL BLUEGRASS - POA PALUSTRIS L.
SELECTION # (identifier) - MV5

ORIGINAL COLLECTION LOCATION	Teslin, Yukon Territory
DISTRIBUTION OF SPECIES	Circumpolar
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (54 N Lat) to the Eagle Plain, Yukon Territory (66 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Comparable latitudes in North America; possibly Europe and Asia
PREFERRED HABITAT	Slightly mesic, semi-shaded sites
GROWTH HABIT	Loose, short-rooted bunch grass, minor rhizome development in some locations
SEED PRODUCTION CHARACTERISTICS	Unusual in that it frequently produces some seed in the year of planting. Will produce seed throughout its range.
USES	Nurse crop for northern reclamation
OTHER CHARACTERISTICS	The species, including this selection, is a short-lived perennial. Usually will winterkill within three winters. Excellent nurse crop as it provides considerable first-year cover but its loose growth habit and weak root system do not provide a barrier for slower developing components of a seed mixture.
CURRENT SEED AVAILABILITY STATUS	This selection was in a breeders seed plot from 1987 to 1990. This plot was removed in 1990 but can be replaced if the market indicates that there is some demand for the selection. It could also be seeded to field-scale if necessary.

NUGGET KENTUCKY BLUEGRASS - POA PRATENSIS L. CV NUGGET
SELECTION # (identifier) - NUGGET

ORIGINAL COLLECTION LOCATION	Alaska
DISTRIBUTION OF SPECIES	Circumpolar: originally from Eurasia (some botanists claim that it is also native to North America)
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (58 N Lat) to approximately 65 N Lat in Alaska
OTHER PROBABLE SUITABLE REGIONS	Comparable latitudes in the northern hemisphere; possibly as far north as Inuvik, N.W.T. (68:10 N Lat)
PREFERRED HABITAT	Well-drained, non-acid soils
GROWTH HABIT	Short to medium height rhizomatous grass
SEED PRODUCTION CHARACTERISTICS	Fair seed producer. Some seed cleaning problems.
USES	Important turf species for subarctic and boreal sites. Useful reclamation selection in northern boreal forest.
OTHER CHARACTERISTICS	Some susceptibility to mildew in parts of Alaska - as yet, no signs of this in the Yukon nursery. Not adapted to high arctic or alpine sites but may have some reclamation potential in the subalpine.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to a breeder's seed plot in 1988. Survival has been excellent but seed production has been limited to date. However, the plot will be maintained and limited amounts of seed may be available for purchase by the fall of 1991.

VIOLET WHEATGRASS - AGROPYRON VIOLACEUM (HORNEM.) LANGE
SELECTION I (identifier) - MV6

ORIGINAL COLLECTION LOCATION	Kluane Lake, Yukon Territory
DISTRIBUTION OF SPECIES	Boreal and subalpine western North America
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (54 N Lat) to southern Yukon Territory (63 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Similar latitudes in other northern regions. Non-alpine sites to 66 N Lat.
PREFERRED HABITAT	Open and semi-shaded sandy loam
GROWTH HABIT	Moderately tall bunch grass
SEED PRODUCTION CHARACTERISTICS	Very successful in northern Alberta; Yukon production rate seems favourable in selection nursery. Easy to handle.
USES	The most useful selection for Alaska Highway reclamation and other sites with its range of adaptation.
OTHER CHARACTERISTICS	This selection is completely awnless. This facilitates seed cleaning and, combined with its leafy growth habit, suggests that the selection may be very useful for forage production on marginal northern sites. Successful on neutral to moderately alkaline sites. Not useful on alpine sites.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to field-scale in June, 1990. Emergence was successful in 1990 and some seed was available by the fall of 1991. Large amounts of seed should be available for purchase by the fall of 1992.

