Alaska Plant Materials Center

2005 Annual Report

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ALASKA PLANT MATERIALS CENTER

2005 ANNUAL REPORT

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LETTER FROM THE DIRECTOR

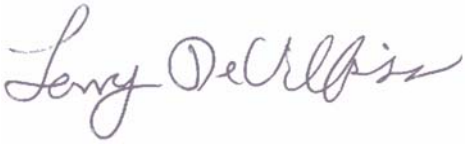
The Alaska Plant Materials Center (PMC) will be celebrating its 32nd anniversary in 2005. The PMC'S present and past dedicated employees should be proud of their accomplishments. Maintaining high levels of service over a thirty-one year period has been challenging with increased costs of operation accompanying decreases in State funding.

The PMC has maintained excellent service levels while actively seeking non-state funds to continue their daily operations. Additionally, changes in methods of operation and efficiency improvements have allowed the PMC to continue providing a multitude of services to the public and individuals it serves.

The PMC Manager has promised further improvements and efficiency changes. These will include increasing the level of non-state funding, thereby further reducing the need for Agriculture Revolving Loan Funds.

The PMC is a strong asset to the State of Alaska and the Agricultural industry.

Sincerely,



Larry DeVilbiss
Director

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Introduction

The Alaska Plant Materials Center (PMC) is a section of the Division of Agriculture within the Department of Natural Resources. The Plant Materials Center's work advances applied plant research for northern latitudes through four major programs: (1) Revegetation and Native Seed Production, (2) Alaska Ethnobotany Research Project, (3) Foundation Seed Program, (4) Potato Seed Program. Each of these programs will be addressed in this report.

Often in late July or early August, the Plant Materials Center hosts an open house. The PMC staff is available to answer questions about the projects and give tours of the facilities. Over 300 people attended the last open house. Scheduling conflicts did not allow an open house in 2002. Construction activities precluded an open house in 2004 and 2005. However, in 2007 the PMC's open house program will resume.

The majority of the Plant Materials Center's funding comes from non-state sources. In recent years, USDA has become the major funding source. The majority of the remaining operating monies are allocated from the Agriculture Revolving Loan Fund. The PMC no longer relies on the state general fund. That change occurred in fiscal year 1997. Additionally, the center brings in small amounts of revenue through cooperative projects with other agencies, the private sector and through the sale of plant materials. All funds derived from outside sources can be used for direct operations of the Plant Materials Center.

History

Early attempts to establish a federal Plant Materials Center in Alaska were unsuccessful because the U. S. Department of Agriculture believed that the centers at Pullman, Washington and Corvallis, Oregon could serve the needs of Alaska.

The Alaska Legislature was not discouraged, and at the urging of the University of Alaska, conservation groups and farmers, prepared legislation that would establish the Alaska Plant Materials Center.

In 1972, Governor Bill Egan signed into law a bill creating the Alaska Plant Materials Center. This legislation directed the Plant Materials Center to fulfill several traditional agricultural responsibilities and to develop plant varieties and techniques for revegetation and erosion control and provide technical reclamation assistance to industry.

Soon after the Plant Materials Center bill was enacted, a 285-acre tract near Palmer was selected for the center's site. An additional 120-acre parcel adjacent to the PMC was acquired through a land exchange with the Matanuska-Susitna Borough in 1982. This gave the PMC a total of 405 acres to accomplish its mandated duties which then included revegetation work, horticultural development, foundation seed production and disease-free potato seed stock production.

In 1987, the PMC's programs were consolidated into two programs: the North Latitude Revegetation and Seed Production Project and the North Latitude Vegetable and Landscape Crop Improvement Project.

In 1994, the PMC assumed responsibility for the maintenance and production of breeder class seed of all University of Alaska developed grass varieties. The transfer of responsibility has placed the PMC in the position of being the repository and maintainer for Alaska-developed germplasm.

In November 1997, the PMC was notified that the U.S. Department of Agriculture granted the PMC to operate the Arctic Genetic Resources Unit this included an operating and capital funds grant. In 1998, the Germplasm Repository became a reality. The first USDA employee was hired and the state initiated the design of a screen house. The screen house was completed in 2001. The Arctic Genetic Resources Unit currently holds accessions of alpine, arctic and polar plants with a special emphasis on wetland species. The site also became instrumental at increasing germplasm held at other USDA repositories. A new short-term specific cooperative agreement was implemented in 2003. We expect a long and productive cooperative effort with USDA.

In 1999, a grant from USDA Natural Resource Conservation Service (NRCS) allowed the PMC to expand its program in native seed production and commercialization. This program is continuing.

In the year 2000, an additional grant from NRCS allowed the PMC to expand a cold regions program. The program not only allows for the establishment of a supplemental plot network throughout Alaska, it funds additional circumpolar seed exploration/collection projects.

The Cooperative State Research, Education, and Extension Service Program of the USDA funds the research programs (channeled through Alaska's Land Grant University of Fairbanks.) The funding for the Alaska Seed Grower's Research Project started in 2003. The funds for the Alaska Ethnobotany Research Project started in 2004.

The PMC has been very aggressive in securing grants and federal funds. This trend is not expected to decline; in fact, the level of non-state funding is expected to increase.

North Latitude Revegetation & Seed Production Program

The Revegetation and Native Seed Production Program's products and methods are used to encourage a healthy seed industry and develop new plant materials and methods for land reclamation and erosion control. These two functions are complementary and are intended to promote an instate seed industry while providing state-of-the-art revegetation and erosion control information to the public.

Revegetation & Reclamation Efforts

The construction of the Trans Alaska Pipeline in the 70's triggered the current reclamation research activity in Alaska. However, since the pipeline, ideas associated with revegetation have changed. Continued oil development, renewed interest in surface and placer mining, as well as new federal, state and local regulations have caused applied research activities to address "reclamation" as defined by regulations, which in some cases has precluded the use of "traditional" plant material and planting technology.

The Alaska Plant Materials Center continues to lead Alaska in reclamation, erosion control, research and technology transfer and revegetation. The use of dormant seedlings to extend planting seasons, cost-effective and successful methods in willow planting, and wetland and coastal restorations are research priorities for the Plant Materials Center.

The project follows seven basic steps to establish a resource of conservation plants for use in land reclamation, wildlife habitat improvement and erosion control. They are: 1) define and anticipate conservation problems and establish priorities; 2) research and assemble candidate plant materials; 3) conduct initial evaluations; 4) establish small scale seed or vegetative increases; 5) perform advanced and final testing and field evaluation plantings; 6) establish large scale seed or vegetative increases; and, 7) release of a variety or cultivar.

This program has gathered at least 275 plot years of information collected from sites around the state (Figure 1), developed 11 new cultivars for revegetation and reclamation and assisted scores of agencies and private companies in reclamation, erosion control and revegetation. Figure 2 represents a typical plot layout used in off-site evaluations.

This report outlines some of the present revegetation and reclamation research being conducted by the PMC and summarizes current activities at sites around the state. Additional information can be found in the individual reports that are listed in this report. Copies of these reports are available from the Alaska Plant Materials Center and on line at http://www.dnr.state.ak.us/ag/index.htm.

Figure 1 – Map of Alaska, Plant Materials Center Plot Locations

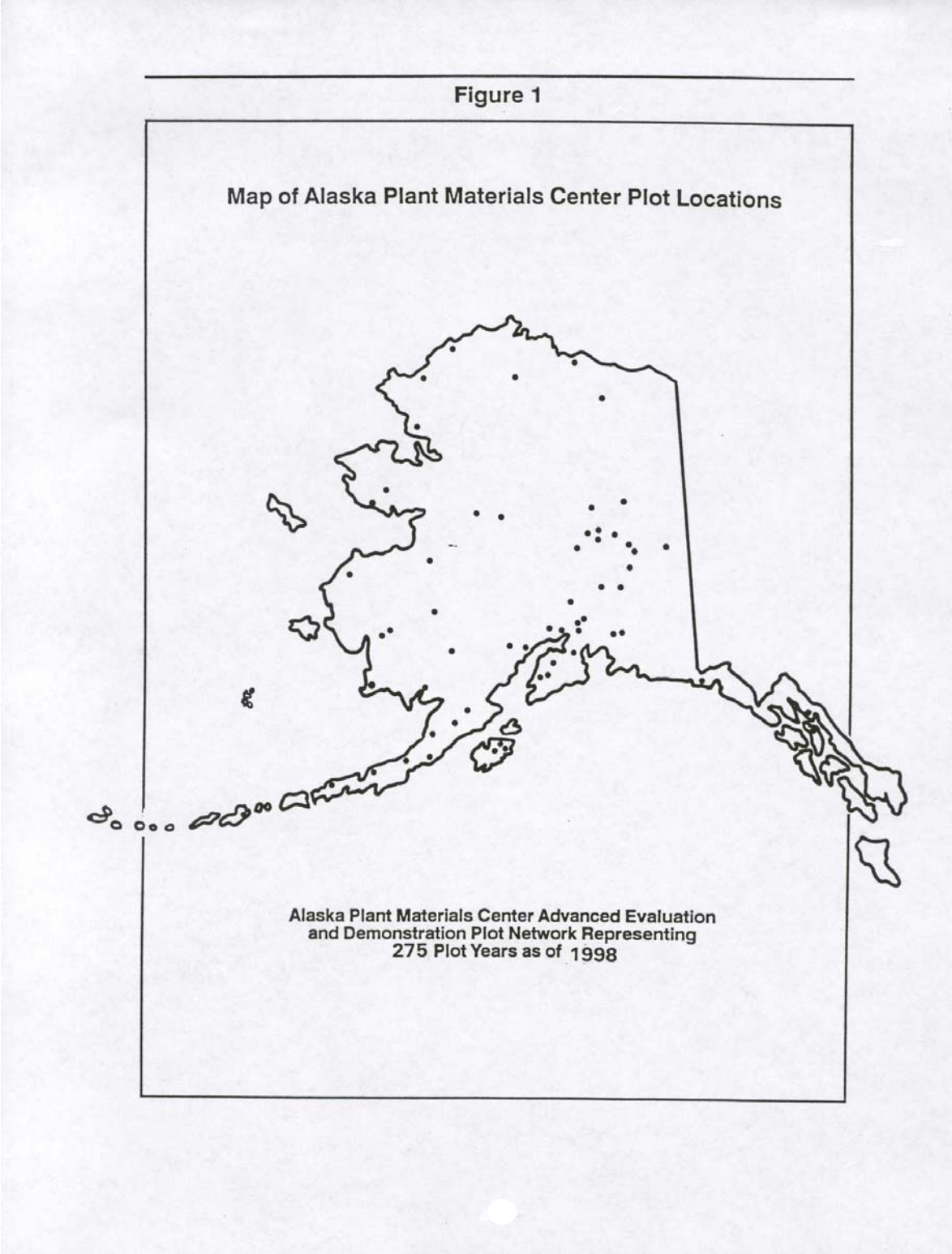

Figure 2 – Typical Plot Layout

Nugget Kentucky bluegrass	Merion Kentucky bluegrass
Park Kentucky bluegrass	Banff Kentucky bluegrass
Sydsport Kentucky bluegrass	Fylking Kentucky bluegrass
Service big bluegrass	Troy Kentucky bluegrass
Sherman big bluegrass	Canbar canby bluegrass
Tundra glaucous bluegrass	Reubans Canada bluegrass
Poa glauca T08867	Gruening alpine bluegrass
Agropyron subsecundum 371698	Sodar streambank wheatgrass
Nordan crested wheatgrass	*Agropyron subsecundum*
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
Norcoast Bering hairgrass	*Elymus sibiricus* 2144
Sourdough bluejoint	Nortran tufted hairgrass
Meadow foxtail	*Calamagrostis canadensis*
Garrison creeping foxtail	*Alopecurus geniculatus*
Boreal red fescue	Arctared red fescue
Egan American sloughgrass	*Festuca scabrella*
Durar hard fescue	Pennlawn red fescue
Covar sheep fescue	Highlight red fescue
Kenai polargrass	Manchar smooth brome
Alyeska polargrass	Carlton smooth brome
Caiggluk tilesy sagebrush	Polar brome

The U.S. Cold Regions Plot Evaluation Network

The project is responsible for obtaining and evaluating plant material/seed of species indigenous to regions north of 52° North Latitude and equivalent vegetated regions in the southern hemisphere (south of 52° South Latitude). Support will be given to all U.S. and foreign parties engaged in authorized plant material acquisition and research in the stated geographic regions.

