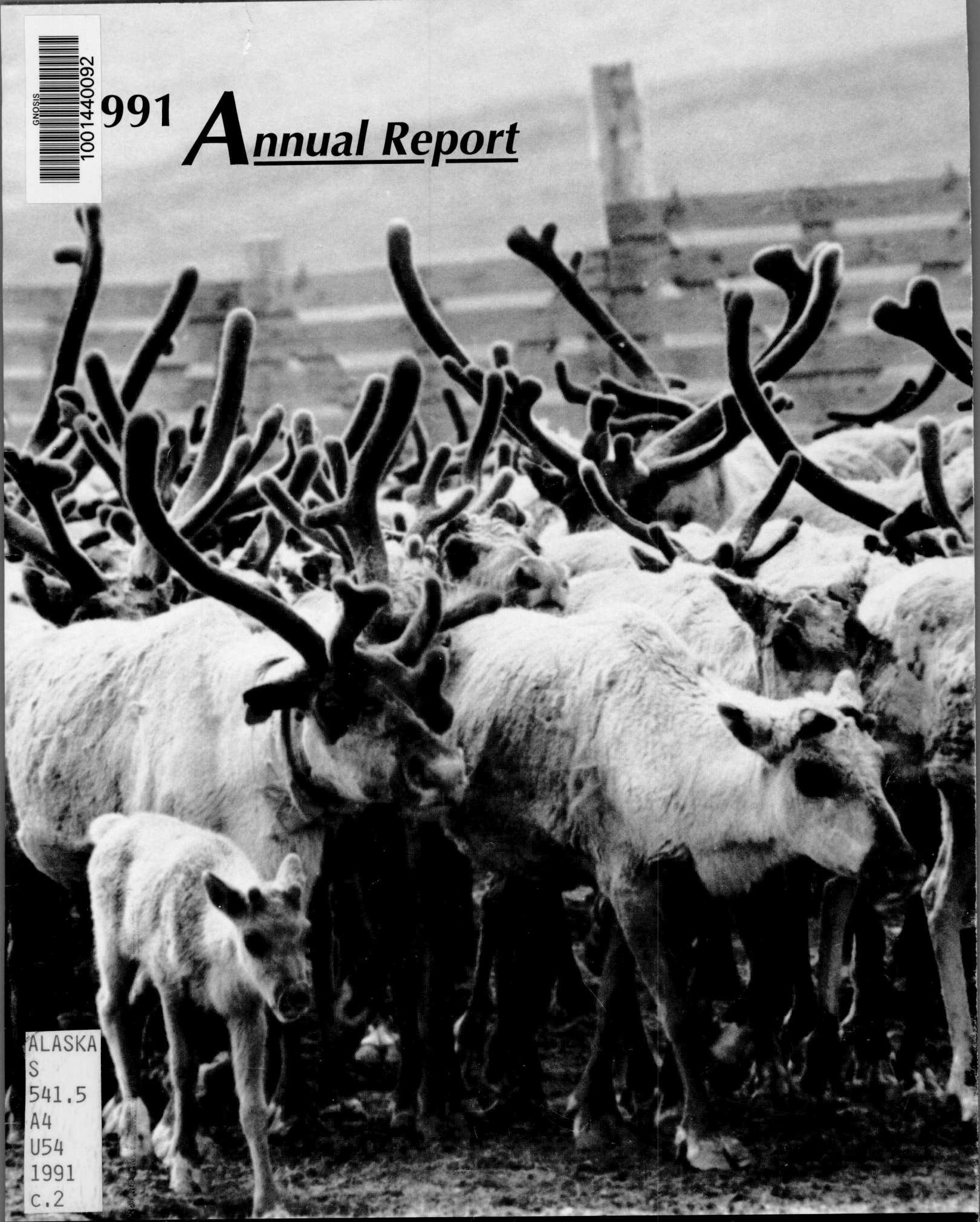
1991 Annual Report



AGRICULTURAL AND FORESTRY EXPERIMENT STATION • UNIVERSITY OF ALASKA FAIRBANKS

About the cover: Reindeer, fresh from the range, wait in a holding pen during the annual reindeer roundup on the Seward Peninsula. For more than three decades, University of Alaska Fairbanks researchers have worked with Alaska's reindeer industry. Agricultural and Forestry Experiment Station researchers and graduate students work with herders throughout the year in all kinds of weather helping develop better management techniques and improving animal health. The reindeer behind the fawn (near the front) is wearing a radio tracking collar used in a university research study.

Agricultural and Forestry Experiment Station

School of Agriculture and Land Resources Management

University of Alaska Fairbanks

ANNUAL REPORT

For the year ending December 31, 1991

Fairbanks, Alaska 99775-0080

Misc. Pub. 92-1

June 1992

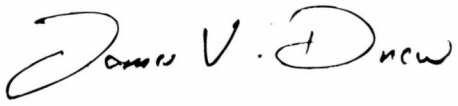
Letter of Transmittal

The Honorable Walter J. Hickel
Governor of Alaska
Juneau, Alaska 99811

Dear Sir:

I submit herewith the annual report of the Agricultural and Forestry Experiment Station, School of Agriculture and Land Resources Management, University of Alaska Fairbanks, for the period ending December 31, 1991. This is done in accordance with an act of the Congress, approved March 2, 1887, entitled "An act to establish Agricultural Experiment Stations, in connection with the Agricultural Colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and also of the act of the Alaska Territorial Legislature, approved March 12, 1935, accepting the provisions of the act of Congress.

Very respectfully,



James V. Drew
Director

Fairbanks, Alaska
June 30, 1992

Contents

Statement of Purpose

This report summarizes research progress at the Alaska Agricultural and Forestry Experiment Station (AFES). Our research projects are designed to provide results useful for the development and conservation of land resources in Alaska.

Specifically, the AFES research objectives are to provide new information to:

1. provide a base of research information for the management of renewable resources of high latitudes; and
2. provide technology for enhancing the economic well-being and quality of life at high latitudes.

Foresters, farmers, and land managers use AFES research results. All Alaskans directly benefit from the wise use of land resources.

In identifying local Alaskan research needs, experiment station scientists regularly meet with land managers, foresters, and farmers from throughout the state to discuss specific needs and problems. Our researchers also work directly with producers through farm forums, agricultural field days, greenhouse workshops, vegetable conferences, reindeer herder workshops, and forestry workshops. Through these direct public contacts they discover additional research needs. In addition, experiment station scientists work with Cooperative Extension Service personnel who have day-to-day contact with land managers, foresters, and farmers. Agency managers and staff share their research needs with members of the AFES faculty and staff. Several experiment station scientists also serve on advisory panels for land and resource management agencies.

Because of these contacts, most of our research projects described in the plant and animal sciences section of this report were in response to producer requests. Research projects in the forest sciences and resources management sections were developed at the request of industry or state and federal agencies for information to address specific needs.

Research completed at AFES is published in scientific journals as well as experiment station bulletins, circulars, conference proceedings, books, and the station's own journal, *Agroborealis*. Experiment station scientists disseminate their findings through conferences, professional journals, workshops, and other public information programs. Subjects range from greenhouse operations to potato production, from reindeer herding to forest productivity, and from mine soil reclamation to the management of outdoor recreation.

Administratively, AFES is an integral part of the School of Agriculture and Land Resources Management (SALRM) at the University of Alaska Fairbanks. This association provides direct linkage between research and teaching in forestry, agriculture and natural resources. Scientists who conduct research at the experiment station also teach, sharing their expertise with both undergraduate and graduate students.

Drastic Retreat of Columbia Glacier Shows Natural Reforestation at Work

Many people think of Alaska as a land of only snow and ice. While the residents of Alaska know better, at least one kind of ice in Alaska attracts many visitors and is unique among the states. Alaska has 52 tidewater glaciers—glaciers where saltwater laps up against ice cliffs and icebergs fall into the sea. Forests grow on fiord walls next to many Alaska tidewater glaciers and trees can even be found on patches of soil on top of the ice. The setting of Alaska's tidewater glaciers is often spectacular—the deep blue of fiord saltwater, the gleaming white of mountainous snowfields, the eerie blue of compacted glacier ice, surprisingly abundant marine and bird life, the deep green forests of spruce and hemlock, and often a zone of gray moonscape where the ice has pulled back and exposed a raw new landscape.

Significance of Tidewater Glaciers

About 11,500 years ago, near the end of the last ice age, the world warmed dramatically and forests across most of the world's mid latitudes migrated into landscapes that ice had recently occupied. The retreat of Alaska's larger tidewater glaciers represent a small-scale model of that process of rapid ice retreat, climate warming, and forest development on disturbed land. Lessons learned about the process of revegetation in areas of glacier retreat could be useful in reclaiming disturbed land and in forest management.

To document features of natural diversity and revegetation in the path of a glacier's retreat, Glenn Juday, associate professor of Forest Ecology at the School of Agriculture and Land Resources Management, is conducting a study of reforestation on land near Columbia Glacier in Prince William Sound.

Development of Alaska's Tidewater Glaciers

Glaciers reach the sea only in southern Alaska (the northern part of the southeast "Panhandle" and the Southcentral region of the state), not in the cold northern portions of the state. Glaciers develop in the mild, humid climate of coastal Alaska for two reasons. First, so much snow falls in the winter that it can't all melt in the summer. Second, the shorelines of Southcentral and northern Southeast Alaska are lined with some of the tallest coastal mountains in the world, so there are high-elevation snow-gathering areas all around. Even though the climate at sea level may be mild, it's always below freezing high on the slopes of a mountain.

Columbia Glacier

Columbia Glacier is one of the largest and most impressive of Alaska's tidewater glaciers (Figure 1), and until recently, it was the last with a terminus in an extended position into the fiord it occupies. In the late 1970s the U.S. Geological Survey predicted that Columbia Glacier would begin a drastic retreat, a process of exceptionally rapid physical disintegration. Tidewater glaciers, instead of melting in place like glaciers grounded on land, are broken up by oceanic heat transfer, currents, and tides. Figure 2 shows how a small amount of glacier retreat off the protective moraine causes the ice to stand in deep water where it is attacked more effectively by the ocean. In 1985 the U.S. Geological Survey confirmed the drastic retreat of Columbia Glacier.