MEADOW FOXTAIL - ALOPECURUS PRATENSIS L.
SELECTION # (identifier) - MV7

ORIGINAL COLLECTION LOCATION	Smithers, British Columbia
DISTRIBUTION OF SPECIES	Circumpolar: originally from Eurasia
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (54 N Lat) to the Eagle Plain of Yukon Territory (66 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Comparable latitudes in the northern hemisphere; possibly as far north as Inuvik, N.W.T. (68:10 N Lat)
PREFERRED HABITAT	Mesic, slightly organic soils
GROWTH HABIT	Tall bunch grass
SEED PRODUCTION CHARACTERISTICS	Prolific seed producer. Some seed cleaning problems.
USES	Major reclamation species for northern mesic sites; especially those on organic soils.
OTHER CHARACTERISTICS	Has excellent potential as a northern forage crop. Very palatable grass. Has limited survival on true alpine sites but useful in the subalpine.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to a breeder's seed plot in 1988. However, this plot was not successful because of weed infestation. The plot was eliminated in 1989 but can be reseeded if there is a demand for this selection in the future. There is still a row of this selection in the selection nursery.

WHEATGRASS - AGROPYRON SP.
SELECTION # (identifier) - MV8

ORIGINAL COLLECTION LOCATION	Arctic Red River, N.W.T.
DISTRIBUTION OF SPECIES	North of 60 N Lat. Western North America and eastern Eurasia
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Alaska Highway, Yukon Territory (61 N Lat) to Arctic Red River, N.W.T. (68 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Similar latitudes throughout the northern hemisphere
PREFERRED HABITAT	Open loamy sand, gravel or shale
GROWTH HABIT	Robust, moderately tall bunch grass; occasionally with short rhizomes
SEED PRODUCTION CHARACTERISTICS	Successful in the Yukon selection nursery. Awns present some seed cleaning difficulties.
USES	The most successful wheatgrass for reclamation in the northern Yukon.
OTHER CHARACTERISTICS	This selection does not fit precisely into the AGROPYRON key. It likely is a naturally occurring hybrid between some members of the A. VIOLACEUM, A. SUBSECUNDUM, A. MACROURUM and A. BOREALE complex. This is the most winter-hardy of any AGROPYRON (both native and introduced) tested in the Yukon and NWT. Successful in the subalpine but not in the Richardson Mountains.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to a breeders seed plot in 1988. However, this plot was not successful. Thus, it was eliminated but may be restored in the future, using seed from the selection nursery.

SLENDER WHEATGRASS - AGROPYRON PAUCIFLORUM (SCHWEIN.) HITCHC.
SELECTION # (identifier) - MV9

ORIGINAL COLLECTION LOCATION	Teslin, Yukon Territory
DISTRIBUTION OF SPECIES	Boreal forest to subarctic in North America
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (54 N Lat) to southern Yukon Territory (63 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Similar latitudes in North America; possibly Eurasia
PREFERRED HABITAT	Open clay to sandy loam
GROWTH HABIT	Very leafy, moderately tall bunch grass
SEED PRODUCTION CHARACTERISTICS	Produces seed very late in the growing season. Easy to handle if seed ripens in time.
USES	Reclamation species throughout its range of adaptation. Possible northern forage crop.
OTHER CHARACTERISTICS	This selection has tremendous potential as a northern forage crop because of its highly vegetative growth habit. It is more tolerant of northern pathogens and environmental stresses than any currently available cultivar of slender wheatgrass.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to a breeders seed plot in 1990. Seed production in the selection nursery has been very successful and thus it is anticipated that some seed will be available by the fall of 1992.

BEARDED WHEATGRASS - AGROPYRON SUBSECUNDUM (LINK) HITCHC, SELECTION # (identifier) - MV10

ORIGINAL COLLECTION LOCATION	Stewart Crossing, Yukon Territory
DISTRIBUTION OF SPECIES	Southern United States to subarctic in North America
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (58 N Lat) to Eagle Plain, Yukon Territory (66 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Disturbed sites in the boreal forest throughout North America
PREFERRED HABITAT	Open sandy, gravelly soils
GROWTH HABIT	Loose, moderately tall bunch grass
SEED PRODUCTION CHARACTERISTICS	Prolific seed producer but large awns cause major seed cleaning problems.
USES	Strictly a reclamation species for nutrient-deficient sites where other wheatgrasses have difficulty.
OTHER CHARACTERISTICS	Tolerates low nutrient and alkaline soils. Some salinity tolerance. Only a short-lived perennial (5-6 years) at its northern limit. May have potential for roadside reseeding as the long awns will tend to discourage domestic livestock and wildlife from grazing where they are hazardous to traffic.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to a breeders seed plot in 1988. Seed production was successful but the plot was eliminated in 1990 to aid in weed control. Some seed is available for purchase, and the breeders seed plot will be reseeded if there is a demand for this selection.