A national systematic and uniform trial program did not previously exist for cold region plants. Previously, material collected in the Arctic and Antarctic was evaluated under temperate conditions or in growth chambers. The Alaska sites now allow for evaluation under confined natural conditions. The plot network transects the state and the resulting data will be incorporated into ongoing global warming studies. The network is jointly operated by the PMC and NRCS.

2003 Activities

Seed was obtained from Alaskan and Canadian sources. They were as follows:

-Alaska Mill and Feed
-Alaska Plant Materials Center
-Hannas Seeds

All test plots were laid out in the same manner. Each species was planted in a 4' x 10' plot making the overall plot dimensions 20' x 72'. The plot layout is as follows:

Park Kentucky Bluegrass	Alene Kentucky Bluegrass
Nugget Kentucky Bluegrass	Tundra Glaucous Bluegrass
Service Big Bluegrass	Norcoast Bering Hairgrass
Durar Hard Red Fescue	Nortran Tufted Hairgrass
Arctared Red Fescue	Boreal Creeping Red Fescue
Pennlawn Red Fescue	Boreal Creeping Red Fescue
Gruening Alpine Bluegrass	*Poa macrocalyx*
Puccinellia nutkaensis	Egan American Sloughgrass
Alyeska Polargrass	Meadow Foxtail
Sourdough Bluejoint	*Artemisia tilesii*
Hannas High Tech Alfalfa	Beaver Alfalfa
James Dahurian Wild Rye	Siberian Wild Rye
Altai Wild Rye	Russian Wild Rye
Kirk Crested Wheatgrass	Slender Wheatgrass
Wainwright Slender Wheatgrass	Intermediate Wheatgrass
Manchar Smooth Brome	Carlton Smooth Brome
Climax Timothy	Engmo Timothy
Farol Timothy	Alma Timothy

Plots have been planted across the state with many different cooperators. The plot locations, date planted and the cooperators are as follows:

Location	Date Planted	Cooperator
Homer	June 11, 2003	Jim Van Oss
Willow	June 23, 2003	DOT&PF
Delta Junction	June 25, 2003	UAF
North Pole	June 27, 2003	Warren Smith
7 Mile Camp Dalton Hwy	June 28, 2003	DOT&PF
Jim River Camp Dalton Hwy	June 29, 2003	DOT&PF
Talkeetna	July 7, 2003	DOT&PF
Trapper Creek	July 7, 2003	DOT&PF
Cascade Camp Glenn Hwy	July 9, 2003	DOT&PF
Nome	July 15, 2003	Alaska Gold and DOT&PF
Kodiak	August 28, 2003	Bill and Buck Burton

All the plots except Kodiak were evaluated in the fall of 2003. Plots are scheduled for evaluation at least once per year for the next three years. Of the plots evaluated in 2003, good growth was present in most species.

Several more plots are planned for 2004. More species will be included in the plots from sources such as the Alaska Plant Materials Center Native Plant Nursery, Arctic Alpine Seed, Northstar Seeds, Seedland, and others.

2004 Activities

Plots planted in 2004 were the same as the 2003 plots plus some additional species. Additional plant material was obtained from the Alaska Plant Materials Center and the Native Plant Nursery. The plot layout for 2004 was as follows:

Cold Regions Plot Layout 2004

Park Kentucky Bluegrass	Alene Kentucky Bluegrass
Nugget Kentucky Bluegrass	Tundra Glaucous Bluegrass
Service Big Bluegrass	Norcoast Bering Hairgrass
Durar Hard Red Fescue	Nortran Tufted Hairgrass
Arctared Red Fescue	Boreal Creeping Red Fescue
Pennlawn Red Fescue	Boreal Creeping Red Fescue
Gruening Alpine Bluegrass	*Poa macrocalyx*
Puccinellia nutkaensis	Egan American Sloughgrass
Alyeska Polargrass	Meadow Foxtail
Sourdough Bluejoint Reedgrass	*Artemisia tilesii*
Hannas High Tech Alfalfa	Beaver Alfalfa
James Dahurian Wild Rye	Siberian Wild Rye
Altai Wild Rye	Russian Wild Rye
Kirk Crested Wheatgrass	Slender Wheatgrass

Wainwright Slender Wheatgrass	Intermediate Wheatgrass
Manchar Smooth Brome	Carlton Smooth Brome
Climax Timothy	Engmo Timothy
Farol Timothy	Alma Timothy
Kenai Polargrass	*Poa eminens*
Polar Brome	*Agropyron macrourum*
Max Q Tall Fescue	Needlegrass
Hedysarum alpinum	*Ligusticum scoticum*
Solidago multiradiata	*Senecio Pseudo-arnica*
Lupinus nootkatensis	*Cnidium cnidifolium*
Artemisia stellariana	*Tripleurospermum maritima*
Denali Alfalfa	Tall Jacob's Ladder

The plots in Southeast Alaska as well as one plot at Red Dog Mine had the following additions as well:

Senecio Pseudo-arnica	Dwarf Fireweed *Chamerion latifolium*
Polemonium pulcherrimum	*Geranium erianthum*
Boykinia richardsonii	*Plantago canescens*
Solidago decumbens	*Aster sibericus*
Oxytropis campestris	*Oxytropis deflexa*
Galium boreale	

Many additional plots were planted in 2004. The locations and cooperators are listed below.

Location	Date Planted	Cooperator
Juneau	May 10, 2004	DOT and Div of Parks
Sitka	May 11, 2004	DOT&PF
Ketchikan	May 12, 2004	City of Ketchikan and USFS
Petersburg	May 13, 2004	DOT&PF
Glennallen	May 24, 2004	DOT&PF
Valdez	May 25, 2004	DOT&PF
Tok	May 26, 2004	DOT&PF
Lake Creek	May 29, 2004	Bentalit Lodge
Kodiak	June 2, 2004	Bill and Buck Burton
McGrath	June 8, 2004	DOT and Les Malone
Nome	June 23, 2004	Rick Wolfe
Delta Junction	July 1, 2004	Harley Olberg
Red Dog Mine	July 11, 2004	Red Dog Mine

Evaluations of all of the plots planted in 2003 were evaluated at least once during the summer of 2004. Most of the plots were performing well. The Kodiak plot needed to be replanted due to damage from grazing livestock. Most of the 2004 planted plots were evaluated in the fall.

Grain was included at some locations in 2004. The barley, wheat and oat varieties maintained by the PMC were sent to interested growers in various communities of Alaska including Nome, McGrath, and Delta Junction. All varieties performed well in all locations, though grower notes will need to be reviewed to determine the levels of maturity attained.

2005 Activities

2005 Plot Locations

Location	Date Planted	Cooperator
Prudhoe Bay	June 28, 2005	DOT&PF
Franklin Bluffs	June 28, 2005	DOT&PF

All plot locations planted in 2003 and 2004 were evaluated at least once in 2005. Growth on most of the plots continued to be good. A few locations have been overgrown by vegetation previously existing on the sites. Notable performance variations are becoming evident between individual accessions and plot locations. All plots will be evaluated again in 2006.

Red Dog Mine Revegetation & Demonstration Plots

This project grew out of a mutual need for information. The PMC required revegetation data from northwestern Alaska, and Cominco Alaska, Inc. needed information on species that would perform well in future mine revegetation programs. In 1987, Cominco agreed to provide the PMC with sites to establish evaluation and demonstration plots for at least four years.

In order to provide the best information for both the PMC and Cominco, three plot sites, representing different conditions, were selected. A site selected near the port facility was a sandy, gravel beach area common to the region. The second plot was located at the original campsite's fuel bladder containment area. The third plot was similar to the camp area, but provided a site to compare spring and fall seedlings.

This combination of plots was intended to supply data for revegetation species selection and planting windows for seeding. The port site was planted on July 6, 1987 and provided information regarding revegetation in the coastal portion of the mine project.

A dormant plot was seeded at the campsite on September 8, 1987. Because of space limitations, the plot dimensions were slightly reduced and 12 accessions were dropped from the plot. The accessions that were eliminated are species that have failed elsewhere in northern Alaska. Their elimination from the plantings did not compromise the value of the information obtained from the plots. On June 15, 1988, a plot was planted on gravelly soil similar to the surface that will exist when construction of the mine is complete.

A major demonstration planting was also established on June 14, 1988. This plot, located on an abandoned disposal site north of the facility, was contoured and seeded entirely with native species. It was also evaluated for four growing seasons. The completion of the evaluation program occurred September 1990, at which time a final report was prepared for Cominco.

A complete listing of conclusions and recommendations can be found in 1990 Final Report of Data and Observations Obtained From the Red Dog Mine Evaluation and Demonstration Plots.

During September 1992 and 1993, these sites were again visited and evaluated. All of the plots and trials continued to perform very well. During the 1993 site visit, plans were developed for a new research effort planned for 1994. These plans were put "on hold" until 2002.

In 1996, a collection of native species occurred near the port site. This seed was cleaned at the PMC and returned to the mine operator. The 1997 site visit was not conducted because of scheduling conflicts. The areas were, however, evaluated in 1998.

In 2001, soil samples were taken from several locations within the mine site. The samples were sent to the PMC and were tested for pH, N, P, and K as well as several heavy metals that are known to be present in the mine spoils. The soils were then used in greenhouse trials with the goal of determining specific plant species that might tolerate and thrive in the toxic soils.

In 2003, Red Dog Mine was again visited to review revegetation efforts. Changes in Tech Cominco personnel resulted in the loss of some of the technical notes on soil sample locations and revegetation activities. A summary of the historical involvement of the PMC with Red Dog was prepared along with pressed samples of plant materials currently being used for revegetation at the mine.

The 2004 site visit to Red Dog Mine was completed July 10 – 14. The goals of the trip were to establish test plots, review revegetation activities and performance, and develop a working relationship with the contractor developing the restoration plan for the mine.

Test plots were installed at three locations around the mine site. Fifty-two individual accessions were planted in each plot. Diverse plot locations were selected in order to give a broad representation of the performance of individual species on different parent materials. The test plots will provide valuable information on plant species that are suitable for use in ongoing revegetation activities.

Many areas at Red Dog Mine have been seeded since revegetation efforts began at the site. These locations were visited in 2004 to start or continue monitoring efforts. Photo points have been established at bridge crossings on the port road. Later a new series of photo points were established at many locations around the mine site. Photos were taken during these visits and will continue to be taken during future visits to develop a photographic documentation of the progression of the restoration. Permanent transects have been installed at three locations. These will provide a quantitative measure of plant cover and species diversity.

Test plots planted in 2004 were evaluated during a site visit in July of 2005. Performance of the test plots was generally good with the different parent materials exhibiting distinct growth characteristics. All of the test plots produced valuable data. The plot in the freshly bladed tundra just past the waste rock dump performed the best with several promising species. Most notably the *Tripleurospermum* was flowering very nicely and had spread outside of the area where it was planted. Other varieties that did well were ‘Nortran’ Hairgrass, ‘Arctared’ Red Fescue, ‘Gruening’ Alpine Bluegrass, ‘Wainwright’ Wheatgrass, ‘Tundra’ Bluegrass, Tall Jacobs Ladder, and ‘Kenai’ Polargrass.

Similar results were obtained from the plot located on the overburden stockpile. That plot had suffered from some vehicle traffic over the last year. The plot near drainage ditch #4 on the Siksikpuk parent material did not produce much plant growth except for the Tall Jacob's Ladder.

Red Dog environmental personnel collected soil samples for greenhouse evaluations which will occur in the summer of 2006.

Upper Knob Creek and Jones Mine

In 1998, the Plant Materials Center continued to work with the Division of Mining and their abandoned mine land program to revegetate two additional sites, Upper Knob Creek and Jones Mine Phase II. Upper Knob Creek is divided into several pits of varying size totaling over 40 acres. The Jones Mine is a 15-acre area across the valley from Upper Knob Creek. These sites were characterized by gravelly, rocky material mixed with finer particles of clay, silt or sand. When wet the substrate was slippery, sticky and easily eroded. When dry the substrate was crusty with cracks that formed as it dried.

Past revegetation efforts have demonstrated that planting combinations of willow brush layers, bundles and live stakes along with transplants and seedings with native grasses and forbs are appropriate techniques for revegetating sites with steep slopes and erosive soils.