Columbia Glacier in Prince William Sound was until recently the last of Alaska's tidewater glaciers with its terminus in an extended position into a fiord. In the early 1980s, the glacier began a drastic retreat, leaving many acres of newly exposed terrain and giving scientists a window on the revegetation process as it might have occurred at the end of the last ice age.

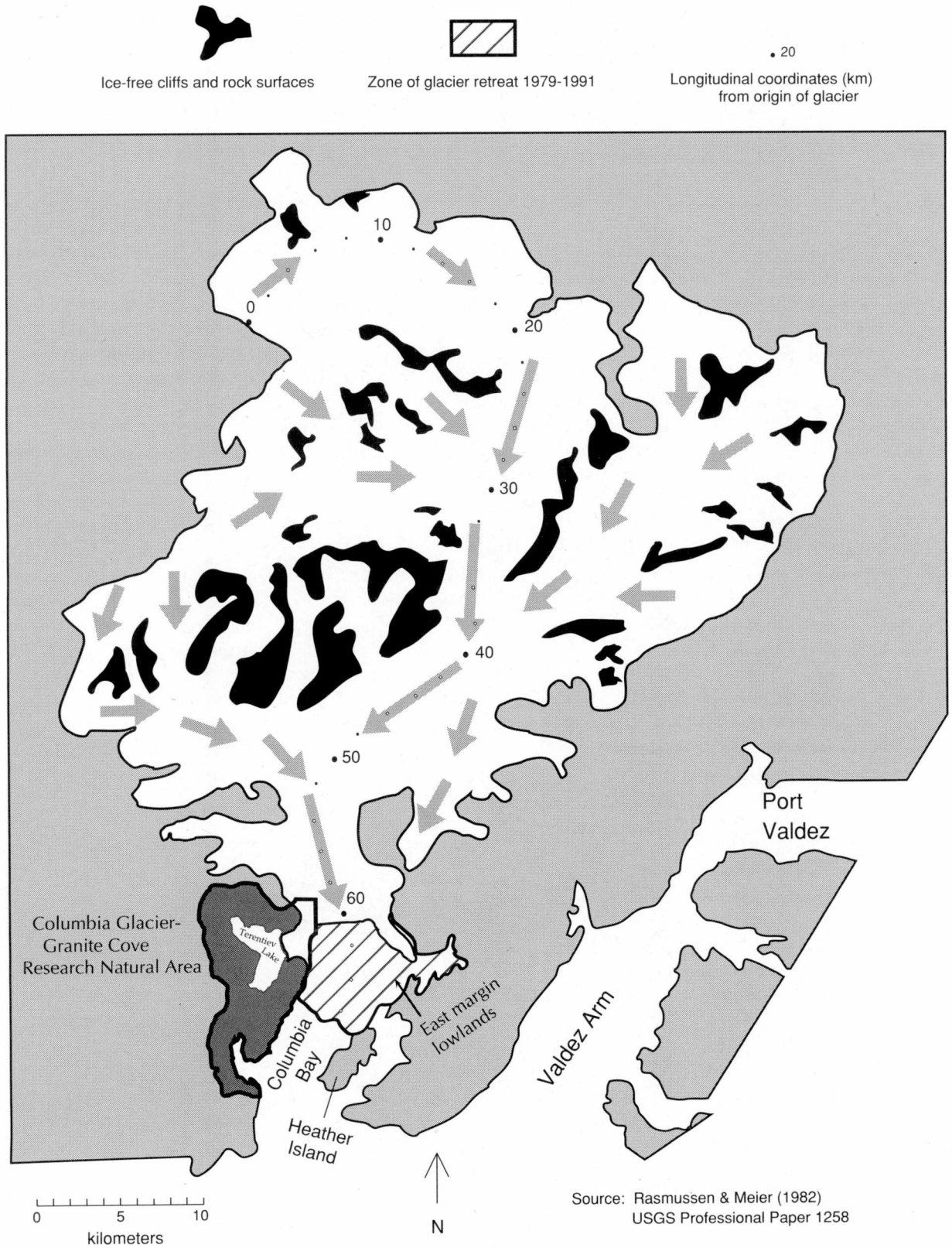


Figure 1. *Location, extent, flow, and recent retreat of Columbia Glacier. The proposed Columbia Glacier–Granite Cove Research Natural Area is located at the glacier terminus on the west side. The greatest expanse of new land exposed to date is the east margin lowlands.*

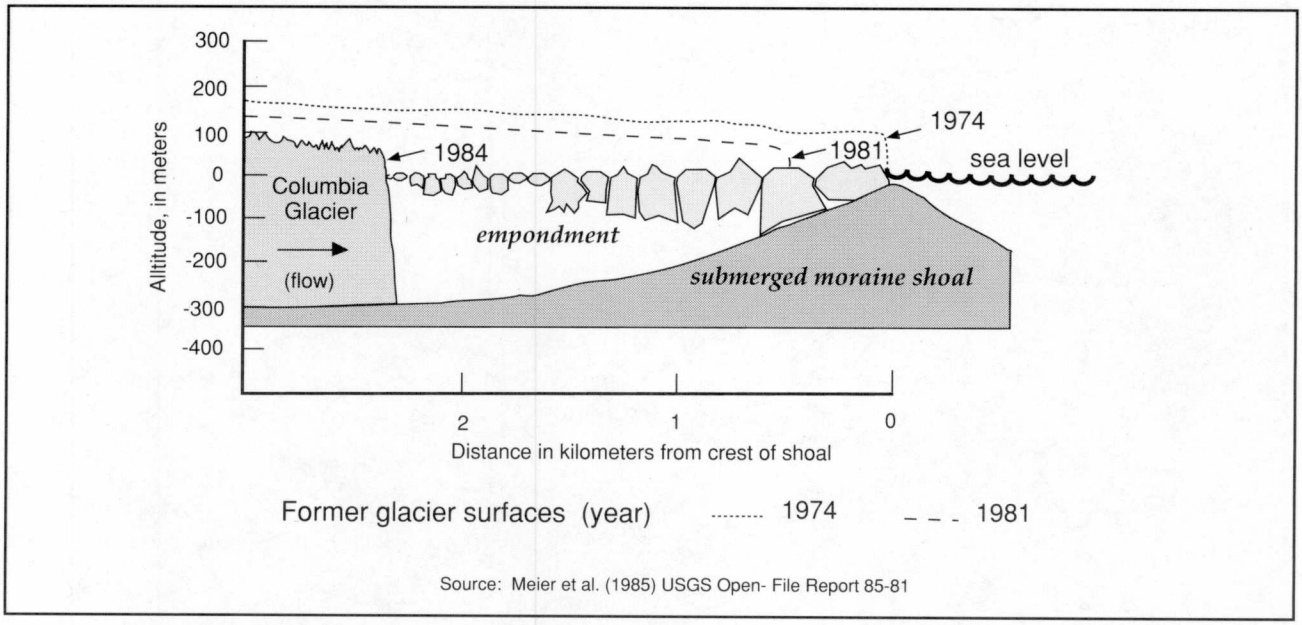


Figure 2. *Cross section view of recent changes at the terminus of Columbia Glacier. Ice loss from a tidewater glacier is directly proportional to the depth of water in which it stands. The glacier's ice front had been resting on a submerged moraine shoal, but once a slight retreat put the front in deep water in the early 1980s, a reinforcing process of drastic retreat began. The empondment between the ice cliff and the crest of the moraine shoal is usually choked with icebergs in the warm season as large icebergs become grounded. Note that the glacier has thinned as well as retreated.*

Juday visited the glacier in 1983, just as the retreat was beginning, and documented features of the proposed Columbia Glacier–Granite Cove Research Natural Area (RNA). He and a team from the U.S. Forest Service returned in 1985 and conducted site reconnaissance studies and established baseline monitoring sites in the RNA and the east margin lowlands (Figure 1). He returned in 1991 to remonitor the sites and note the changes that had taken place.

As of 1991 the Columbia Glacier ice front was continuing to retreat several hundred yards per year and was located more than 3 miles (5 km) back from the stable position it occupied on its moraine as recently as 1983 (Figure 3). Columbia Glacier has been the subject of both pioneering and recent intensive glaciological studies (many conducted by the U.S. Geological Survey) and is one of the best-documented major tidewater glaciers in the world. Its drastic retreat is occurring in a forested region.

Natural Reforestation at Columbia Glacier

When Columbia Glacier was first carefully observed in 1899 it was advancing—even dropping blocks of ice onto large trees. The glacier's last and farthest advance ended about 1923 and was followed by a slight pullback, making a distinct zone where natural forest development has been underway ever since. Two other narrow zones along the glacier's margin became free of ice in 1935 and 1974 or 1975. The oldest (1923) zone is now carpeted by a dark forest of vigorous young Sitka spruce trees. The 1935 surface is covered by a dense tangle of Sitka alder mixed with pole-size Sitka spruce trees, and the 1975 surface is an alder jungle. Previous interpretations of natural reforestation held that alder prepared the way for spruce, which then replaced the alder. The 1923, 1935, and 1975 surfaces appear to follow that pattern. But the rules may be different when glacier retreat is rapid.

In the 1980s Columbia Glacier's retreat accelerated and new land suddenly became free of ice more than a mile (1.6 km) from the surviving forests at the terminus. On the newly exposed land along the east margin lowlands (Figure 1) often the first, and occasionally the only, plant to arrive is Sitka spruce, sometimes within only a year or two of the retreat of the ice. Will a spruce forest develop without alder? Or will the spruce trees only grow slowly until the nitrogen-fixing alder enriches the site?

Now that an entire landscape has suddenly become free of ice at Columbia Glacier, the land surfaces are not stable. Some sites that became free of ice were later washed out by new stream drainages that continue to develop on the new land. Some ponds that formed just as the ice retreated are gradually draining. These events *after* the general retreat of the glacier appear to be common and locally important—they reset the reforestation "clock." Post-retreat disturbances may explain why sites that have been free of ice for the same number of years often support different kinds of vegetation. The reforestation process may be more predictable than thought in the past, but it may be responding to a more complicated series of events too.