NUTTALL'S ALKALIGRASS - PUCCINELLIA NUTTALLIANA (SCHULT.) HITCHC, SELECTION # (identifier) - MV11

ORIGINAL COLLECTION LOCATION	High Level, Alberta
DISTRIBUTION OF SPECIES	Southern United States to boreal forest in western North America
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Northern British Columbia and Alberta (58 N Lat) to central Yukon Territory (64:30 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Alkaline and saline soils in similar latitudes
PREFERRED HABITAT	Nutrient-deficient, alkaline soils
GROWTH HABIT	Loose, moderately tall bunch grass
SEED PRODUCTION CHARACTERISTICS	Prolific seed producer but weak culms result in lodging and concomitant seed harvesting problems.
USES	Strictly for use on alkaline and saline soils where other selections cannot survive.
OTHER CHARACTERISTICS	This selection is unable to compete with other grasses in more favourable environments. However, until other northern alkali grasses are developed, it is the optimal selection if a saline site in the north needs reclamation.
CURRENT SEED AVAILABILITY STATUS	This selection was seeded to a breeders seed plot in 1988. Emergence was marginal, although seed production was reasonable. Some seed is available. The plot was removed in the spring of 1990 and reseeded in October, 1990, in an effort to increase seed production.

TUFTED HAIRGRASS - DESCHAMPSIA CAESPITOSA (L.) BEAUV.
SELECTION # (identifier) - MV12

ORIGINAL COLLECTION LOCATION	Richardson Mountains, Yukon Territory
DISTRIBUTION OF SPECIES	Circumpolar, In North America from Arctic Ocean to southern United States
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	Central British Columbia and Alberta (55 N Lat) to northern Yukon Territory (67 N Lat)
OTHER PROBABLE SUITABLE REGIONS	Subalpine and possibly alpine sites throughout western North America
PREFERRED HABITAT	Moist soils throughout its range
GROWTH HABIT	Tall bunch grass
SEED PRODUCTION CHARACTERISTICS	Prolific seed producer but tall culms may result in lodging with some seed harvesting problems.
USES	At present, a reclamation grass for northern and subalpine sites; may have potential as a northern forage grass.
OTHER CHARACTERISTICS	The species is credited in the literature with considerable tolerance for both acid and alkaline soils, depending upon the study. MV12, described here, has not been tested on such soils, but has proven very successful on several windswept, subalpine sites in the Yukon, including one as far north as the Yukon-N.W.T. border in the Richardson Mountains.
CURRENT SEED AVAILABILITY STATUS	This selection has been in the selection nursery since 1986. It was seeded to a breeders seed plot in early October, 1990. If this plot is successful, there will be some seed available for purchase in the fall of 1992.

MOUNTAIN TIMOTHY - PHLEUM COMMUTATUM Gandoger
SELECTION # (identifier) - MV13

ORIGINAL COLLECTION LOCATION	Haines Road, Yukon Territory
DISTRIBUTION OF SPECIES	Circumpolar: usually on subalpine or alpine sites
PROVEN LATITUDINAL ADAPTABILITY OF THIS SELECTION	North as far as 61 N Latitude
OTHER PROBABLE SUITABLE REGIONS	Subalpine and alpine sites throughout the northern hemisphere
PREFERRED HABITAT	Gravelly subalpine soils
GROWTH HABIT	Short bunch grass
SEED PRODUCTION CHARACTERISTICS	Moderate seed producer in selection nursery row. Field-scale seed production unknown at present
USES	Potential major reclamation species for subalpine and alpine sites throughout North America.
OTHER CHARACTERISTICS	Potential as a northern forage crop as it is more leafy than most mountain timothy selections. As it is a true alpine species it has great potential for seeding of ski slopes; but this still needs verification in trials.
CURRENT SEED AVAILABILITY STATUS	This selection was collected in 1987 and seed has been multiplied in the selection nursery since then. It was seeded to a breeders seed plot in October, 1990 and if this plot is successful, some seed will be available for purchase in the fall of 1992.