These techniques were used at Upper Knob Creek and Jones Mine Phase II sites. Also, soil that had been salvaged was spread over a relatively small area on the upper slopes of the Jones Mine.

The Jones Mine contains both cut and fill slopes. After the area was graded to contour, most of the area was scarified. Some areas on the middle and upper portions of the cut slope could not be scarified because large rocks would be pulled to the surface and disturb the site too much. Several terraces were created on the lower section of the mine to reduce slope length.

Transplants salvaged from Phase III of the Jones Mine restoration were placed on the terraces. In addition to transplants, numerous brush layers were scattered over the slope. Bundles were strategically placed in areas where rilling had begun to occur and in other locations that appeared to be prone to erosion.

Plots were also established to evaluate three alternative fertilizers; Biosol, Fertil-fibers and Humazyme. Three large plots were set up on the southeast-facing slope and three smaller plots were set up on a northeast-facing slope. The products were applied according to manufacturer's directions. The site was seeded with native grasses and forbs and the area outside of the fertilizer study plots was fertilized with 20-20-10 fertilizer.

The timing of activities is important and this project reminded us of this point on several occasions. The site was first scarified, and then a backhoe was used to move transplants and install brush layers. The substrate where the backhoe had traveled became compacted and smooth. The benefits of scarification were lost and the soils became more vulnerable to erosion.

During June 2000, a seven-acre section of Phase III of the Jones Mine was revegetated. The site was scarified and planted with willow bundles and a few brush layers. A large quantity of willows had been purchased for the 2000 planting season with the idea that more of Phase III would be ready for revegetation. Since only a total of seven acres was available, the site was planted heavily. Excess material was used on selected areas in Lower Knob Creek.

Driwater, the slow-release gel watering product described in the Lower Knob Creek section, was used at this site also. The product was installed late in the season when the rains were beginning and it is not apparent that it provided a benefit. In dry years it may be very beneficial. This site will be monitored for several years.

The Upper Knob Creek site contained four pits. The primary revegetation effort focused on slowing surface water erosion. Willow bundles, and to a limited extent, brush layers were placed in areas that had begun to show signs of rilling in Pits 6 and 7. After a very heavy thundershower, the importance of timing became apparent again. Many of the bundles had just begun to leaf out when they were buried by sediment resulting from the erosion caused by the intense rainfall. The young new shoots required careful excavation by hand. Despite the weather conditions, the woody plantings became well established.

All of the pits were seeded with native grasses and forbs and fertilized with 20-20-10 granular fertilizer. With the exception of Pit 6, seed and fertilizer were broadcast by hand. The fertilizer for Pit 6 was applied by airplane.

Pit 6 was particularly susceptible to erosion. In 1999, additional willows and grass seed were planted at Pits 6 and 7 at Upper Knob Creek. Considerable erosion had occurred at these pits late in the 1998 growing season. Intensive willow plantings using brush layering, bundles and gully plantings addressed these erosion areas. A light seeding of grass was also broadcast on bare areas.

The 1999 plantings appeared to be growing well at the end of growing season. Some of the woody plantings were not completed until mid-July, nearly two weeks after the recommended cut-off date. A survey of the plantings in 2000 indicated that the late-planted willows survived.

Extensive cooperation with the Division of Mining, Land and Water's Abandoned Mine Land Project continued in 2002 with the revegetation of Phase V of Jonesville Mine. The area consisted of a large rock face that needed seed and fertilizer above and below it. The lower 18-acre portion was easily treated using a 4x4 tractor with a broadcast spreader. The upper eight acre portion was considerably more challenging due to poor accessibility and steep terrain. The entire project was completed August 10, 2002 and good growth was apparent in September.

Planning for the revegetation of Phases III and IV of Jonesville Mine was completed and then revised in 2002. These areas have steep, erosive slopes consistent with the rest of the site. The area was contoured to decrease downhill water movement. Live willow stakes and bundles, straw logs, and seeding with native grasses and forbs were the techniques employed to revegetate this portion of the site. Alder seedlings were planted as a new possible technique on the upper most portion of phase IV. Seeds were collected in the fall of 2002 for around the mine site. The seed was cleaned and tested. Seeds were sown in flats in a greenhouse and were about 3 inches tall at the time of transplanting onto the site. Approximately 4000 alder seedlings were planted.

A monitoring program was implemented on phases III and IV and monitoring continued on phase V. Phase V is showing good growth after one season with only one small area needing more seed in 2003. By the fall of 2003, the willows and grass seedlings were growing well across phases III and IV.

Plant establishment on phases III, IV, and V continued to be tracked through 2004. Growth was good on all species planted. Even the test planting of alders performed well. Wildlife and ATV traffic resulted in only a few lost plants. Species diversity in the restored areas is increasing.

Monitoring of Phase V was completed in 2005 and is described in the report Abandoned Mine Land Reclamation, Phase 5 Jonesville Mine, Sutton Alaska Revegetation Implementation and Monitoring. Monitoring of Phase III and IV continued in 2005 and is expected to be reported on in 2006.

North Atlantic Germplasm Collection Project

As a part of the newly funded Cold Regions Vegetation Project, the PMC initiated a seed collection project on Iceland and the Faroe Islands in 2001. Part of the program is dedicated to acquisition of seed from other circumpolar regions.

Germplasm Collection Project on Iceland and the Faroe Islands
August 19, 2001 – September 11, 2001

Results of the Collection Effort:
Iceland: August 19-25, 2001, North Iceland
Faroe Islands: August 31 - September 7, 2001
Iceland: September 8-11, 2001, South Iceland

Most of the species targeted and collected were indigenous to both Alaska and the two Atlantic Island groups. Collection of material not present in Alaska was limited and only conducted based on interest expressed by the Icelandic or Faroese scientists.

Material Collected/Total Accessions:

Angelica archangelica /1
Anthoxanthum odoratum /4
Dactylis glomerata /2
Deschampsia caespitosa /14
Deschampsia flexuosa /4
Festuca richardsonii /11
Festuca rubra /12
Holcus lanata /4
Leymus arenarius /23
Ligusticum scoticum /1
Lolium multiflorum /2
Lupinus nootkatensis /9
Luzula sylvatica /1
Phleum alpinum /3
Phleum pretense /1
Poa alpina /14
Poa glauca /11
Poa pratensis /3
Trisetum spicatum /2

Total: 123 accessions

All the material collected was immediately re-cleaned and tested after arrival in Palmer. In March 2002, all the collections were planted in greenhouses. The resulting seedlings were field planted in July 2002. All the plantings are on PMC property at Palmer. Between July and October 2002, all the plantings were evaluated three times.

Svalbard (Spitzbergen) Collection 2002

In 2002 a seed collection project was planned and conducted on the Svalbard Archipelago (Spitzbergen), Norway and the Tromso region of Norway. The collections occurred between August 16 and September 10, 2002.

As with the Iceland and Faroe Islands collections of 2001, the Norway collections concentrated on species common to both the collection areas and Alaska. The new material from Norway and particularly Svalbard, (78-81 degrees north latitude) has added a significant and important component to the U.S. collection.

Material collected/total accessions:

Leymus arenarius /19
Deschampsia caespitosa /40
Deschampsia boreal /10
Deschampsia alpina /88
Trisetum spicatum /6
Poa arctica /7
Poa alpina /4
Poa glauca /2
Alopecurus borealis /3
Festuca rubra /4
Festuca hyperboreal /1
Festuca richardsonii /19
Festuca vivipara /1
Colpodium vahlianum /1
Puccinellia phyganodes /1
Calamagrostis stricta /1
Dupontia pelligera /1
Luzula arcuta /1
Papaver dahlianum /1
Rumex acetosa /1
Oxyria digyna /1

Total: 212 accessions

All the seed from Svalbard was returned to the U.S. under a Norwegian phytosanitary permit and the general USDA import permit. No problems were encountered on return to the U.S. This seed was field planted on the PMC property in June 2003. Evaluation of the plantings continued through 2005 and will terminate after the 2006 season.

West and South Greenland Collection Project

In 2003 a seed collection project was conducted in west and south Greenland between September 5 and October 8, 2003. The seed collection project was very successful resulting in 403 collections, and included 31 species. This was at the time the largest collection the Plant Materials Center had ever made during a federally funded germplasm collection project. The volume (weight) and number of species exceeded the initial goal by at least sixty percent. This was in part due to the fact that grazing animals, primarily sheep, are well-managed and restricted in Greenland. Therefore, no competition for the resource existed. But more importantly, the suggested time of the collection project was perfect for the availability of the maximum amount of seed. This combined with the previous summer's weather contributed to very high quality seed. The collection conditions were nearly ideal with only a few days of rain.

There were only minor flight delays between towns so time on the ground was maximized. The people on Greenland were very helpful. All of these factors contributed to the success of the project.

The Danish Plant Health Directorate, located outside Copenhagen, was helpful and efficient in having the seed inspected. Every collection was inspected and a Phytosanitary Certificate was issued after two working days.

Upon arrival in Seattle the seed was immediately sent to the local APHIS inspection station for a final screening. Four collections needed further inspection and were held in Seattle. Two days after the seed collection was surrendered to APHIS the remainder of the collections arrived in Palmer.

The seed was planted at the PMC in June 2004 and evaluated by traditional techniques. The evaluations continued through 2005 with termination scheduled for 2008.

Greenland Species and Accessions Collected:

Agrostis capillaries	14
Agrostis mertensii	1
Alopecurus alpina	18
Angelica archangelica	4
Artemisia borealis	8
Calamagrostis langsdorffii	9
Calamagrostis neglecta	5
Campanula gieseckiana	4
Cerastium alpinum	1
Deschampsia caespitosa	45
Deschampsia flexuosa	14
Dryas integrifolia	1
Elymus alaskanus	9
Eriophorum scheuchzeri	1
Festuca brachyphylla	16
Festuca richardsonii	11
Festuca rubra	22
Hierochloe odorata	2
Leymus mollis	91
Nardus stricta	1
Phleum alpina	3
Poa alpina	9
Poa arctica	35
Poa glauca	16
Poa pratensis	19
Poa flexuosa	18
Papaver radicatum	1
Puccinellia maritima	10
Salix glauca	1
Saxifraga oppositifolia	3
Trisetum spicatum	13
Viscaria alpina	2
Total	**407**

The remaining areas of the circumpolar region are still of interest. Closing this loop will be possible over the next two years.

Nunavut Territory, Nunavik (Quebec) & Nunatsiavut, Labrador (Newfoundland and Labrador) Canada Germplasm Collection Project (2004-2005).

Introduction and Overview for Nunavut Territory

The seed collection project conducted from August 19 to September 22, 2004, in the Canada High Arctic (Nunavut) was very successful. The collection consists of 424 collections and includes 27 species. This is the second largest collection the Plant Materials Center has ever made during a federally funded germplasm collection project. The collection conditions were not ideal, only a few days were free of rain. Rain tends to make collection difficult and often produces seed that requires additional work to dry prior to shipping.

There were also some major flight delays and the commercial airline schedules did not allow time on the ground to be maximized. The high Canadian Arctic was fascinating in many regards other than the vegetation. People were open and friendly.

The Canadian Genetic Resources Unit located in Saskatoon, was helpful and efficient in having the seed inspected. Every collection was inspected and a Phytosanitary Certificate was issued after one working day.

From Saskatoon the seed was sent to Beltsville, Maryland to clear US Customs. On Sept 30 the inspected seed collections arrived in Palmer. The system worked like it was intended.