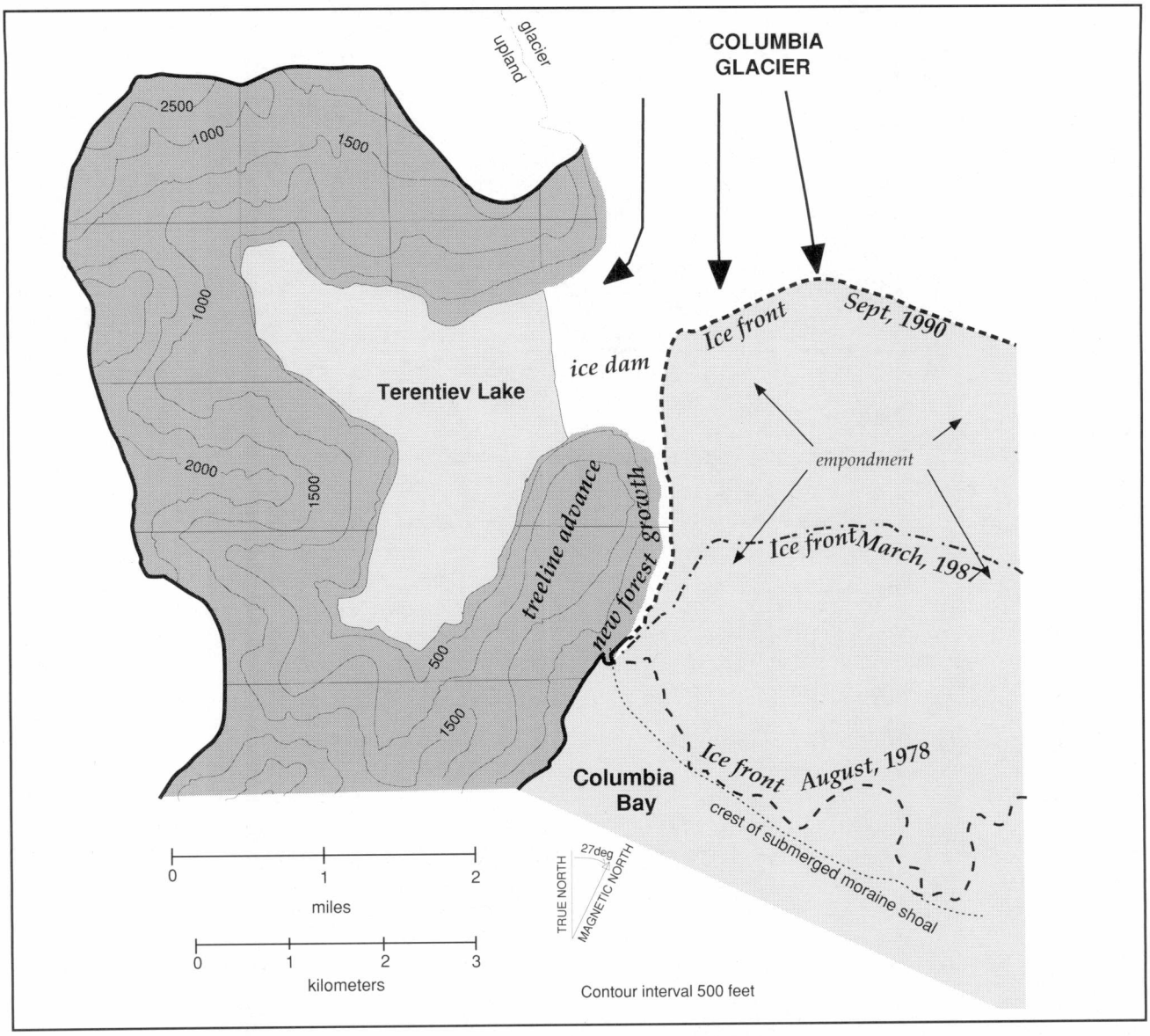


Figure 3. *Western terminus region of Columbia Glacier showing the northern half of the Research Natural Area. New forest growth has begun on the fiord wall, but soon the collapse of the ice dam holding back Terentiev Lake will open up an entire valley for forest colonization.*

The Future

As the retreat continues and a new saltwater fiord replaces glacier ice, the local climate will warm. A treeline advance up the mountain slopes around Columbia Glacier (Figure 3) can be expected (or may be underway), just as would happen in potential global warming. But the establishment of a forest on bare land is not the same as the movement of trees into a well established tundra. One preliminary indication near Columbia Glacier is that small disturbed sites, such as mountain goat scrapes, may be important for the establishment of tree seedlings.

When Columbia Glacier was at its full extent it flooded a large valley along its west side forming 1,590-acre (644-hectare) Terentiev Lake. Now, only a thinning ice dam holds back the lake water and icebergs (Figure 3). Soon, certainly within a few years, the ice dam will collapse and the lake will drain. Then, starting on a given day, the old lake bed will experience the development of a new forest. The natural reforestation of an entire valley should be instructive.

With the completion of a final report on its natural diversity features, the proposed RNA should be established soon. Juday plans to seek funding for continued and expanded studies in the area. The dense, flowing ice that smothered the land and water at Columbia Glacier is yielding its grip. Now life in all its complexity and richness is reasserting itself, as it has countless times before. What makes this recovery of life different is that this time knowledge and insight are taking root and growing too. ❑

Reindeer Range and Productivity Studied in Beringia Heritage International Park

The Beringia Heritage International Park was endorsed by Presidents George Bush of the United States and Mikhail Gorbachev of the Soviet Union at their Summit meeting in June 1990. Under the plan, the two nations will study aspects of the Bering Land Bridge, the isthmus that joined Alaska and eastern Siberia during the glacial epoch 14,000 to 25,000 years ago.

The Alaskan part of the Park includes much of the northern Seward Peninsula, an area that is intensively managed for reindeer. The University of Alaska Fairbanks Reindeer Research Program has worked with the reindeer industry in this region since 1977.

With National Park Service funding, the Reindeer Research Program defined a project to research and document the range, utilization, and productivity of reindeer within the Park. Knowledge of reindeer grazing systems and the needs of the reindeer industry are essential before a functional and realistic management plan can be produced. One of the goals of the project is to better understand this relationship in order to maintain a balance between herbivore numbers and range carrying capacity.

To accomplish this resource management goal for reindeer grazing in the Beringia Heritage Park, the project views several inter-connected systems. The combined network of systems can be viewed in Figure 1.

The biological system is characterized by the productive dynamics of the range vegetation and reindeer it supports. One of the basic information gaps the project addresses is to define the dynamics of range vegetation and the extent to which it is available to herbivores. This implies a good working knowledge of range productivity and utilization and animal productivity, but the management plan must also be flexible in order to respond to changes that occur, such as range fires. Researchers hope to gain insight into successional patterns of plant communities that were subjected to either cool or hot burning fires.

The Beringia Reindeer Range and Productivity Project was begun in the summer of 1991 to determine appropriate techniques necessary to define these interrelationships within the Park. Associated with the project are Nancy A. Karidis, research associate with the Reindeer Research Program; Lyle A. Renecker, assistant professor of Animal Science, School of Agriculture and Land Resources Management; Johannes Bauer, range and wildlife ecologist, European Wildlife Institute, University of Saarland, Germany, and Hunter J. Michaelbrink, Cooperative Extension Service agent for the University of Alaska in Nome.

An independent aspect of the Beringia project is to contact persons in the Chukotka portion of the Park in Russia. An organized exchange of scientists and reindeer herders would begin collaborative research to compare and assess range quality and herding characteristics in both countries joined by the Park.

In June 1991, Reindeer Research Program personnel attended reindeer handlings in the Park. They helped with general corralling activities and learned about each herder's practices and point of view. A "Herder Questionnaire" was assembled to determine the seasonal reindeer ranges and herd history of each of the five herds within the Park. Six seasonal reindeer ranges were delineated: spring (pre-calving, calving, post-calving), summer, autumn (rut), and winter.

Dr. Bauer, a world-renown vegetation ecologist from Germany, took part in the August pilot field study and reviewed the hypotheses, objectives, and vegetation sampling techniques. Transects were es-

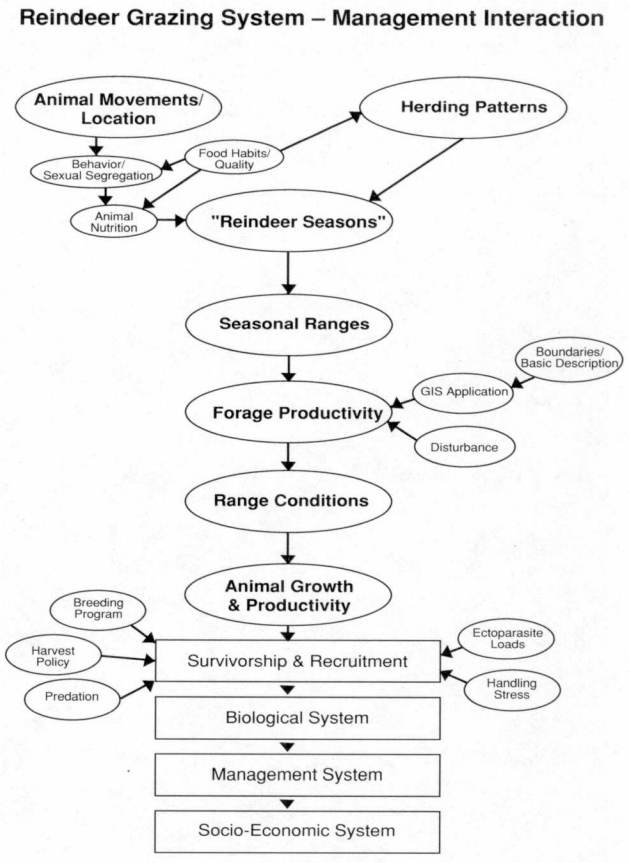


Figure 1. Flow diagram of the interactions that must be considered in a Reindeer Grazing System.