APPENDIX C

BOTANICAL AND COMMON NAMES OF PLANT SPECIES

BOTANICAL AND COMMON NAMES OF PLANT SPECIES

GRASSES

BOTANICAL NAME*	COMMON NAME
Agropyron cristatum (L.) Gaertn.	Crested wheatgrass
Agropyron dasystachyum (Hook.) Scribn.	Northern wheatgrass
Agropyron pauciflorum (Schwein.) Hitchc.	Slender wheatgrass
Agropyron Smithii Rydb.	Western wheatgrass
Agropyron subsecundum (Link) Hitchc.	Bearded wheatgrass
Agropyron violaceum (Hornem.) Lange	Violet wheatgrass
Agropyron yukonense Scribn. & Merr.	Yukon wheatgrass
Agrostis gigantea Roth	Redtop
Agrostis scabra Willd.	Ticklegrass
Agrostis tenuis Sibth.	Bentgrass
Alopecurus aequalis Sobol.	Short-awn foxtail
Alopecurus pratensis L.	Meadow foxtail
Alopecurus arundinaceus Poir.	Black foxtail
Arctagrostis latifolia (R.Br.) Griseb.	Polargrass
Beckmannia erucaeformis (L.) Host	Sloughgrass
Bromus inermis Leyss.	Smooth brome
Bromus Pumpellianus Scribn.	Northern brome
Calamagrostis canadensis (Michx.) Beauv.	Bluejoint reedgrass
Danthonia intermedia Vasey	Timber oatgrass
Deschampsia brevifolia R. Br.	Hairgrass
Deschampsia caespitosa (L.) Beauv.	Tufted hairgrass
Elymus innovatus Beal	Hairy wild ryegrass
Festuca altaica Trin.	Altai fescue
Festuca ovina L.	Sheep fescue
Festuca rubra L.	Red fescue
Festuca saximontana Rydb.	Northern fescue
Festuca scabrella Torr.	Rough fescue
Hierochloe alpina (SW.) Roem. Schult.	Alpine sweetgrass
Hierochloe odorata (L.) Wahlenb.	Sweetgrass
Koeleria cristata (L.) Pers.	Junegrass
Phleum commutatum Gandoger	Mountain timothy
Poa alpigena (E. Fries) Lindm.	Northern bluegrass
Poa alpina L.	Alpine bluegrass
Poa arctica R. Br.	Arctic bluegrass
Poa arctica R.Br. ssp. grayana Vasey	Arctic bluegrass
Poa compressa L.	Canada bluegrass
Poa glauca M. Vahl	Glaucous bluegrass
Poa palustris L.	Fowl bluegrass
Poa pratensis L.	Kentucky bluegrass
Puccinellia Nuttalliana (Schult.) Hitchc.	Nuttall's alkaligrass
Setaria viridis (L.) Beauv.	Green foxtail
Trisetum spicatum (L.) Richt.	Spike trisetum

*Nomenclature follows; Hulten, E. 1968. Flora of Alaska and Neighboring Territories, Stanford University Press.

BOTANICAL AND COMMON NAMES OF PLANT SPECIES (CONT.)

LEGUMES AND OTHER FORBS

BOTANICAL NAME*	COMMON NAME
Astragalus agrestis Dougl.	Field milk vetch
Astragalus alpinus L.	Alpine milk vetch
Astragalus americanus (Hook.) M.E. Jones	American milk vetch
Astragalus eucosrous Robins.	Elegant milk vetch
Astragalus tenellus Pursh	Pulse milk vetch
Astragalus umbellatus Bunge	Tundra milk vetch
Astragalus Williamsii Rydb.	William's milk vetch
Hedysarum alpinum L.	American hedysarum
Hedysarum Mackenzii Richards.	Mackenzie's hedysarum
Lupinus arcticus S. Wats.	Arctic lupine
Mertensia paniculata (Ait.) G. Don	Tall bluebell
Oxytropis campestris (L.) DC.	Yellow locoweed
Oxytropis Maydelliana Trautv.	Maydell's locoweed
Oxytropis nigrescens (Pall.) Fisch.	Blackish oxytrope
Oxytropis splendens Dougl.	Showy locoweed
Polemonium acutiflorura Willd.	Tall Jacob's ladder
Polemonium pulcherrimum Hook.	Jacob's ladder

*Nomenclature follows; Hulten, E. 1968. Flora of Alaska and Neighboring Territories, Stanford University Press.