Itinerary and Collection Areas

19 Aug	-	Anchorage-Fairbanks-White Horse, Yukon Territory
20-21 Aug	-	Yellowknife, Northwest Territories
22-25 Aug	-	Cambridge Bay (Kaluktutiak) Victoria Island collection area. 30 acc.
26-27 Aug	-	Rankin Inlet (Kangiqsliniq) collection area. 26 acc.
28-31 Aug	-	Resolute (Qausuittuq) Cornwallis Island collection area. 18 acc
1-4 Sept	-	Grise Fiord (Ausuittuq) Ellesmere Island collection area. 49 acc
5 Sept	-	Pond Inlet (Mittimatalik) Baffin Island collection area. 90 acc
6-8 Sept	-	Pond Inlet (Mittimatalik) Baffin Island collection area. 90 acc.
9 Sept	-	Iqaluit, Baffin Island
10-13 Sept	-	Clyde River (Kangiqtugaapik) Baffin Island collection area. 86 acc.
14-16 Sept	-	Iqaluit (Forbisher Bay) Baffin Island collection area. 102 acc.
17 Sept	-	Rankin Inlet (Kangiqsliniq) collection area. 27 acc.
18 Sept	-	Winnipeg, Manitoba
19-22 Sept		Saskatoon, Saskatchewan for Phytosanitary certificate and pack seed for shipment to Beltsville, MD
22 Sept	-	Calgary-Vancouver-Seattle-Anchorage

Nunavut Territory Species and Accessions Collected

Alopecurus alpinus	136
Arctagrostis latifolia	1
Armeria scabra	2
Artemisia borealis	7
Calamagrostis langsdorffii	1
Calamagrostis neglecta	9
Carex membranacaea	8
Deschampsia caespitosa	18
Draba lactea	16
Eriophorum scheuchzeri	3
Festuca baffinensis	9
Festuca brachyphylla	1
Festuca vivipara	5
Hierochloe alpina	10
Honckenya peploides	4
Leymus mollis	42
Poa alpina	11
Poa arctica	55
Poa glauca	46
Poa pratensis	19
Poa flexuosa	18
Papaver radicatum	5
Puccinellia greenlandica	2
Puccinellia phyrangoides	11
Salix arctica	17
Salix herbaceae	1
Salix reticulata	1
Tofieldia pusillia	1
Trisetum spicatum	2
Total	**424**

Introduction and Overview for Nunavik 2005 Project

The seed collection project in the Arctic Canada (Nunavut) in 2004 and Canada Sub-Arctic (Nunavik) Quebec and the Labrador coast (26 August – 29 September, 2005) was very successful. The combined collection consists of 424 and 451 accessions respectively and includes a total of 27 species. Each was by themselves were the largest single collection the Plant Materials Center had ever made during a federally funded germplasm collection project. The collection conditions in Canada were not ideal as only a few days were free of rain. Rain tends to make collection difficult and often produces seed that requires additional work to dry prior to shipping.

There were no major flight delays but the commercial airline schedules did not allow time on the ground to be maximized. Surface transport with the Labrador Ferry Service was more problematic. There was a major delay due to remnants of Tropical Storm Ophelia. This forced the dropping of a Nain collection and stay. The Canadian Arctic, Sub-Arctic and Labrador were fascinating in many regards other than the vegetation. People were open and friendly.

The Canadian Genetic Resources Unit located in Saskatoon, was helpful and efficient in having the seed inspected. Every collection was inspected and a Phytosanitary Certificate was issued after one working day.

From Saskatoon the seed was sent to Beltsville, Maryland to clear US Customs. The seed arrived in Palmer, Alaska on 6 October. The system worked like it was intended.

The Nunavik/Labrador collection along with the material from Nunavut, Greenland, Spitzbergen, Norway; Iceland, the Faroe Islands and of course Alaska, puts the Alaska Plant Materials Center in the unique position of having the largest Nordic or Arctic Germplasm collection under evaluation in North America. While the collection efforts have been time consuming, the potential value of the collections is immeasurable. The remaining areas of the Circumpolar region are still of interest. Closing this loop will be possible over the next two years. A collection project in Lesser Canadian Arctic, (the NWT and Yukon) is now in the planning stage. Any efforts in Russia are still in the very early planning stages and will require more investigation.

Itinerary and Collection Areas

26-27Aug	-	Anchorage-Vancouver-Montreal
28 Aug	-	Montreal
29-31 Aug	-	Kuujjuarpik (Great Whale, Poste la Balene, Whapmagoostui), Nunavik Quebec collection area. 44 accessions
1-2 Sept	-	Sanikiluaq (Belcher Island), Nunavut collection area. 87 accessions
2 Sept	-	Kuujjuarpik, Nunavik
3-4 Sept	-	Inukjuak, Nunavik . 44 accessions
5-7 Sept	-	Puvirnitug, Nunavik. 24 accessions
8 Sept	-	Kuujjuaq (Fort Chimo) Nunavik collection area. 36 accessions
9 Sept	-	Aupaluk, Nanavik. 39 acessions
10 Sept	-	Kangirsuk, Nunavik. 31 accessions
11 Sept	-	Quaqtaq, Nunavik collection area. 27 accessions
12-13 Sept	-	Kangiqsujuaq, Nunavik collection area. 38 accessions
14 Sept	-	Kuujjuaq (Fort Chimo) Nunavik
15-16 Sept	-	Kangiqsualujjuaq, (George River) Nunavik. 25 accessions
16-17 Sept	-	Montreal

18-19 Sept - Goose Bay & Rigolet, Labrador. 7 accessions
20 Sept - Makkovik, Labrador. 11 accessions
21 Sept - Postville & Hopedale, Labrador. 26 accessions
22 Sept - Natausish (Davis Inlet) & Nain, Labrador. 7 accessions
23-24 Sept - Return Nain to Goose Bay, Labrador
25 Sept - St. Johns Newfoundland.
26-27 Sept - Saskatoon, Saskatchewan for phytosanitary certificate and pack seed for shipment to Beltsville, MD
28-29 Sept - Vancouver-Seattle-Anchorage

Nunavik/Labrador Regions of Canada Species and Accessions Collected

Agrostis mertensii	*2*
Alopecurus boreal	*2*
Armeria scabra	*2*
Artemisia borealis	*11*
Calamagrostis canadensis	*11*
Calamagrostis neglecta	*1*
Deschampsia caespitosa	*50*
Draba lactea	*4*
Elymus alaskanus	*2*
Festuca brachyphylla	*2*
Festuca richardsonii	*2*
Festuca rubra	*4*
Honckenya peploides	*2*
Lathyrus maritimus	*3*
Ligusticum scoticum	*2*
Leymus mollis	*193*
Poa alpina	*39*
Poa arctica	*77*
Poa eminens	*3*
Poa glauca	*14*
Papaver dahlianum	*7*
Trisetum spicatum	*12*
Total	**445**

Acknowledgements

This collection project would have been nearly impossible without the assistance of Dr. Ken Richards with Plant Genetic Resources of Canada. Dr. Richards provided the permit to collect in Canada.

Dallas Kessler, also with the Plant Gene Resources of Canada, was extremely helpful in getting the seed through the Canadian inspection process needed for the phytosanitary certificate. Dallas also made sure the collection was properly sent to Beltsville.

I also wish to thank Maryann Loftus with the PEO in Beltsville for her assistance in getting the federal paper work, forms and permits.

Native Plant Commercialization and Evaluation Project

In 1999, the Plant Materials Center (PMC) initiated a project focusing on the commercialization of native plants in Alaska. The primary goal of the PMC Native Plant Commercialization Project was to increase the commercial availability of native plants and seed for the landscaping and revegetation industries. The project is funded by the NRCS.

One of the first and ongoing accomplishments of this project was to produce and maintain the Directory of Alaska Native Plant Sources. This document is very useful as a marketing tool for native plant growers, suppliers and end users. The directory is available for viewing online on the PMC web page located at: http://www.dnr.state.ak.us/ag/NEWnative_directory.htm.

Seed for initial production for the project was gleaned from historical PMC collections. Many additional collection efforts have since been undertaken at locations including Hatcher Pass, Healy, Chugach National Forest, the Denali Highway, Tangle Lakes, Gulkana glacier, McClaren summit, Wrangell-St. Elias National Park, Craigie Creek, Purinton Creek, Unalaska/Dutch Harbor, and the Kenai Peninsula.

A focus on a broad range of species has been maintained since the program's inception including wetland, dryland and facultative species. Developing cultural practices for producing these plants has been a primary goal of the project. Many complex strategies have been evaluated such as germination techniques, growing media and fertility requirements and harvesting and conditioning protocols. Specific information about successful propagation protocols of 17 different species established by the program efforts have been entered on the Native Plants Network web site, an international database for plant propagation. http://nativeplants.for.uidaho.edu/network. Publication preparation is underway on additional species and cultural practices. The following list includes all the species the program has pursued:

Aconitum delphiniifolium
Agropyron boreale
Alnus crispa
Androsace chamaejasme
Anemone multifida
Anemone narcissiflora
Anemone parviflora
Antennaria sp.
Aquilegia formosa
Arctophila fulva
Arctostaphylos alpina
Arctostaphylos rubra
Arctostaphylos uva-ursi
Armeria maritima ssp. *arctica*
Arnica alpina
Arnica alpina attenuata
Arnica amplexicaulis
Arnica frigida
Arnica latifolia
Arnica lessingii ssp. *lessingii*
Artemisia arctica
Artemisia frigida
Artemisia furcata
Aruncus sylvester
Aster sp.
Aster sibiricus
Aster subspicatus
Aster subspicatus/modestus
Astragalus aboriginum
Astragalus alpinus
Astragalus americanus
Athyrium filix-femina

Beckmannia erucaeformis
Betula glandulosa
Betula nana
Boykinia richardsonii
Bromus pumpellianus
Bromus sitchensis
Bupleurum triradiatum
Calamagrostis nutkaensis
Calamagrostis purpurascens
Calla palustris
Caltha palustris ssp. *arcticus*
Caltha palustris ssp. *palustris*
Carex aquatilis
Carex bigelowii
Carex enanderi
Carex magellanica
Carex mertensii
Carex nardina
Carex rhynchophysa
Carex utriculata
Castilleja sp.
Chamerion latifolium
Chamerion angustifolium
Cicuta douglasii
Corydalis sempervirens
Cornus canadensis
Cornus stolonifera
Crepis nana
Cypripedium passerinum
Diapensia lapponica
Delphinium glaucum
Draba incerta
Dodecatheon frigidum
Dryas drummondii
Drosera rotundifolia
Elaeagnus commutata
Dryopteris dilatata
Empetrum nigrum
Elymus innovatus
Erigeron peregrinus
Erigeron acris
Eriophorum angustifolium
Erigeron purpuratus
Eriophorum chamissonis
Eriophorum brachyantherum
Festuca rubra
Festuca altaica
Galium boreale
Fritillaria camschatcensis
Gentiana platypetala
Gentiana glauca
Geocaulon lividum
Gentianopsis detonsa
Geum rossii
Geranium erianthum
Gymnocarpium dryopteris
Glyceria pauciflora
Hedysarum mackenzii
Hedysarum alpinum
Heracleum lanatum
Hierochloe odorata
Impatiens noli-tangere
Hordeum brachyantherum
Juncus arcticus
Iris setosa
Lathyrus palustris
Lathyrus maritimus
Ledum palustre
Ledum groenlandicum
Lesquerella arctica
Leptarrhena pyrolifolia
Lloydia serotina
Linum lewisii
Luetkea pectinata
Loiseleuria procumbens
Lupinus nootkatensis
Lupinus arcticus
Luzula parviflora
Luzula arcuata
Melandrium affine
Matteuccia struthiopteris
Mertensia paniculata
Menyanthes trifoliata
Minuartia sp.
Mimulus guttatus
Myrica gale
Moneses uniflora
Oplopanax horridus
Oxycoccus microcarpus
Oxyria digyna
Oxytropis arctica
Oxytropis arctica barnebyana
Oxytropis campestris
Oxytropis deflexa
Oxytropis viscida
Papaver alaskanum
Papaver alboroseum
Papaver lapponicum
Papaver macounii
Papaver walpolei
Parnassia palustris
Parrya nudicaulis
Pedicularis sp.
Petasites frigidus
Petasites hyperboreus
Phyllodoce aleutica
Pinguicula vulgaris
Plantago canescens

Plantago maritima
Poa alpina
Poa eminens
Podistera yukonensis
Polemonium acutiflorum
Polemonium pulcherrimum
Polygonum bistorta
Potamogeton sp.
Potentilla fruiticosa
Potentilla multifida
Potentilla palustris
Potentilla uniflora
Potentilla villosa
Primula tschuktschorum
Pyrola asarifolia
Pyrola secunda
Rhododendron camtschaticum
Ribes triste
Rosa acicularis
Rubus chamaemorus
Rumex arcticus
Salix alaxensis
Salix barclayi
Salix lanata
Salix reticulata
Salix setchelliana
Salvia pratensis
Sambucus racemosa
Sanguisorba officinalis
Sanguisorba stipulata
Saussurea angustifolia
Saxifraga bronchialis ssp. *funstonii*
Saxifraga oppositifolia
Saxifraga tricuspidata
Scheuchzeria palustris
Schoenoplectus tabernaemontani
Scirpus validus
Senecio atropurpureus
Senecio congestus
Senecio pseudo-arnica
Senecio triangularis
Shepherdia canadensis
Sibbaldia procumbens
Silene acaulis
Silene menziesii
Solidago decumbens
Solidago multiradiata
Sparganium sp.
Spiraea beauverdiana
Streptopus amplexifolius
Swertia perennis
Thalictrum sparsiflorum
Tofieldia coccinea
Trichophorum alpinum
Trientalis europaea ssp. *arctica*
Triglochin maritimum
Triglochin palustris
Trisetum spicatum
Typha latifolia
Vaccinium vitis-idaea
Valeriana capitata
Veratrum viride
Viburnum edule
Viola epipsila

Demonstration and evaluation plantings have been installed at many locations throughout Alaska. The primary production has occurred at the nursery facility and PMC fields. Demonstration plantings and plant distributions have taken place for locations such as Alaska Wildlife Conservation Center (formerly Big Game Alaska) near Portage, a waste water treatment facility near Talkeetna, State Forestry, Division of Mining, Land and Water, the U.S. Fish and Wildlife Education Center in Kenai, Bird Point, Chugach National Forest, Copper Center for an NRCS interpretive trail head, Wrangell-St. Elias National Park, and Unalaska/Dutch Harbor for the Kiroshima oil spill.