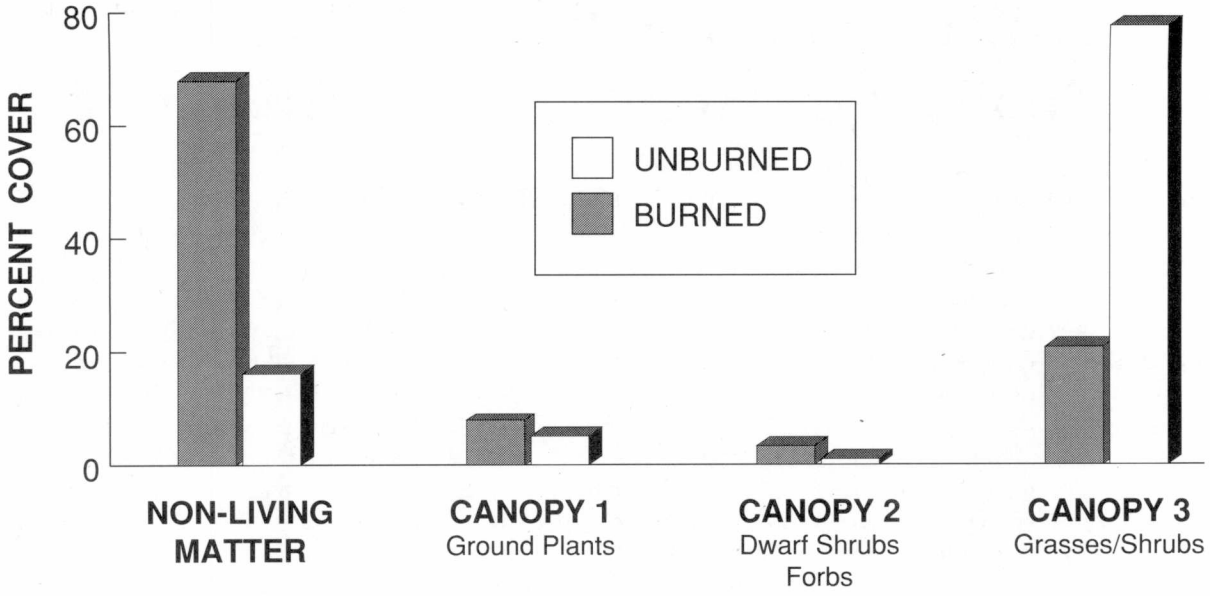


Figure 2. *Comparison vegetation components in burned and unburned range near Candle on the Seward Peninsula. Non-living matter includes water, mineral soil, raw humus, ash, and dead plant matter; ground plants include mosses, foliose lichens, fructose lichens, and crustose lichens; dwarf shrubs/forbs include Empetrum, mushrooms, Pedicularis, and Loiseleuria; and grasses and shrubs include Betula, Ledum, Rubus, Arctostaphylos, Vaccinium, Eriophorum, Carex, Gramineae, and Epilobium.*

tablished in plant community types that occurred on the seasonal reindeer range.

Plant phenology and abundance of each plant species observed in the one-meter circular sample plots along the transect were estimated by ocular cramming. Ocular estimates were then later transformed to the Braun-Blanquet classes of cover for plant abundance. Vegetation present was comprised of four plant canopy layers. Because these canopies can overlap in relation to the three dimensional space involved, the numerical value often was greater than 100 percent. Therefore, four canopy layers were defined: 1—ground plants; 2—dwarf shrubs and forbs; 3—grasses and shrubs; and 4—high shrubs and trees. The more vegetative canopies on the plot, the greater the potential for vegetation overlap. Therefore, the total ocular abundance was as high as 150 percent. This provided a visual interpretation to the density characteristics of the sample plot (See Figure 2).

Vegetation sampling on reindeer winter range near Independence on the Seward Peninsula.

Protocol to establish an estimate of biomass from a clip plot on each transect was also completed. Plant samples were collected for laboratory analysis of crude protein, neutral detergent fiber, acid detergent fiber, and gross energy.

Rumen content samples were collected from reindeer sacrificed in both June and August for

plant fragmentation analysis. This information will give insight into the reindeer diet at different times of the year which can then be related to the seasonal ranges. In turn, this information will be used to assess the importance of the plant as a seasonal dietary item for reindeer.

The approach is to apply the forage resource (plant community data) information from field work by researchers and knowledge of reindeer herders with data from other agencies (reindeer radiotelemetry locations, previous range fires, U.S. Geological Survey information, and Soil Conservation Service ecotype mapping). When interfaced together on a computer Geographical Information System such as IDRISI used by the Reindeer Research Program, a functional range assessment map will be produced for use by both the reindeer herders and other agency personnel. Computer automation of this information will make it possible to plan strategies for enhancement of herd production that is compatible with the productivity of the range.

In the 1992, additional forage resource information will be obtained. Plant species will be analyzed for quality and compared to the 1991 results. Dietary habits will be monitored through fragmentation analysis of rumen and fecal samples from reindeer.

Communications have been difficult but have progressed with Beringia scientists in Russia. Exchange arrangements have been made for travel in the summers of 1992 and 1993. During the visit to Chukotka, UAF scientists will conduct vegetation analysis of reindeer range, exchange scientific information, and compare methods of reindeer herding. ❑

Radio Collars Aid Research into Neonatal Reindeer Calf Mortality

Reindeer herding is currently practiced to harvest velvet antlers, but the long-term stability of this livestock industry must focus on red meat production. Increasing demand for leaner, healthier meats and the potential for increased financial gains for Native herders that diversification and greater sustainability would bring, have shifted research emphasis to productivity and management of reindeer herds.

To maintain meat markets, there must be a product of consistent quality and quantity. This requires a productive reindeer population with good survival rates and recruitment into the yearling age class. In accomplishing this goal, herders are faced with the opposing circumstances of a maximum limit to the carrying capacity of their range and the need to produce more animals.

The agencies that manage the ranges have placed limitations on maximum stocking rates. The herder, therefore, must determine the factors within his management program that will allow him to optimize production of animals. The first obvious method for improvement of herd productivity is through high calf survival.

Reindeer calf survival is influenced by a variety of aspects: nutrition of dam and calf, handling stress, including abandonment and orphaning; predation; range conditions; natural mortality, and genetic or

Reindeer neonate killed by a predator.

congenital defects (See Figure 1).

A research project conducted by C.L. Chetkiewicz, a graduate student with the Reindeer Research Program, and Lyle A. Renecker, assistant professor of Animal Science, School of Agriculture and Land Resources Management, is attempting to partition mortality of radio-collared calves to address the claim that grizzly bears are a major source of neonate and calf mortality.

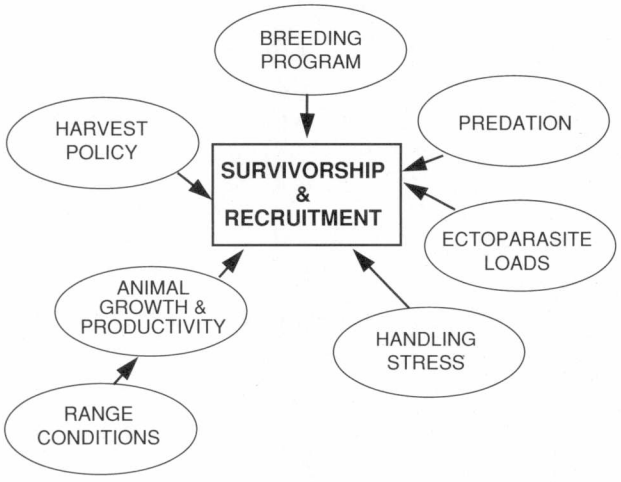


Figure 1. *Variables affecting survivorship and recruitment of reindeer populations on the Seward Peninsula.*

During the 1991 calving period (April 22-28), 47 reindeer neonates (24 male and 23 female), 6 to 48 hours old, were sexed, aged, weighed and fitted with expandable elastic radio-collars with mortality sensors. When mortalities were located, data on the cause of mortality were taken and the collar was refurbished and placed on another neonate when possible.

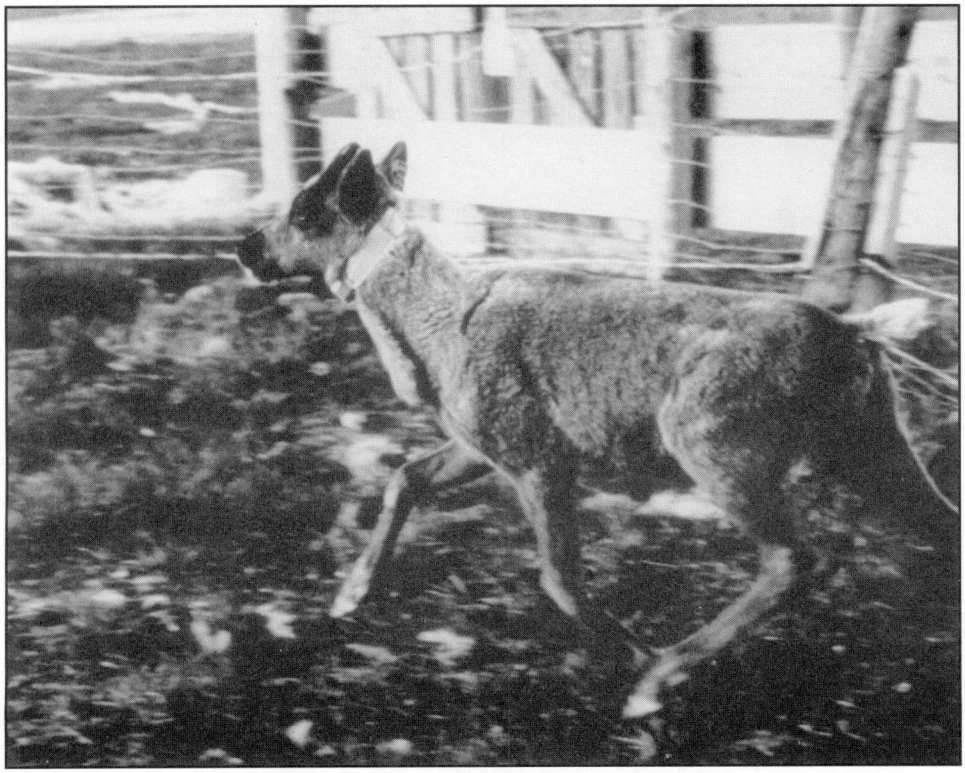
Data was analyzed for survival from: 1) capture to handlings in June , to November, and until the end of 1991; and 2) survivorship for males versus females in 1991.

Within six days of the birthing period 14 neonates were dead (39.5 ± 10.3% Standard Deviation). Ten of the 14 neonates were female. There was only one other mortality prior to the handlings in June. Mean survival time was 47 ± 5 Standard Error (S.E.) days. Three animals died post-handling and 11 additional animals out of 47 calves were dead by November. Mean survival time for animals from the handling to November was 137 ± 5 S.E. days. In 1991, 47 reindeer neonates were radio-collared and 28 died. Mean survival time was 131 ± 13 S.E. days.

The finite survival rate for male and female reindeer calves on the Seward Peninsula from April to November, 1991, is 0.50 ±0.14. There are two distinct periods where reindeer calf survival is compromised. These are as neonates (0–20 days of age) and in late October/early November (180–200 days of age). In general, proportionately more females died as neonates than males and males constituted the majority of reindeer mortalities after more than 180 days.

The causes of death for radio-collared animals to the last tracking flight in October included: disease, drowning, predation, and unknown causes. Bears and foxes appear to be the main predators.

In 1992, assessment of bear tissue and alternative prey tissues and scat analysis will begin to determine food habits. The 1992 field season began April 15, 1992 with minor adjustments to protocol and additional protocol for vegetation sampling and fecal analysis in preparation for development of a population model in the fall. ❑



Radio collared reindeer calf being released at the June handling.

Moose Browse on Site of Mining Reclamation Study

All mine operators on public lands in Alaska are required to stabilize surface materials and return the disturbed land to the specified post-mining land uses but coal mines are subject to still more stringent regulations. They are required to establish diverse, self-reproducing plant communities that meet bond-release standards established before the mining permit is issued.

Establishment of moose browse and other local plant species is a major goal of reclamation of mined lands in many areas of Alaska. However, little information is available on plant species survival and growth rates on revegetated sites.

To obtain this information the Alaska Science and Technology Foundation and Idemitsu Alaska, Inc., funded a project to study responses of different plant species to several soils. Dot Helm, research associate professor of vegetation ecology with the Agricultural and Forestry Experiment Station in Palmer, is conducting the research.

Trials using seven woody species on four different plant growth media were initiated in June 1989 for the proposed Wishbone Hill Coal Project near Palmer. Four willow species (balsam poplar, feltleaf willow, Barclay willow, and Bebb willow) were chosen for their rooting ability and palatability to moose. Three other woody species were selected for their abundance in native vegetation (paper birch), nitrogen-fixing abilities (alder), or hiding or thermal cover (white spruce).

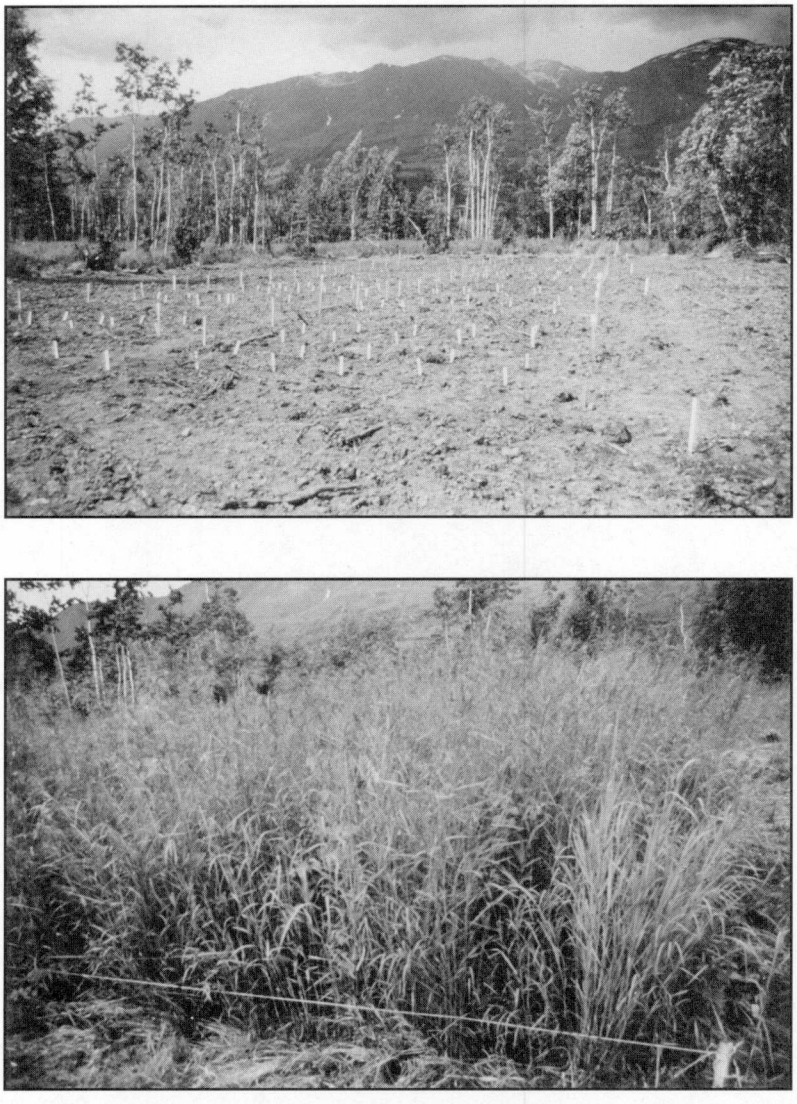


Figure 1. *Upland meadow plots are shown shortly after planting of bluejoint (top photo) and at the end of the third growing season (bottom).*

Three soils were selected for their biological components, including plant and mycorrhizal fungal propagules (seeds, rhizomes, spores). Mycorrhizae are symbiotic mutualistic relationships between fungi and plants. The fungus helps the plant absorb soil nutrients and moisture and the plant provides carbon substrates (energy) for the fungus. Soils under paper birch–white spruce communities were expected to support natural regeneration of many plant species and contain mycorrhizal fungal propagules for white spruce trees. Upland meadow communities were dominated by bluejoint reedgrass, which competes with woody regeneration, and were not expected to have mycorrhizal propagules appropriate for the woody species. Lowland meadow communities were more diverse than other vegetation types. Overburden, the material beneath the developed soils, was assumed to have few biological components and was left exposed at one of the sites as a control.

The four sites were prepared by stripping the existing vegetation and topsoil. On the three soil sites, the topsoil was spread again over the plots within one day.

Plant growth on all the local soils has been excellent at the end of three years. Most planted seedlings and cuttings as

well as many volunteers have become mycorrhizal also, even in areas where it was not believed that appropriate mycorrhizal fungi existed. Moose have been browsing unfenced plants during the winter, demonstrating that moose browse can be regenerated in a timely manner under conditions of this study. Outplanted cuttings and seedlings have been able to attain sufficient height to survive most competition from bluejoint. However, browsing of unfenced plants may alter this relationship in the future.

In addition to the good woody plant growth, many local plant species have colonized the plots. Thirty-one native plant species have been identified on these four sets of plots which provided 70 percent vascular plant cover. The lowland meadow communities were more diverse than the others and contained 21 species at the end of three years.

To address the issues of soil stability and plant species diversity, seed mixes of one or several grass species were evaluated for plant cover, diversity of plant species, and suppression of desirable or undesirable native species. Each of these goals may be appropriate for different areas of a mine and one goal may conflict with another. Competitive species such as bluejoint are desirable where soil stability is a concern, but undesirable where browse or diversity is the goal. 'Nortran' tufted hairgrass, 'Norcoast' Bering hairgrass, and 'Arctared' red fescue all provided good cover. When seeded at heavy rates in a mix, they were able to suppress undesirable bluejoint in the short term. In contrast, 'Gruening' alpine bluegrass was a very low-growing grass that provided some soil stabilization yet did not compete with the woody plant establishment and would have little effect on the native regeneration.

Results of these studies are being used in reclamation planning for the proposed Wishbone Hill Coal Project. ❑