Providing plant material and production protocols to commercial growers has been a major aspect of achieving the program's overall goals. Initially, growers were solicited through direct contact with established greenhouse and field production operations as well as major media announcements. Interested growers were made aware of plant and seed availability. The material was provided at no cost to the producers, though the program did ask to be repaid in seed or plants produced.

Between 1999 and 2005, the program cooperated with approximately 20 different growers in locations including Talkeetna, Trapper Creek, Willow, Wasilla, Sheep Mountain, Anchorage, Seward, Girdwood, Ester, Two Rivers, Delta Junction, Homer, Sterling and Southeast Alaska. Distribution of plant material to these growers included 4008.6 grams of seed and 37,759 seedlings comprising 67 different species.

In 2005, the program recognized a shift in primary focus from commercialization to evaluation. This happened to coincide with a move of the base of operation from the nursery facility on Trunk Road to the PMC farm in Butte. This new objective includes the evaluation and potential formal release of plant material proven promising during previous production efforts. Many species appear to be suitable for landscape or restoration purposes and initial increase fields are being prepared.

Stewart River Training Area, Damaged Section of Access Trail near Nome

Starting in 2003, The Plant Materials Center, through an agreement with the Alaska Army National Guard Environmental Section, developed the revegetation plan and performed post-restoration monitoring for a disturbance along the route to the Stewart River Training Area near Nome, AK. Damage to the tundra and erosion resulted from off-road vehicle traffic traversing a new route due to the impassability of the traditional trail. Four levels of treatment were prescribed in the revegetation plan including eliminating traffic, seed and fertilizer applications, filling large gullies to reduce thermal erosion, and live-staking willow cuttings. The revegetation efforts occurred during the summers of 2004 and 2005. Though there were some difficulties with willow cutting survival and introduction of a few undesirable plants, the restoration effort was generally successful and stability appears to be returning to the site. The efforts are described in the report Revegetation and Monitoring of the Closed Section of Access Trail Stewart River Training Area Nome, Alaska.

Department of Transportation and Public Facilities Vetch Survey

Recent statewide interest in invasive/non-native plants prompted concern in DOT/PF about certain species becoming established along road right-of-ways. *Vicia cracca* is one that is prevalent, thus DOT/PF and the PMC joined together to look into the extent of the infestation and the role DOT/PF should play in its control. The report is available on the internet at:
http://www.dot.state.ak.us/stwddes/research/assets/pdf/fhwa_ak_rd_02_11.pdf.

Though infestations are considered a problem, more research is needed to determine the invasiveness of this species before eradication control measures are implemented. Including this species in a general weed management plan is appropriate. Care must be taken not to misidentify other native legumes with similar growth habits as the problem vetch. Many strategies are effective in controlling it but mowing is preferred.

Department of Transportation and Public Facilities Vegetated Riprap Survey

The Plant Materials Center, in collaboration with the Alaska Department of Transportation and Public Facilities, conducted a survey and developed a report that documents and presents the results of a site study of riprap-armored stream banks along Alaskan highways. The study's intent was to evaluate and determine the governing parameters of a successful hybrid environment using rock to stabilize the stream banks in concert with vegetation to maintain healthy riparian habitat.

In order to design and build riprap revetments that successfully incorporate, support, and promote successful revegetation on a sustainable basis, design and construction engineers require quantitative limits on the governing parameters. This evaluation was performed to support the development of engineering design guidelines for successful vegetated riprap installation. Study sites of focus were located along Alaskan highway/stream interfaces where riprap was designed and installed to protect stream banks and bridge structures.

For each study site, a combination of factors needs to be present in order to enable and encourage a successful hybrid environment of bank protective riprap coexisting with thriving vegetative reinforcement. The factors investigated during site evaluation include hydrologic and hydraulic, regional, existing riprap characteristics, and plant species present.

Findings of this study indicate that site- specific hydrologic and hydraulic characteristics need to be elucidated for a riprap-armored stream bank to sustain vegetative growth. In addition, given a vegetative-friendly riprap structure, this study found that Alaska's diverse regional climate influences species composition. The report is currently in a draft review process with a final version expected to be completed in 2006.

Alaska Seed Growers Research Project

The Alaska native seed industry is in a fledgling stage. Presently, commercial growers are producing as little as fifteen to twenty percent of the statewide demand for native seed. Resource development in Alaska could be impacted by the lack of seed produced at competitive prices. This project is intended to assist growers in meeting seed demand in an efficient and competitive manner.

The Alaska Plant Materials Center (AKPMC) is and the primary research/service agency involved in native species seed production. Our mission statement clearly supports this project. "The North Latitude Plant Materials Center works to promote Alaska-produced agricultural crops for use in revegetation and seed production." No other agency has the experience with producing Alaska revegetation species on a statewide scale. This is critical when planning for revegetation of lands disturbed by resource development.

The objective for this program is to disseminate effective state-of-the-art Alaska native plant seed technology to existing and potential Alaska seed growers with the end result of enhancing commercial production of native plants in Alaska.

Progress in 2005 was extensive. An evaluation of the main concerns of users and growers of Alaska native seed showed a lack of knowledge of plants being grown for production. Many research and informational materials on these plants exist, but not in a usable format. Thus, the highest priority for this project is individual plant flyers, interpretively describing the use and cultivation of native plants. A statewide Alaskan revegetation manual is the second priority, with a seed production manual to follow.

Developing plant flyers involves interpretive design, photos, research, evaluation of educational needs, accuracy of information, and grammatical review. Revisions continue until the flyer passes standards developed by the review committee. Hundreds of digital photos were taken for illustration in our publications to support the project.

Twenty-six plant flyers are now available on the Plant Materials Center's web site (http://www.dnr.state.ak.us/ag/ag_pmc.htm.) They are:

- 'Benson' Beach Rye
- 'Nortran' Tufted Hairgrass
- 'Gruening' Alpine Bluegrass
- 'Arctared' Red Fescue
- 'Sourdough' Bluejoint Reedgrass
- 'Reeve' Beach Wildrye
- 'Egan' American Sloughgrass
- 'Nugget' Kentucky Bluegrass
- Wainwright Germplasm slender wheatgrass
- 'Norcoast' Bering Hairgrass
- Solomon Germplasm thickspike wheatgrass
- 'Service' Big Bluegrass
- 'Alyeska' Polargrass
- 'Kenai' Polargrass
- Adak Germplasm arctic bluegrass
- Andrew Bay Germplasm large-glume bluegrass
- Casco Cove Germplasm beach lovage
- Clam Lagoon Germplasm beach fleabane
- Henderson Ridge Germplasm red fescue
- Kotzebue Germplasm arctic wild chamomile
- Lowell Point Germplasm meadow barley
- Nelchina Germplasm spike trisetum
- Teller Germplasm alpine bluegrass
- Tin City Germplasm arctic bluegrass
- Tok Germplasm Jakutsk snowparsley
- Twenty Mile Germplasm boreal yarrow.

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On-going assistance to Alaska Seed Growers includes an educational list-serve and seed testing (germination, purity, noxious, tetrazolium, moisture) of seed lots (906) from all over Alaska. Answers were provided daily covering the gamut of questions from what revegetation seed mixes to use where, how to propagate specific plants, plant regulations, noxious weed eradication, seeding rates, costs and availability of seed, landscape suggestions, and even identification of an alien moss invader for a local newspaper!

Visiting existing and potential farmers of Alaska native seed enabled us to promote the potential marketability and growing techniques for many species of plants. Farmers talked to us about their problems – the primary questions included: how to manage their crops which have infestations of invasive weeds (candle grass, hawksbeard, white cockle, hemp nettle, chickweed, and foxtail); what kind of fertility management might be best in crops that grow for 2 to 20 years; and whether there will be a market for their crops. In all cases, we answered their questions immediately, based on the PMC's experience, or followed up, once we found answers from other sources.

Field tests of the affect of *Lolium multiflorum* on establishing native grasses continue. This research relates to the need for weed suppression and the determination of an appropriate amount of annual rye to include in a revegetation seed mix using native plants. Annual rye (*Lolium multiflorum*) has a known allelopathic effect. It was seeded in 2004 at various rates (20 lbs., 10 lbs., 8 lbs., 4 lbs., and 2 lbs., per acre.) A grid of native grass seeds was then planted horizontally to the rows of annual rye. The grasses were 'Egan' (*Beckmannia syzigachne*), 'Wainwright' (*Elymus trachycaulus*), 'Nortran' (*Deschampsia caespitosa*), 'Gruening' (*Poa alpina*), 'Arctared' (*Festuca rubra*), and 'Alyeska' (*Arctagrostis latifolia*.) Preliminary results show that in the second year after planting, annual rye planted at the higher rates (20, 10, and 8) inhibited broadleaf weed growth better as dead litter, than as live growth (through August, 2005). It also inhibited the growth of the six grasses. The grasses that were able to survive in the annual rye applications of 2 and 4 pounds. per acre were 'Egan', Nortran', and 'Arctared'. These results seem to suggest that revegetation seed mixes should not use annual rye at applications higher than 4 pounds. per acre. It also shows that farmers who want to suppress broadleaf weeds in fallow or borders should use more than 8 pounds. per acre of annual rye. This experiment will be continued in a more controlled field setting in 2006.

The revegetation manual is in progress – many requests from agencies and contractors are speeding up its production. Creation of the plant production manual was also started. It will include topics for each plant on techniques, planting times, harvest and seed processing.

The PMC's website now presents eighty-eight scanned publications (in full text) originating from the PMC's thirty-two years of research and education. Also included in the topical listing are other publications by the PMC staff, which were copyrighted or published elsewhere.

Also new in 2005 are ten new professional exhibits for the PMDC building to educate people on some of the our major programs. Updated field maps were designed, along with photographic field labels (with the plant's common, scientific, and cultivar name), enabling visitors to visually evaluate more than 100 field-grown plants at the PMC.

The program continues its educational and extension components through farm tours (at least one per week in the summer.) Two college interns spent the summer 2005 learning how the PMC provides assistance to seed growers. One was featured nationally in the NRCS Plant Materials Program Seasonal Workers article (7/29/2005.) She created plant identification markers for farm tours, designed innovative exhibits for the PMC's buildings, took hundreds of digital photographs for our publications, and scanned full text publications for the web site. The other intern assisted our seed analyst in testing 112 seed lots for germination, purity, and moisture.

The question, "Why use Alaska native seed versus seed from outside Alaska?" continues to underline the need for this program. The seeds in our collections have evolved and adapted to the harsh winter conditions, long summer daylight, and drought-like conditions present in much of the region north of 60 degrees latitude.

Our grasses and legumes are especially suitable for propagation in adverse conditions. They thrive because they are acclimatized to a photoperiod consisting of longer daylight in the summer, which triggers them to set seed and go dormant at the proper time in late summer. Grasses and legumes introduced from the south are not triggered to set seed and go dormant which means that over time they will die off. Using native species means that less seed is needed because they have a better survival rate.