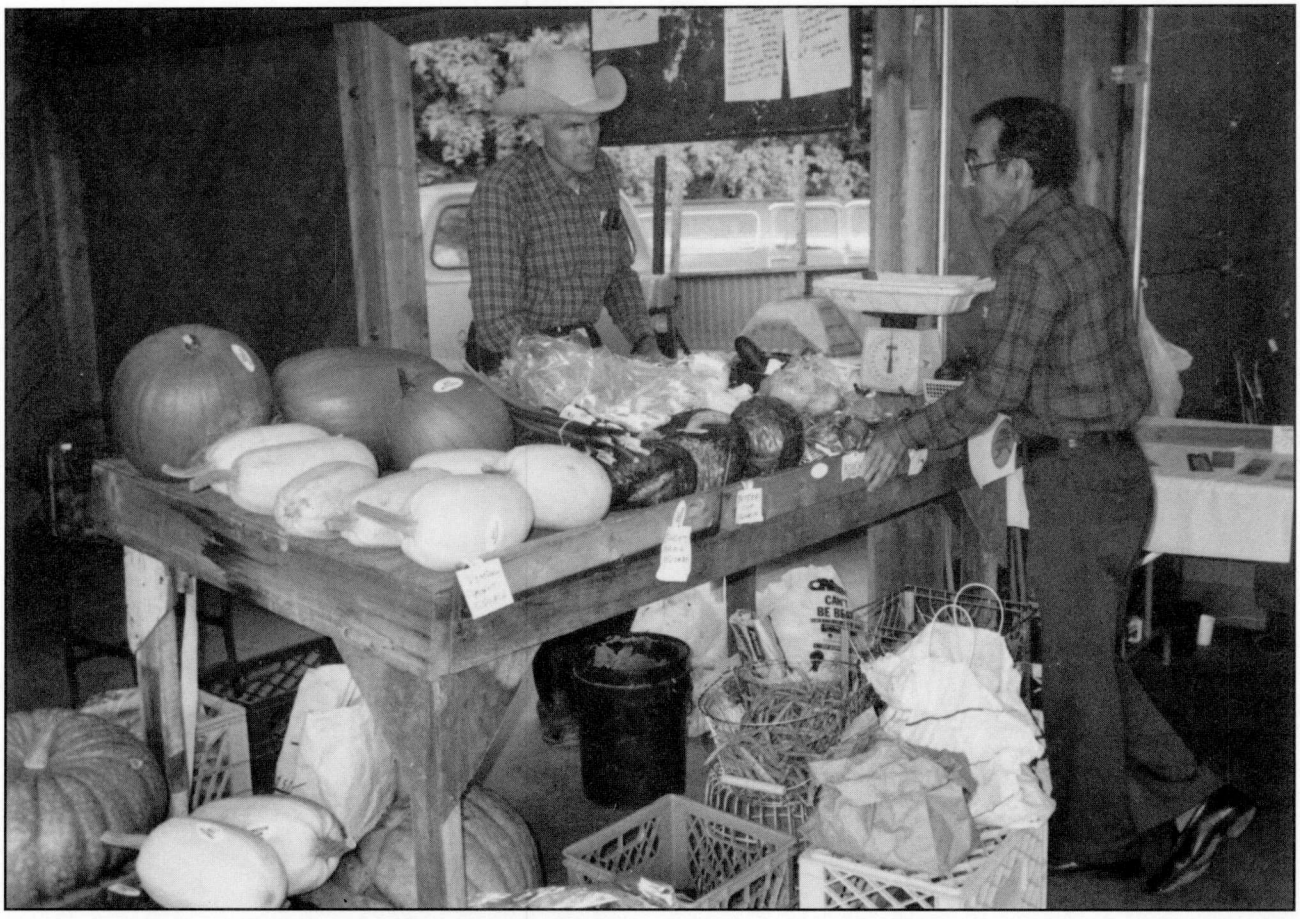
Developing Marketing Strategies for Alaska's Agricultural Entrepreneurs

State policy directives emphasize the need to increase the market share held by Alaskan agricultural producers. To provide background for these directives, the Agricultural and Forestry Experiment Station and the School of Agriculture and Land Resources Management provide information to consumer and merchant groups concerning availability of Alaskan food products, food acquisition patterns, and food cost. Researchers have also prepared a chart showing when Alaskan fruits and vegetables are available to help consumers better plan purchases of local products.

Interest has also been expressed in specific Alaskan products directed toward "niche" markets. One of those products is Alaskan blueberries. A survey of consumers and processors indicated there is a potential for increasing the amount of indigenous Alaskan blueberries now marketed to processors of jams and jellies. This will only be possible if berries are of high quality and priced competitively.

Alaska honey is a relatively new entrant in the gourmet market. In 1990, 60,000 pounds of honey were produced. Primary outlets are farmers' markets and roadside stands, health food stores, gift and specialty shops, and direct sales. Price was a concern when consumers were faced with choices among similar honeys.

The Tanana Valley Farmers Market provides a direct marketing outlet for farmers in the Fairbanks area to sell their produce.



A wide selection of locally grown produce is sold at the Farmers Market near the Tanana Valley Fairgrounds on College Road.

Urban Alaskan consumers are dissatisfied with the quality of produce available. Furthermore, these same consumers pay approximately 25 percent more than their counterparts in selected Western states to obtain a nutritionally balanced diet. To promote quality Alaskan products and increase market share, the Alaska Division of Agriculture has introduced the "Alaska Grown" logo. This logo, and its quality guarantee, appeal to Alaskans, who have been shown to be more label conscious than consumers in the other 49 states. Indeed, 79 percent of urban Alaskan food purchasers look for the "Alaska Grown" label when they shop.

Direct marketing through farmers' markets and roadside stands offers a potential for current Alaskan producers to increase their market share, enter "niche" markets with new products, and for new farmers to enter the marketing chain. In 1990, 43 percent of Alaskan shoppers purchased products at these locations at least several times a year.

To gauge the effectiveness of direct marketing and other marketing strategies, Ruthann Swanson and Carol Lewis of the School of Agriculture and Land Resources Management conducted a confidential survey of 417 randomly selected direct market consumers in the Railbelt area to express their opinions. In particular, the survey solicited opinions concerning production methods, characteristics of fresh produce, produce selection criteria, purchasing trends, concerns about available foods, and identification of sales outlets and the role of government, food distributors, and producers in certifying quality of produce. The results of the survey will be available in 1992. ❑

R.S. 2477 — The Key to Access Across Federal Lands

R.S. 2477 is the title of a federal law passed in 1866 and repealed in 1976. It reads, "The right-of-way for the construction of highways over public lands, not reserved for public uses, is hereby granted."

Despite its simple language, and its repeal, R.S. 2477 presents a thicket of legal issues to anyone considering access across federal lands.

Harry Bader, assistant professor of Natural Resources Law at the School of Agriculture and Land Resources Management, said the law will in all likelihood continue to govern conveyances of access across federal lands. He is engaged in a project to research the issues involved and to develop a systematic, formal, and legally acceptable system for resolving R.S. 2477 questions.

The issue of R.S. 2477 assertions is particularly significant in Alaska because of the pattern of land selections by federal land-owning agencies in the wake of the Alaska National Interest Lands Conservation Act (ANILCA) in 1980. The configuration of federal conservation units has isolated many state and private land holdings, and limited access hinders resource development.

The project is divided into three parts. First, an exhaustive legal analysis will be made, defining the parameters of the issue and thereby establishing the range of options legally available to the state.

Second, an on-site scientific field survey of potentially affected landowners will be conducted, using three established trails as case studies. The surveys will address concerns of miners, Native allotment holders, private timber companies, village and regional corporations, towns, homesteaders, state agencies and federal resources managers. The information gained from the legal analysis and field surveys will be compiled and arranged into a set of recommendations.

Third, these recommendations will serve as the basis for a mediated state-federal workshop designed to generate principles for a memorandum of agreement representing the interests of all concerned parties.

Bader said there are hundreds of court decisions dealing with R.S. 2477 from 1866 to the present. Although the law was supplanted by the Federal Lands Policy and Management Act of 1976, the new law does not affect routes that qualify as valid rights-of-way under the old law.

State courts generally have interpreted R.S. 2477 under principles of common law, which hold that access corridors may be established through common and customary use. Different courts have made different interpretation and the law itself has evolved.

The law refers to access for highways, but Bader said it can apply to any public way, such as a path, wagon road, pack trail, street, alley and other transportation routes common and customary in an area.

Questions of access often involve competing interests. To date, no guidelines for management of R.S. 2477 have been found that satisfy all interests. In the absence of such common ground, it is likely that each question of R.S. 2477 access will be litigated in court on a case-by-case basis, with resulting costs, delays and uncertainties.

"Uncertainty concerning the ability of the state to legally assert access rights across federal lands pursuant to the terms of R.S. 2477 coupled with conflicts between state and federal agencies over management goals has created a volatile regulatory environment which inhibits capital investment by private parties, thereby decreasing the potential value of state, Native corporation, and other private lands," Bader said.

"Without resolution of the R.S. 2477 issue, many of the lands selected by the state and Native corporations, as well as recognized mining claims, for the purposes of development, will not be fully utilized. As a result, the state will lose millions of dollars in potential revenue, Native corporation long-range planning will be frustrated, and rural employment opportunities will be diminished." ❑

Plant, Animal and Soil Sciences

Management of Alaskan Beef Cattle to Maximize Forage Use

The major objectives of this study are: 1) To maximize use of Alaskan forage for beef cattle through alternative management techniques, and 2) to manage Alaskan beef cattle on a fall calving scheme and compare animal survival, health, and the economic considerations of labor and feed costs, with traditional spring calving methods.

• *Leroy B. Bruce*

Primary Productivity

This study provides information on cover, botanical composition, biomass, seasonal, yield, regrowth capacity, and feed quality of major plant species grazed by Snow Geese in the Sagavanirktok River Delta area on the North Slope.

• *Leroy B. Bruce, Michael T. Panciera, Raymond G. Gavlak, and J. M. Cadle (Tarleton State University).*

Potato Variety Comparisons and Evaluations of Rhizoctonia Disease of Potato

Forty-five potato cultivars were evaluated in irrigated and non-irrigated trials. Top-yielding varieties included Gold Coin (22.8 tons/acre), Green Mountain, and Denali in the irrigated trial; and IditaRed (19.6 tons/acre), Allagash Russet, and Green Mountain in the non-irrigated trial. Average total yields were 19.2 tons/acre in the irrigated trials and 15.7 tons/acre in the non-irrigated trial. Up to now it had been thought that most isolates of *R. solani* AG-3 collected from plants other than potato appear to not cause damage to potato. Characteristics of isolates of AG-3 not pathogenic to potato are being determined.

• *Donald E. Carling*

Efficacy and Persistence of Herbicides in Alaskan Soils

Residues of metribuzin and linuron present in the soil after application to potato crops can damage vegetable seedlings. Bioassay reveals that the first year following application, metribuzin can kill germinating lettuce and cabbage seedlings, and linuron may cause damage. By the second year, little or no damage is observed. Lettuce transplants are damaged to a lesser extent.

• *Donald E. Carling and Jeffery S. Conn*

Interseeded Faba Beans and Oats

Interseeded faba beans and oats make a quality forage, but little is known about the N fixation and transfer to the oats. Field studies near Delta Junction showed that faba beans seeded in alternate rows with oats could fix up to 100 lb of N, but little of that was taken up by the oats.

• *Verlan L. Cochran*

Nitrogen Fertilizer Placement in Barley

Field studies showed that deep banding N fertilizer between crop rows did not increase grain yields in comparison to broadcast in conventional tillage, but did increase grain yields in no-till planted barley. No-till yields were equal to conventional tillage when fertilizer was deep banded.

• *Verlan L. Cochran and Sharon F. Schlentner*

Potential for Herbicides to Leach

Contamination of groundwater by agricultural chemicals is of national concern. We studied downward movement of nitrates and two herbicides (metribuzin and metolachlor). Soil cores were obtained from irrigated potatoes and non-irrigated barley. The herbicides were confined to the top 6 inches and nitrates did not move below 18 inches.

• *Jeffery S. Conn and Verlan L. Cochran*

Yield and Yield Component Response of Barley Grown in Subarctic and Temperate Environments

The agronomic performance of four subarctic-adapted and four temperate-adapted barley cultivars was evaluated at two subarctic (Palmer and Fairbanks) and two temperate (Midwestern) locations for two years. Grain yield of the two classes of cultivars was similar in subarctic environments, but temperate-adapted cultivars were far superior when grown in temperate environments. Yield was positively correlated with all three yield components in temperate

environments, but only with heads/m^2 in subarctic environments.
• *Stephen Dofing*

Use of Alaska-Grown Canola in Dairy Cattle Diets

One hundred acres of 'Tobin' canola were grown by a farmer near Delta Junction in 1991 in a demonstration/cooperative research project. Use of whole canola seed in dairy cow diets is currently being evaluated through feeding trials conducted at a local dairy producer's farm and at the Agricultural and Forestry Experiment Station dairy facility in Palmer.
• *Stephen Dofing*

Pre-mining Vegetation Inventory for Hoseanna Creek Basin, Usibelli Coal Mine

Vegetation inventories must be conducted before mining to identify the vegetation types present, species present, and ecological relationships between vegetation types and environmental conditions. Twenty-four vegetation types were identified and described on approximately 25 sections of land along Hoseanna Creek of the Usibelli Coal Mine. This information will be used for reclamation planning.
• *Dot Helm*

Revegetation Studies for Two Bull Ridge, Usibelli Coal Mine

Several grass species are being tested on several growth media which are being evaluated for potential revegetation use on south-facing slopes. Existing reclaimed sites have been on north-facing slopes. Wildlife grazed most of the grasses during 1991, the first growing season. Decomposition of several grass species will be evaluated.
• *Dot Helm*

Patch Formation and Mycorrhizal Colonization during Succession on Glacial Till

Plant and mycorrhizal fungal species change during vegetation succession on glacial till. Mycorrhizal fungi that colonize an initial pioneer plant may spread to neighboring individuals. The study consists of an initial survey, field experiments, and growth room experiments to investigate the role of mycorrhizal fungi during primary succession.
• *Dot Helm*

Vegetation Succession Near Exit Glacier, Kenai Fiords National Park

Descriptions and ages of vegetation in the various successional stages are being developed for the vegetation types near Exit Glacier. Successional stages range from almost bare ground to climax Sitka spruce–hemlock communities. This will provide background information for the interpretative displays and presentations for the National Park Service.
• *Dot Helm*

Vegetation Sampling Tutorial

A vegetation sampling tutorial was developed for the Alaska Division of Mining to help coal mine operators and consultants understand what is required for premining vegetation inventories. Descriptions of field sampling techniques and statistical calculations were included.
• *Dot Helm*

Comparison of Alder Planting Techniques with Different Mycorrhizal Inocula for Mine Soil Stabilization

Soil-transfer inocula from different vegetation types were used to improve colonization of alder roots by mycorrhizal fungi and nitrogen-fixing bacteria. Soil from under alder shrubs was more effective than that from under black spruce communities. Seedlings were more successful than seeds, which failed to germinate in the field.
• *Dot Helm*

Reproductive Biology of the Endangered Aeutian Shield-Fern

Spores of the Aleutian shield-fern germinate on Knop's solution and Hoagland's No 2 solution in aseptic culture. Germination was delayed but not inhibited by agar concentrations greater than 6g/l. Liquid medium pH from 4.7-5.8 had no influence on germination. Spores exhibit a thermodormancy at 25°C and require light for germination.
• *Patricia S. Holloway*

Clonal Multiplication of Lingonberry

Tissue culture micropropagation is being compared with stem and rhizome cuttings of lingonberries to determine the optimum method of clonal multipli-

cation for commerical field establishment. Plant growth, rhizome development, and fruit production will be evaluated in germplasm collected from throughout its circumpolar range.
• *Patricia S. Holloway*

Nutrition of Lingonberries and Wild Blueberries for Commercial Fruit Production

Lingonberries and blueberries planted in 1991 will be treated with varying levels of nitrogen, phosphorus and potassium fertilizers to determine the optimum levels for commercial fruit production. Annual foliar applications of fertilizer will begin in June 1992.
• *Patricia S. Holloway*

Breeding of Lingonberries

Germplasm was collected from throughout the circumpolar distribution of the lingonberry and will be evaluated for hardiness and cultivation potential. In 1991, the first hybrid seeds were germinated from crosses between Alaska subspecies *minus* and German subspecies *vitis-idaea*. Hybrids will be evaluated for commercial fruit productivity and hardiness.
• *Patricia S. Holloway*

Commercial Cultivation of 'Kiska' Red Raspberries

Raspberries were planted at three locations in the Tanana Valley and will be treated with varying levels of nitrogen, phosphorus and potassium fertilizers. A second study will determine the effect of row orientation on fruit production. Plants will be evaluated during the next three years for fruit yield and quality, pollinator activity, and vegetative growth.
• *Patricia S. Holloway*

Evaluation of Small Fruit Cultivars in Interior and Southcentral Alaska

The hardiness and fruit production of red and black currants, red and black raspberries, half-high blueberries and saskatoons are being evaluated at 13 locations in the Railbelt area to determine their suitability for commercial production. Preliminary results identified 'Boskoop Giant' black currant and 'Smoky' saskatoon as having potential for commercial production.
• *Patricia S. Holloway and Catherine I. Wright*

Nutrition of Alaska Native Black Currant

Rooted cuttings of black currant were planted in the Lazy Mountain area near Palmer and treated with varying concentrations of nitrogen, phosphorus and potassium fertilizer. Plants were evaluated during 1990 and 1991 for vegetative growth and tissue nutrient content.
• *Patricia S. Holloway and Paul Kroenung*

Annual and Perennial Landscape Plant Cultivar Evaluations

In 1991, 62 species and cultivars of woody plants, 197 herbaceous perennials, 125 annual flowers, and 152 herbs and vegetables were evaluated in the Georgeson Botanical Garden. Plants were evaluated for landscape potential and hardiness.
• *Patricia S. Holloway and Patricia Wagner*

Methods of Handling Bare-Root Nursery Stock

Bare-root nursery stock was received on two shipping dates and heeled in peat outdoors, heeled in peat in cold storage, containerized and placed in a heated greenhouse, or containerized and stored outdoors. All plants were subsequently planted in the field in either spring or fall and are being evaluated for vegetative growth and hardiness to determine optimum methods for handling bare-root nursery stock.
• *Patricia S. Holloway*

Nutrition of Greenhouse-Grown Pasqueflower

Pasqueflower seedlings were grown in cell packs containing a commercial potting mix and fertilized with varying concentrations of nitrogen, phosphorus and potassium. Models were calculated for response of several vegetative growth factors to levels of fertilizer. Predicted optimum levels of were 105 mg/l nitrogen and 200 mg/l phosphorus. Optimum levels of K could not be predicted from the plant measurements recorded.
• *Patricia S. Holloway and Grant Matheke*

Characteristics and Feed Value of Barley and Western Protein Supplement for Swine. Objective 2

Six cultivars (Azure, Coughar, Datal, Morex, and Otal steptoe) were grown in six locations (Alaska, Alberta, Washington, Montana, North Dakota, and Utah) for two years. The growing location trend was

for reduced ß-glucan and increased kernel weight and acid detergent fiber with increasing latitude and therefore in Alaska grown cultivars.
• *Frederic M. Husby*

Characteristics and Feed Value of Barley and Western Protein Supplement for Swine. Objective 3

A study was conducted with 96 pigs (6.6 kg) to determine the feeding value of a salmon meal (heads, viscera, racks, and blood) in replacement of 0, 5, 10, and 13.5% diet by weight for soybean oil meal in all-barley starter pig diets. A significant reduction in average daily gain in the 13.5% diet was related to a significant decrease in average daily feed intake of 1.5 lb/day compared to the average intake of 1.6 lb/day for the other three diets. Feed efficiency was not significantly different for the four diet treatments at 2.07 lb feed/lb gain.
• *Fredric M. Husby*

Flower Initiation in *Primula vulgaris*

The requirements of day length, temperature and total irradiance per day for flower initiation were studied in *Primula vulgaris*. Optimum conditions for flower initiation include 14 hours or longer day length, 12 to 16°C and 10 to 18 mol • day^{-1}m^{-2} of total daily irradiance.
• *Meriam G. Karlsson and Jan T. Hanscom*

Comparison of Growth Regulator Persistence in Vegetative Chrysanthemum

The length of efficiency after spray or drench application of five growth regulators (A-Rest, B-Nine, Bonzi, Cutless, Sumagic) was determined in chrysanthemum 'Bright Golden Anne' and 'Deep Luv.' Treated plants returned to similar growth as the control plants eight to ten weeks after growth regulator application.
• *Meriam G. Karlsson and D.A. Gilbertz*

Growth Regulator Effects in Begonia

The efficiency of growth regulators in controlling plant morphology and post-harvest performance is studied in seed propagated tuberous begonia.
• *Meriam G. Karlsson, Jeff W. Werner, and Jan T. Hanscom*

Effects of Irradiance and Temperature on Greenhouse Produced Plants

The influence of photoperiod, light intensity and temperature on flower initiation and plant morphology is studied in several flowering plants.
• *Meriam G. Karlsson*

Photoperiodic Control in Begonia

Conditions with short days are expected to delay plant development and flowering in seed propagated tuberous begonia. One week of short days delayed flowering by 12 days in the cultivar Nonstop. The cultivars Clips and Musical flowered two weeks later after exposure to short days for three weeks during plant development compared to plants grown under continuous long days.
• *Meriam G. Karlsson and Jeff W. Werner*