Once established, native species require no irrigation or fertilization. They are also resistant to most pests and diseases, and will not become invasive, as many foreign species will. Native plants also balance the ecology of the site for all species, attracting other native plants, insects and wildlife.

This project encourages the availability by providing educational and technical assistance to Alaskans involved in seed production of native seed for use on revegetation sites. Expertise from this project will enable selection of components for seed mixes according to site specifications to meet environmental needs.

Other continuing activities include continued maintenance and coordination of communications with other Alaskan plant ecologists, farmers, plant growers, and professionals; research and staying up-to-date on new and existing information and technology; and responding to current needs on weed evaluation, noxious plant determinations, ethnobotanical concerns, and photo documentation.

This project has the support of the Alaska Seed Growers Association.

Alaska Ethnobotany Research Project

Funds for the Alaska Ethnobotany Project were made available late in 2004, and the project began in 2005. The project exists to create better understanding and management of the non-timber forest products used for subsistence, traditional-use and commercial purposes on State land.

To initiate work, agronomists from the PMC, attorneys from the Alaska Department of Law, natural resource specialists in permitting from the Alaska Division of Mining, Land and Water, harvesters with commercial non-timber forest products companies and cottage industries, members of Alaska Native tribes, and members of the National Network of Forest Practitioners discussed Alaska's growing non-timber forest product industry and regulation needs in a variety of settings.

The discussions resulted in a better understanding of the big picture at hand. Extensive research was also done on the internet and otherwise to become aware of issues surrounding non-timber forest products, the most important of these species found in Alaska, and commercial markets in existence or potentially arriving in Alaska for those species.

To form a point of reference for Alaska's situation, a substantial spreadsheet of rules and regulations regarding commercial harvest of non-timber forest products from the governments of most of the United States and several foreign countries was created by the Department of Law through an RSA. The Department of Law also composed a succinct point paper about the need for regulation of commercial harvest of Alaska's non-timber forest product species.

A list of plants with commercial and/or ethnobotanical value found in Alaska was begun and assessment criteria were created. Ten ethnobotanically significant species were planted in a demonstration garden at the Plant Materials Center for educational and research purposes, and as the initiation of the process to incorporate similar gardens at Native cultural and educational centers. Together with the Traditional Healing Department of the Southcentral Foundation (Alaska Native Medical Center), a list of forty-nine species of medicinal plants to propagate was created for a future ethnobotanical garden at their site. An important element of the project is to establish relationships with Native peoples to acquire knowledge and understanding about subsistence and sustainability issues from their perspectives.

Editing assistance was given for a harvest manual for the sustainable and ethical gathering of several Alaska native plants written by the owner of a small commercial wild tea company. The manual and the associated permit application were then approved by the State's permitting authority in the Division of Mining, Land and Water for the company, Alaska Supernatural Teas. Public comment was offered on other permit applications for commercial harvest of non-timber forest products received by the Division of Mining, Land and Water.

During 2005, the PMC provided education about harvest and propagation of the medicinal plant devil's club to nine interested individuals and similar information for many other traditional-use plants (berries, mushrooms, dogwood, willow and ginseng) was provided to several people. World and local events pertaining to commercial harvest of native plants were monitored throughout the year and pertinent information was disseminated.

Future goals are set to further the project. In partnership with the Department of Law and the Division of Mining, Land and Water, the PMC will help develop statewide rules and regulations for commercial harvest of non-timber forest product species on State-managed lands and develop reporting and record-keeping requirements for harvesters. As part of this effort, the permitting process for commercial harvest of non-timber forest products will be streamlined into a cohesive application and review process. This will simplify the permitting process to encourage harvesters to obtain permits (i.e. allowing for application and reporting online and/or over the counter). The PMC will set standards of commercial harvest to distinguish low-impact sustainable collection of these species from high-impact, potentially damaging collection.

A personnel description for an agronomist to carry forward the Alaska Ethnobotany Project was written and then approved for advertising in 2006.

Foundation Seed Program

This section of the North Latitude Revegetation and Seed Production Project increases and preserves cereal grain and grass varieties developed for the special growing conditions prevalent in Alaska and other northern latitude countries.

In the past, “breeder” seed of grasses and grain were obtained from the University of Alaska, Agricultural and Forestry Experiment Station (AFES). The Alaska Plant Materials Center was given the responsibility for producing breeder seed of the numerous varieties of grasses in 1994. Small blocks of breeder seed have been established and are being maintained. Breeder seed of the numerous grain varieties developed and released by the AFES is still provided.

The progeny of breeder seed, designated “foundation” seed, is made available to the industry through the state’s seed certifying organization, the Alaska Seed Growers, Inc., in conjunction with the state Division of Agriculture. This process ensures that farmers growing “registered” (progeny of foundation) and “certified” (progeny of registered) classes of seed meet all requirements of genetic purity and cleanliness, and are in compliance with state seed regulations and the Federal Seed Act.

When the PMC began operations in 1973, the Foundation Seed Program began increasing newly released varieties of barley, oats, and wheat. These varieties, bred by the University of Alaska, Agricultural Experiment Station, became the primary crops of the agricultural projects of the late 1970s and early 1980s. At the same time, new varieties of grasses for revegetation and turf gradually became available. As production from the large projects wound down, interest increased in revegetation varieties. Today, the Foundation Seed Program raises over a dozen varieties of grasses and forbs bred for revegetation and reclamation throughout the state. In addition, new seed collections from throughout the state are planted and evaluated. Promising species are increased at the PMC and made available for new revegetation projects.

Seed quality is a prime essential to successful farming. A grower needs to know that the variety will perform, has acceptable germination and is free from contaminants.

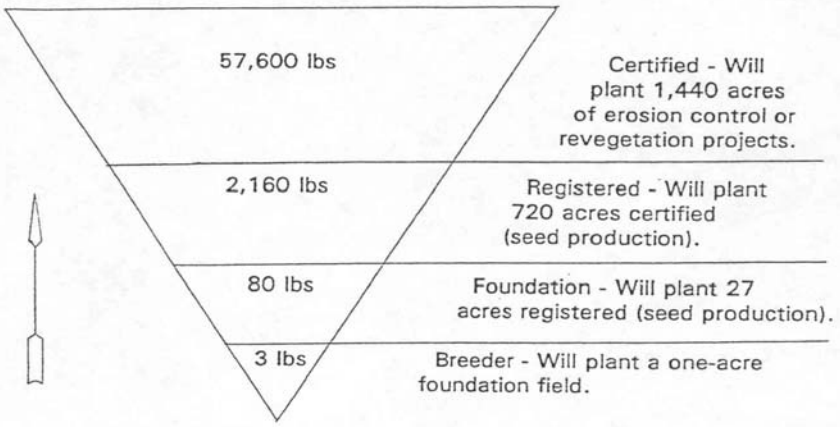
Plant breeders explore the genetic potential of a variety. Varieties are selected based on the intended use as food, fiber, an ecological niche or its chemistry.

Successful growers understand the requirement for good germination and vigor from their seeds. The Federal Seed Act requires that seed offered for sale meet minimum germination standards.

Contaminants in seed include broken seed, chaff, dust, weed seed, other crop seed and pathogenic organisms. The higher the purity of clean seed, the less the possibility of introducing unwanted pests. The introduction of weeds or diseases in the seed increases the production costs and reduces yields not only in the present, but in future years as well.

As a member of the Association of Official Seed Certifying Agencies, the PMC's Foundation Seed Program, along with the Alaska Seed Growers, Inc., joins 43 other states in insuring that in-state and interstate purchasers have access to high quality, genetically pure seed.

Figure 3 - Seed Increase Pyramid



This diagram illustrates the increase of three pounds of grass breeder seed to a commercially useable quantity. Clean seed yield is based on 80 lbs./acre. The planting rate is based on 3 lbs./acre for seed production and 40 lbs./acre for reclamation purposes.

Inspection and Sampling

A service formerly delegated to the Division of Agriculture's main office has been reassigned to the PMC's Foundation Seed Production Program - inspection of certified seed fields and official sampling of seed lots for germination and purity testing. The area of responsibility is south central Alaska, primarily the Matanuska and Susitna Valleys. Seed lots were sampled for testing as required.

Table 1. Revegetation and Turf Varieties in Production in 2005.

Variety	Class	Planted	Acres
'Nugget' Kentucky Bluegrass	Breeder	01	2
'Sourdough' Bluejoint	Breeder	97 & 01	1.5
‘Egan’ American Sloughrass	Breeder	05	1
‘Arctared’ Red Fescue	Breeder	97	1
‘Arctared’ Red Fescue	Breeder	01	2
‘Norcoast’ Bering Hairgrass	Breeder	05	2
'Nortran' Tufted Hairgrass	Breeder	00 & 03	3
‘Kenai’ Polargrass	Breeder	01	2
‘Alyeska’ Polargrass	Breeder	01	.5
'Caiggluk' Tilesy Sagebrush	Breeder	05	.5
'Reeve' Beach Wildrye	Foundation	00	2
‘Gruening’ Alpine Bluegrass	Breeder	05	1.5
‘Service’ Big Bluegrass	Breeder	04	1
‘Tundra’ Glaucous Bluegrass	Breeder	04	.5
‘Polar’ Bromegrass	Breeder	04	2

Table 2. Cereal Grain Seed & Oil Seed Varieties in Storage at the Plant Materials Center, December 2005.

Barley		Wheat		Oats		Rye	
Variety	lbs	Variety	lbs	Variety	lbs	Variety	lbs
Lidal	5,000	Ingal	6,000	Toral	10,000	Bebral	1,400
Otal	1,500	Nogal	7,200	Ceal	4,000		
Thual	9,000	Froid	150	Nip	2,000		
Weal	10,700	Vigal	20	Golden Rain	5,000		
Finnaska	2,200						
Datal	4,400						
Total	32,800	**Total**	13,370	**Total**	21,000	**Total**	1,400

Table 3. Cereal Grains Sales & Receipts, 1999 - 2005.

Type	1999	2000	2001	2002	2003	2004	2005
Barley	13,000	500	2,450	2,800	6,100	11,500	750
	$2,600.00	$170.00	$689.40	$878.77	$2071.24	$3613.07	$246.67
Oats	6,600	1,100	5,500	1,100	400	4,400	1,900
	$1,980.00	$390.00	$1,997.42	$380.62	$153.98	$1,473.31	$613.61
Wheat	1,500	400	1,500	0	0	0	0
	$330.00	$133.75	$431.90	0	0	0	0
	21,000	2,000	9,450	3,900	6,500	15,900	2,650
Total	$4,910.00	693.75	$3118.72	$1,259.39	$2,225.22	$5,086.32	$860.28

Table 4. Grass Seed Sales & Receipts, 1999 - 2005.

Variety	1999	2000	2001	2002	2003	2004	2005
'Nugget' Kentucky	0	97 lbs	25 lbs	119 lbs	110 lbs	94 lbs	25 lbs
Bluegrass	0	$1,164.00	$288.75	$743.65	$1,248.50	$1,055.62	$293.25
'Arctared' Red	200 lbs	0	0	185 lbs	0	30 lbs	100 lbs
Fescue	$2,600.00	0	0	$1,551.19	0	$278.40	$940.00
'Sourdough'	0	0	0	0	0	0	3.5 lbs
Bluejoint	0	0	0	0	0	0	$216.94
'Alyeska'	0	0	0	19 lbs	0	0	0
Polargrass	0	0	0	$336.68	0	0	0
'Gruening' Alpine	0	0	0	0	0	0	0
Bluegrass	0	0	0	0	0	0	0
'Kenai' Polargrass	0	0	0	0	0	0	0
'Egan' American	0	80 lbs	30 lbs	0	30 lbs	0	0
Sloughgrass	0	$1,840.00	$637.80	0	$418.20	0	0
'Norcoast' Bering	0	0	0	0	4 lbs	0	0
Hairgrass	0	0	0	0	$64.52	0	0
'Nortran' Tufted	100 lbs	0	151 lbs	39 lbs	39 lbs	130 lbs	25 lbs
Hairgrass	$1,500.00	0	$1,422.53	$542.10	$648.96	$2,167.10	$380.50
Polar Brome	0	0	0	0	0	0	0
'Tundra' Glaucous	10 lbs	0	0	0	0	0	0
Bluegrass	$130.00	0	0	0	0	0	0
'Caiggluk' Tilesy	0	0	0	0	0	0	0
Sagebrush	0	0	0	0	0	0	0
	310 lbs	177 lbs	206 lbs	362 lbs	183 lbs	530 lbs	153.5 lbs
Total	$4,230.00	$3,004.00	$2,349.80	$3,173.62	$2,380.18	$4,636.21	$1,830.69

Potato Disease Control Program

Potatoes are among the most valuable crops grown on Alaskan farms. Commercial potato production is highly capital intensive. High yields with good quality are required to assure a fair return on investment. Diseases can cause significant losses reducing yield and quality factors.

The potato is a vegetatively propagated plant and as a consequence, has unique production problems. Many economically important diseases and pests can be carried in or on the tubers used as seed. The use of seed potatoes having little or no disease is basic to any management plan. Planting certified seed reduces the risk of losses caused by disease. It is for this reason that the production of disease free seed is a primary goal of the Plant Materials Center.

Seed produced at the PMC is sold to growers who increase the original allotment over the next several years. Seed potatoes are subjected to strict certification inspections to assure minimal disease incidence. The volume of certified seed produced in this fashion enables a grower to replace older diseased seed with clean seed.

Alaska is unique in that many disease and insect pests common to North America that require chemical control do not occur here. The importation of seed from outside the state has the potential to introduce pests not known to occur in Alaska. The inadvertent introduction of these diseases or pests would cause major problems. The importation of seed is therefore discouraged. Growers who wish to try new varieties are encouraged to obtain clean seed stock from the PMC.

Pathogen Testing

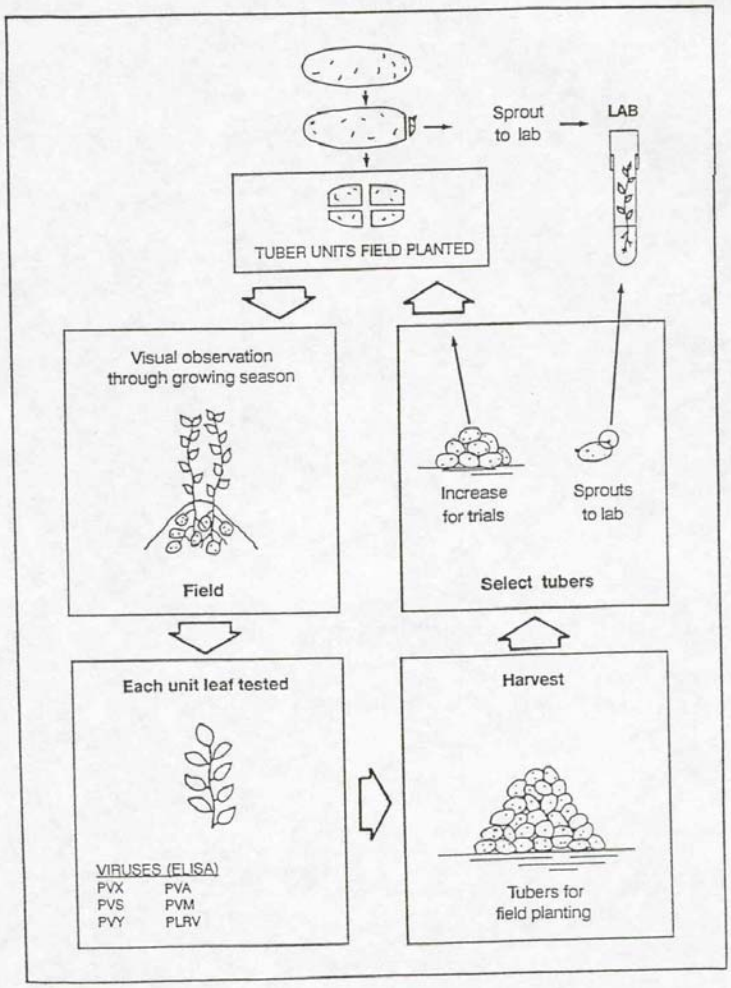
The major focus of the potato program is providing quality seed potatoes to commercial seed growers. Low levels of disease are required of quality seed because diseases can negate a crop's usefulness as seed. The seed provided by the PMC is used as the initiating stock for the ensuing multiple year certified seed production scheme. This seed, therefore, must be of the highest quality possible since any disease introduced at this point would be multiplied during each successive year of seed increase. To this end, all production is rigorously tested and retested for disease prior to sale.

Testing for the presence of diseases is performed in the PMC laboratory on all the initial seed stocks (Figure 4). The diseases of primary importance are Bacterial Ring Rot (BRR) and the viruses Potato Leafroll Virus (PLRV), Potato Virus Y (PVY), Potato Virus X (PVX), Potato Virus S(PVS), Potato Virus A (PVA), Potato Virus M (PVM), and the viroid Potato Spindle Tuber Virus (PSTV).

All newly acquired germplasm and each mother plant used for the in vitro propagation of the greenhouse stock are tested prior to production and again prior to harvest. The field grown materials are visually inspected during the growing season with laboratory testing performed prior to harvest (Figure 5).

Monitoring the health of the potato stocks at the PMC is a critical function. Understanding and accurately performing the disease test procedures, as well as interpreting the results, is essential. The PMC participates in the Potato Association of America Certification Section Standardization Project. This exercise provides participating labs the opportunity to test their materials and methods against a standardized series of antigens, and thereby developing a level of credibility. The PMC has been successful in detecting very low antigen levels as well as various strains found in North America.

Figure 4. TUBER INTRODUCTION



Alaska Seed Potato Production & Disease Testing

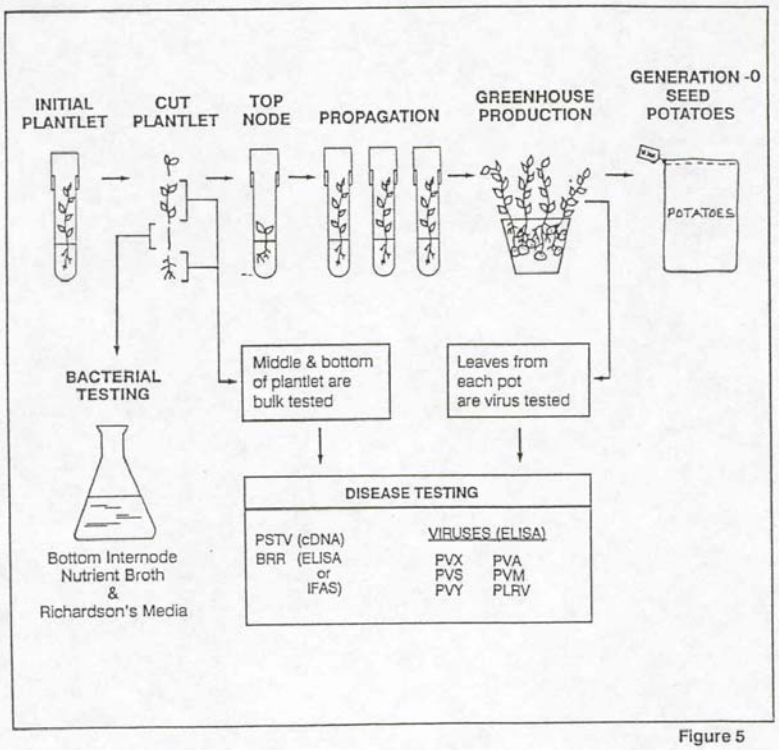


Figure 5

Seed Potato Certification

State of Alaska Seed Regulation 11 AAC 34.075 (J) requires that all potatoes sold, offered for sale or represented as seed potatoes be certified.

The Seed Potato Certification Program is designed to provide growers with potato seed stock that is varietally pure and relatively free from disease causing organisms. These results are achieved by the voluntary compliance of seed growers to the certification regulations. Growers manage their seed production to limit the possible exposure to diseases, but reinfection can occur from soil or other sources. Certification is designed to identify and remove from use as seed those seed lots that have become diseased or are otherwise of reduced value for use as seed.

Diseases are capable of causing severe losses. Many of the diseases affecting the potato are carried in or on the potatoes themselves. The use of seed in which diseases are absent or at low levels has been proven to greatly reduce the risk of losses caused by disease. Certified seed has been inspected during the growing season and has met low levels of the disease tolerances allowed for seed. Certified seed potatoes produced in Alaska are far superior to seed produced outside of the state. The importation of potatoes carries with it the risk of introducing diseases that are capable of having severe consequences to Alaskan growers. The local availability of disease-tested seed reduces the potential of introducing diseases not presently found in Alaska through imported seed.

The Alaska Certification Program is a "limited generation system" in which the initiating seed lot, called Generation 0 (G-0), can be field planted only a limited number of years; i.e., eight years. The rationale of a limited generation system is that the contamination of seed stocks by tuber-borne pathogens increases with each replanting. If the older seed stock is continually removed from the system and replaced with new stock, the probability that pathogens will build up to problem levels is reduced. This system has been very effective in reducing, and in some cases eliminating, virus diseases.

Seed fields are inspected for diseased plants twice during the growing season and once while in storage. Seed lots in which excessive amounts of disease are found are not allowed to be sold as certified seed.

Alaska's Certified Seed Program is administered by the Alaska Seed Growers, Inc. The PMC’s Potato Disease Control Program conducts the inspections. Certified seed potatoes are grown in the Matanuska Valley, Fairbanks, Bartlett Hills, Nenana, Delta Junction and Kodiak. Each lot was inspected according to certification standards for disease and varietal purity.

Table 5. Certified Seed Potatoes

Year	# Growers	# Varieties	# Lots	Acreage
2000	14	238*	180	122
2001	12	49	153	128
2002	11	49	160	116
2003	8	43	172	145
2004	10	46	158	88
2005	11	48	143	88

*Includes PMC variety bank.

DISEASES

Late Blight

Late blight was found in the Matanuska Valley on August 9, 2005. By the end of September, it was known to occur from Sutton and Willow on the north to Anchorage on the south and from Palmer to Point McKenzie, east to west. Commercial, as well as home garden plantings, of potatoes and tomatoes were severely affected. The causal agent, *Phytophthora infestans*, was identified as U.S.11 and resistant to Metalaxyl, the active ingredient in Ridomil. This is the same genotype as was found in the Matanuska Valley in late August 1998.

The weather, cool, rainy and windy, was conducive for rapid spread of the fungus. Small infected areas in the fields enlarged to several acres within days. In a few instances, entire fields were infected. Protectant fungicide sprays, primarily Bravo plus Curzate, were applied to fields that needed more time to make a crop and vine dessicants were applied to fields that were ready to harvest. A few fields were total losses with tuber infection rates at 20% to 30%.

The warm soil temperature is believed to have contributed to higher rates of Pink Rot and Leak.

Educational Program

The University of Alaska Cooperative Extension Service holds an Annual Potato Conference to update growers on research projects and innovations pertaining to potato production. Presentations were made outlining potato diseases found in Alaska. Various control measures were discussed focusing primarily on using quality seed as a management tool.

Scab Resistance Trial

Potato scab is caused by the bacteria *Streptomyces scabies*. It causes brown, circular lesions on the potato skin. The lesions can be raised or sunken and detract from the appearance of the potato. Peeling removes the affected area. Recent work has demonstrated that a chemical (Thaxtomin) produced by this organism can cause lesions to form on tubers in the absence of the live pathogen. The amount of the phytotoxic chemical produced has been shown to correlate with the severity of the pathogenicity of various isolates of the causal organism.

Planting cultivars known to be resistant to scab coupled with production practices that help reduce disease severity is central to integrated pest management systems.

Variety Development

The search for improved varieties is an on-going process. Finding a potato that bulks earlier, has more and better disease resistance, requires less fertilizer and tastes better are but a few of the traits we seek. The new horizon opened with the advances in biological technology appears limitless. Perhaps a potato that would sprout legs and climb into the sack is the next level.

Breeding programs perform controlled cross-pollination between promising parental materials in the hope of creating improved cultivars. The PMC has obtained true seed from several breeders. The seed was planted in the greenhouse and transplanted to the field. One or two small tubers were harvested from each plant. These will be field planted using wide spacing and single hills, which will be observed for yield, skin color and tuber shape. The few hills that meet the minimum requirements will be harvested and replanted for further observations. True seed will be obtained from several potato breeding programs to extend the types of families for testing.

Colored Flesh Project

A cooperative agreement with USDA Agricultural Research Service (ARS) enabled the production of colored flesh breeding material at the PMC in 2005. ARS plant breeder, Chuck Brown from Prosser Washington, provided 3000 seedling tubers from which 128 were selected to be advanced for planting and selection in 2006. The material selected included red, yellow and blue flesh as well as various skin colors. The advanced selections will be planted at the Experiment Station Farm in 2006 while another 4000 seedlings for initial selection will be planted at the PMC.

There are thousands of cultivars in the world today. Each year, millions of dollars are spent on breeding programs in the search for better potatoes. Since the early 1900's, Alaskans have planted and observed hundreds of different potato varieties. Genetic improvements make older varieties obsolete, yet sentiment or special circumstances create a desire to keep replanting them.

There are many varieties of potato beyond the mainstream russets, whites and reds. A veritable cornucopia of shape, size, color, texture and flavor await those willing to explore. As new and unusual potato varieties are collected by the PMC, they are tested for diseases, purified and then planted. Observations are made of horticultural characteristics, plant type, flower color, tuber shape and color, yield, and storage characteristics; the end result being a variety description.

Several novel varieties lacking this type of database have been cleansed of virus and offered for production as "experimental" varieties. These novelty potatoes have been promoted in several gardening magazines and are prized by some Alaskan growers. The PMC maintains these cultivars to provide an instate source to help obviate the necessity of importing seed potatoes which could introduce exotic diseases.

Disease-Tested Seed Potato Production

Disease-tested potato plants are mass propagated in a sterile environment. The PMC produces tubers from these plants in greenhouses. Growers place orders for these seed tubers the winter prior to production. This provides the time necessary to propagate the thousands of plants required for planting tubers that are distributed the following spring. The process takes 18 months form start to finish. Stock material, if not on hand, is typically obtained from other similar programs. In some instances, the only source is a diseased tuber, so radical treatments are used by the PMC to create the initial disease-free stock. The PMC maintains a disease-tested collection of more than 200 cultivars as field grown stock, while 40 are maintained in culture and are ready for propagation.

The commercial growers have shifted from white-skinned to russet-skinned varieties during the last ten years. Gardeners who purchase a considerable amount of certified seed, have broadened their desire to include many novelty varieties having unique color flavor or shape.

Table 6. Seed Potato Production

Year	Number of Varieties	G-0	G-1	Plantlets
2000	72	1,200	687	2,880
2001	49	1840	350	400
2002	62	3,645	699	160
2003	74	1,553	989	1,200
2004	33	971	920	0*
2005	47	502	525	0*

* Due to a shortage of certified seed potatoes, the Plant Materials Center sold field grown seed.

Seed stocks were provided to:

Ohio Potato Growers Association
University of Wisconsin Madison
University of Minnesota
Cornell University

Virus Disease Expression Plot

A small plot was established to examine viral disease symptom expression. Four seed pieces each of known virus-infected materials were planted May 30. The diseases were Potato Leafroll Virus (PLRV), Potato Virus Y (PVY), Potato Virus M (PVM), Potato Virus X (PVX), Potato Virus S (PVS), and very small tubers harvested from a plant having Witches Broom symptoms.

Symptoms of virus infection, except PVS, were apparent throughout the season for all viruses beginning a few days after emergence. The Witches Broom material did not emerge until mid August. It appeared healthy until late September when a light marginal chlorosis could be observed on the newer expanding leaves.

APPENDIX A

CURRENT & HISTORICAL BUDGET INFORMATION

CALENDAR YEAR 2005 AUTHORIZATIONS, EXPENDITURES, AND PROGRAM RECEIPTS

Arctic Revolving Loan Fund (ARLF) Authorizations

Authorizations FY 2005 PMC Total	569,200
Alaska Plant Materials Center	
Project Total	569,200
Personal Services	445,500
Travel	5,000
Contractual	67,300
Supplies	51,400

2005 Calendar Year Monthly Expenditures of ARLF Funds to the Nearest Dollar

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PMC Totals	25,106	506	15,225	35,929	38,390	41,416	29,203	80,308	77,943	63,888	57,254	67,536
Personal Services	22,928	-7,139	11,929	29,396	32,093	36,501	27,410	72,408	71,662	56,701	50,223	38,925
Travel	1,687	274	42	0	520	0	353	1,079	112	0	-353	-611
Contractual	507	7,250	2,527	4,091	6,653	4,046	182	3,773	4,999	4,641	5,584	10,696
Supplies	114	121	727	2,442	-876	869	1,258	3,048	1,170	2,546	1,800	3,516

PMC Operating Budgets

Past Eighteen Fiscal Years

Authorization in thousands	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	FY98	FY99	FY00	FY01	FY02	FY03	FY04	FY05
PMC	596.7	556.7	556.1	566.1	620.8	608.9	585.6	595.3	433.3	522.9*	508.6*	511.1	485.9	523.4	522.0	535.6	544.9	569.2
									100.0*									
Forestry Nursery							180		95.2									
Personnel	16	16	16	16	16	16	17	17	15	14	15	19	22	24	36	37	30	30
Full Time	7	7	7	7	7	7	7	7	6	5	6	5	6	8	9	13	12	12
Part Time	9	9	9	9	9	9	10	10	9	9	9	14	16	16	17	24	18	18

* Indicates Agriculture Revolving Loan Fund source.

When comparing personnel figures listed for FY 05 to those in FY 88, bear in mind that the Plant Materials Center is now performing basically the same duties at nearly the same level as it did in 1987 with 27,500 fewer dollars. The PMC has started generating operating money from federal and private grants to cover needed operations. These funds are in the form of short-term contracts that must continually be renewed. Money to hire and keep labor support staff has been the most critical issue facing the PMC. In the last three years, reductions in supplies and contractual utilities have also become areas of constant concern. These funds are now being supplemented with program receipts.

Program Receipts
Calendar Year 2005

Contracts, Reimbursable Service Agreements and Grants

Source	Face Value of Contracts Awarded in 2005
USDA Agricultural Research Service (Germplasm Repository)	50,097
USDA Natural Resources Conservation Service	522,883
USDA Natural Resources Conservation Service	374,256
USDA Chugach National Forest	23,000
U.S. Army National Guard	4,146
Alaska Dept. of Transportation/PF	26,250
Alaska Dept. of Transportation/PF	8,934
Alaska Dept. of Transportation/PF	8,500
Alaska Dept. of Transportation/PF	2,900
Alaska Dept. of Natural Resources, Mining, Lands and Water	10,000
Alaska Seed Growers	14,000
University of Alaska/ USDA CREES	291,537
University of Alaska/ USDA CREES	250,731
	1,587,234

RSA, Program & Federal Receipt Values since CY 1988

Prior to 1988, Program Receipts and contracts were not sought by the Plant Materials Center.

1988	1989	1990	1991	1992	1993	1994	1995	1996
42,195	31,407	58,417	117,981	126,071	202,886	377,161	334,200	212,800

1997	1998	1999	2000	2001	2002	2003	2004	2005
304,200	1,086,000	928,400	1,013,200	5,630,000	1,238,389	1,262,552	978,133	1,587,234

APPENDIX B

NEW & PENDING CROP RELEASES

CROP CULTIVARS DEVELOPED AND ADVANCED BY THE ALASKA PLANT MATERIALS CENTER

'Long' Barclay Willow, *Salix barclayi* - This attractive, fast growing native willow was released for commercial production in 1985. This cultivar will be used for reclamation, landscaping and shelterbelts.

'Roland' Pacific Willow, *Salix lasiandra* - Roland was released in 1985 and is probably the most attractive willow selected by the PMC to date. This cultivar will be used for landscaping, stream protection and revegetation throughout most of Alaska.

'Wilson' Bebb Willow, *Salix bebbiana* - This willow has a dense growth form and has many potential uses for screening, windbreaks and living fences. Because of the species' wide range of adaptability, it is also expected to be utilized for reclamation activities. Wilson is a 1985 release.

'Oliver' Barren Ground Willow, *Salix brachycarpa* - Oliver was released for commercial production in 1985. This cultivar's interesting growth form will lend itself well for incorporation into hedges. Additional uses range from reclamation to windbreaks.

'Rhode' Feltleaf Willow, *Salix alaxensis* - Rhode was also released for commercial production in 1985. This species occurs throughout Alaska and is listed as a preferred wildlife species. This cultivar will find uses in habitat restoration, reclamation, streambank protection and shelterbelts.

'Egan' American Sloughgrass, *Beckmannia syzigachne* - Egan was released for commercial seed production in 1986. This cultivar has performed well at most test sites. Its expected uses are wetland restoration and waterfowl habitat enhancement. In 1991, Egan was registered as a crop cultivar with the Crop Science Society of America.

'Gruening' Alpine Bluegrass, *Poa alpina* - This selection of alpine bluegrass was released for production in 1987. A native species, alpine bluegrass has shown extreme hardiness throughout Alaska and it is well adapted to harsh sites such as mine spoil. In 1991, Gruening was registered as a crop cultivar with the Crop Science Society of America

'Caiggluk' Tilesy Sagebrush, *Artemisia tilesii* - Caiggluk tilesy sagebrush is a native collection of sagebrush. It was placed in commercial production in 1989. The expected uses range from mine reclamation to restoration of sites contaminated with toxic metals. The cultivar will add diversity to seed mixes. This is the first native broadleaf species brought into commercial production in Alaska. In 1991, Caiggluk was registered as a crop cultivar with the Crop Science Society of America.

'Service' Big Bluegrass, *Poa ampla* - This accession of big bluegrass was derived from a collection made in the Yukon Territories. During the PMC evaluation process, the collection out-performed 'Sherman' big bluegrass (the only known cultivar of big bluegrass) in all categories. Service is expected to find use in dry land revegetation projects in Alaska south of the Yukon River.

'Reeve' Beach Wildrye, *Elymus arenarius* - Reeve beach wildrye was developed from a seed collection obtained from Norway. During the evaluation process, it was determined that this accession was capable of producing commercially viable amounts of seed. This was of extreme interest, as beach wildrye is notorious for not producing seed. Further evaluation indicated that the accession also had hardiness and adaptive traits making it useful in coastal revegetation and reclamation. In 1991, Reeve was released for commercial production. Reeve was registered as a crop cultivar with the Crop Science Society of America in 1994.

'Benson' Beach Wildrye, *Elymus mollis* - This accession was released for commercial production in 1991. Unlike Reeve, Benson was released for vegetative production only. This extremely aggressive and hardy, local collection does not produce seed in any appreciable amounts, therefore, commercial propagation can only be accomplished by vegetative means. This cultivar will find use in transplanting projects where erosion and accretion are beyond the capabilities of any seed species. Benson will become an important cultivar in coastal dune stabilization and restoration in Alaska. In 1994, the cultivar Benson was registered with the Crop Science Society of America.

'Kenai Carpet' Nagoonberry, *Rubus arcticus L*. - 'Kenai Carpet' nagoonberry was selected from a native collection made on the Kenai Peninsula. This vigorously growing ground cover has been tested at various trial sites since 1985. It is best suited for use in large areas where an alternative to turf grass or a mulch is desired. Kenai Carpet nagoonberry spreads by rhizomes and often out competes the surrounding vegetation. A minimal amount of fruit is produced by this cultivar. It was named and released for commercial production in 1991.

'Peanut' syn. 'Swede' Potato. This fingerling potato traces back to the Matanuska Valley in the 1930s. The tubers are small and resemble a peanut in shape and have yellow flesh. Desirable qualities include good yield under adverse conditions and a long dormancy. 'Rote Erstling' syn. 'Rode Eerstling'

'Rote Erstling' syn. 'Rode Eerstling' Potato. European variety promoted by Dr. Donald Dinkel, University of Alaska Fairbanks (retired). Round, red with yellow flesh. Early maturing.

'Alaska Sweetheart' Potato. Germplasm provided by Jayson Dearborn. Round, red with pale pink flesh.

APPENDIX C

LIST OF PUBLICATIONS AND PRESENTATIONS

PUBLICATIONS

Most PMC produced publications are on-line.
http://www.dnr.state.ak.us/ag/index.htm

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APPENDIX D

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