Banded vs. Broadcast Applications of Nitrogen and Phosphorus on Barley

Effects of N and P fertilization rates on 'Otal' barley yield and rate of maturity were evaluated near Delta Junction in 1990 and 1991. All combinations of seven rates of N and seven rates of P were applied either in a band in the seed row or broadcast and incorporated prior to seeding. Plant populations were greatly reduced when band applications of N exceeded 60 pounds per acre.
• *Charles W. Knight*

Effect of Nitrogen and Phosphorus Fertilization Rates on Yield Components of Three Barley Varieties

N and P fertilizer application rates greatly affect the yield and rate of maturity of barley. The varieties of 'Otal', 'Eero', and 'Harrington' were grown at Fairbanks and Palmer in 1991 and fertilized with three N rates and two P rates. Tillers per plant were counted weekly, and fully extended heads were tagged daily. Observations included the effects of fertilization rates on number of tillers per plant, date of heading, rate of ripening, success rate of tillers producing mature seed, and yield components (heads per square foot, kernels per head, and kernel weights.)
• *Charles W. Knight and Stephen M. Dofing*

Biological Suppression of Soil-Borne Plant Pathogens

The objective of this project is to study the interactions between antagonistic micro-organisms and soilborne plant pathogens prevalent in cool soils and conditions. Cold tolerant *Trichoderma* sp CHS 861, a mycoparasite isolated from the soils of Alaska, was used in this study. This isolate is found capable of controlling the growth and development of large numbers of plant pathogenic fungi causing black scurf, damping-off, gray mold, snow mold, *Verticillium* wilt and other economically important soilborne diseases. Mechanisms of control included mycoparasitism and antibiosis.

• *Jenifer H. McBeath*

Cooperative Agriculture Pest Survey

A computer-based network for storing and retrieving plant pest data collected in Alaska has been established since 1984. This network is a part of the National Agricultural Pest Information System. In 1991, field surveys were conducted throughout the state of exotic and endemic plant pests on major agricultural crops. To streamline the field data collection, computer software was developed for the field data collection device (hand-held computer). A workshop on plant disease identification and field data collection was conducted to insure the quality of pest data. Information on plant pest incidence and severity was recorded and transmitted to the national database.

• *Jenifer H. McBeath*

Hard Red Winter Wheat Development

Success in the selection of snow mold disease resistant germplasms of winter wheat and grasses is determined by the detection method used. Traditional methods of field trials are time consuming and highly dependent on winter weather conditions. Furthermore, results of field trials reveal more about the winter survival abilities of germplasms tested than their snow mold resistant characteristics. An in-vitro system has been developed, based on our understanding of the impact of snow mold extracellular enzymes on disease development. This system detects snow mold disease resistant characteristics on wheat germplasms by assessing their responses to extracellular enzymes of snow mold fungi. Enhancements of resistance to snow mold enzymes were observed in plantlets derived from the microspores (pollens) of the cultivar Roughrider, which possesses moderate snow mold resistant properties.

• *Jenifer H. McBeath*

Plant Disease Control Through Biotechnology

The objective of this project is to develop innovative, effective, safe and environmentally sound methods of plant disease control. Enhancement of plant disease resistance is achieved through: l) biological control and 2) plant genetic engineering. A biofungicide is being developed from a versatile, wide spectrum mycoparasite Cold tolerant *Trichoderma* sp. isolate CHS 861, selected from large numbers of mycoparasites found in Alaska. Results of field trials in 1991 indicated that cold tolerant *Trichoderma* is equal to or better than chemical control. A system also has been developed successfully to obtain disease resistant transgenic plants by using techniques of asceptic somatic tissue culture and plant transformation. U.S. and international patent applications have been filed for Cold Tolerant *Trichoderma* isolate CHS 861 and its benomyl-resistant biotypes (mutants) and their applications.

• *Jenifer H. McBeath*

Gravel Vegetation Project 1989-1999

Vegetation and soils (gravel) at three exploratory drilling sites in the National Petroleum Reserve-Alaska were re-examined in 1991. These site were previously inventoried for plant species colonization in 1984, and the study objectives include reevaluations periodically. Researchers found 125 vascular plant species on 10 gravel fill sites in arctic tundra between the Sagavanirktok River Valley and Tunalik Test Wellsite, approximately 120 miles southwest of Barrow. The largest number (58) was recorded on the Lisburne Test Wellsite No. 1 in the Ivotuk Hills. The greatest diversity of animal species using these locations was recorded at Inigok Test Wellsite No. 1, northwest of Umiat. The second planting of a three-planting design was completed on the restructured drilling pad at the BP Put River No. 1 exploratory wellsite near the Putuligayuk River. Sixty-three indigenous plant species have been seeded to a botanical garden at that location. Indigenous plant seed production was very poor in 1991, due to low temperatures during the growing season. During the 1989-1991 period, air temperature degree-hours greater than 0°C varied 400 percent. Heating in 1989 was four times that received in 1991. During 1989, thawing of soils was extensive, resulting in deepening and widening of polygon troughs and draining of several lakes in the Kuparuk region. Seed production from indigenous plants was abundant that summer, in contrast to the limited production for the cool summer of 1991.

• *Jay D. McKendrick, Peter C. Scorup, Warren E. Fiscus, and Gwedo-Lyn Turner*

Legume Adaptation Studies

Fourteen legume species were evaluated at Fairbanks, Delta Junction, and Point MacKenzie. Winter survival of perennials was poor at Fairbanks and Delta Junction, but all species survived at Point MacKenzie. Several species are relatively high in yield and quality and they have potential to reduce the costs of ruminant livestock production in Alaska.

• *Michael T. Panciera*

Red Clover Establishment

Red clover is a promising legume for Alaska. This study was initiated to define management practices that will increase the success of establishment. Clover yield was higher when seeded without a companion crop. Winter survival and subsequent yield will be studied in 1992.

• *Michael T. Panciera*

Fodder Rape Silage

Well-managed fodder rape produces high yields of excellent quality under Alaska conditions. The forage is wet and thus difficult to store for winter feeding. This study was designed to determine how much dry forage must be mixed with fodder rape to produce a quality silage. If a high quality silage can be produced from this crop, it will help to keep feed imports and production costs lower for Alaska producers.

• *Michael T. Panciera*

Variety Trials

Several separate studies have been maintained since 1989. The purpose is to determine which forage varieties (turnips, rape, kale, legumes, annual ryegrasses) are best suited to the growing conditions in southcentral Alaska. The information is useful in making recommendations to local growers.

• *Michael T. Panciera*

Relationship Between Age-Specific Fecundity and Productivity of Reindeer on the Seward Peninsula

Serum samples from known age female reindeer on the Seward Peninsula were collected during the winter from 1987 to 1991. Samples will be analyzed for progesterone level using a radioimmunoassay. Results will be used to determine age-specific fecundity.

• *Heather C.H. McIntyre, Lyle A. Renecker, and Marsha Sousa*

Correlation of Body and Antler Weights on Age and Sex of Reindeer on the Seward Peninsula

Growth data from known age reindeer on the Seward Peninsula was collected from 1988 to 1991. Non-linear regression analysis will be used to explore the relationships between either body or antler weight and age (bulls and cows). Knowledge of these relationships will establish production criteria to help reindeer producers make decisions when animals are culled. This information will be presented at the First Circumpolar Agricultural Conference in Whitehorse, Yukon Territory, in September 1992.

• *Darrell S. Blodgett, Heather C.H. McIntyre, Lyle A Renecker, and Robert A. Dieterich*

Measurement of Reindeer Serum Progesterone as a Method of Determining Pregnancy

Twelve female reindeer were bred in October 1990 and again in September 1991. Serum samples were obtained monthly from February 1991 until April 1992. Samples were analyzed for progesterone using a radioimmunoassay. Pregnant samples had progesterone levels greater than 3 ng progesterone/ml serum within one to two months of conception. Non-pregnant females had levels less than 2 ng/ml until January at which time levels dropped to less than 0.1 ng/ml. Quantification of this technique may lead to a method of pregnancy detection in reindeer.

• *Heather C.H. McIntyre, Lyle A. Renecker, and Marsha Sousa*

Comparison of Blood Mineral Levels From Selected Alaskan Reindeer Herds

Whole blood and serum samples from five reindeer herds in Alaska were analyzed for selenium, copper, zinc, sodium, potassium, phosphorus, calcium, magnesium, and fluoride content. Blood samples from animals in one herd showed distinctly higher levels of copper. Another herd showed lower levels of copper, selenium, and zinc than other herds sampled.

• *Heather C.H. McIntyre, Lyle A. Renecker, and G. Mather*

Development of a Generic Computer Database Management System for Reindeer Producers and Game Farmers

Development continues on a generic computer database management system for use by game farmers and reindeer herders. The current program prototype was used to record data and generate reports during the 1991 summer reindeer handlings. A major objec-

tive is to enable the system to meet specific needs of either extensive reindeer herding or intensive game farming. The game farm system was demonstrated at the First Arctic Ungulate Conference, Nuuk, Greenland, in September 1991. Since then, the program has been demonstrated to game farmers to obtain feedback from potential users. Comments and suggestions will be used to enhance the system to meet individual needs.

• *Darrell S. Blodgett and Lyle A. Renecker*

Testing the Reliability and Practicality of Using Implanted Identification Transponders in Reindeer on the Seward Peninsula

Electronic identification transponders were implanted into 80 reindeer on the Seward Peninsula in June of 1991. The reliability and practicality of reading these implants during a winter handling was tested in November 1991. The implants could be read accurately; however, due to cold temperature (-32°C) the implant scanning device did not function for an adequate period of time. We will evaluate other scanning devices in the future.

• *Darrell S. Blodgett, Greg Finstad, Nancy Karidis, and Lyle A. Renecker*

Survey of the Umnak Island Reindeer Herd

Reindeer were introduced to the Aleutian Islands during the early 1900s to provide Natives with a consistent supply of red meat. Umnak Island has a feral reindeer population that has survived in an environment void of lichens, and yet produced large animals. The population has been virtually ignored the last 40 years, but recent interest in management of the Umnak Island herd has prompted the Aleutian people to seek cooperative studies with the UAF Reindeer Research Program. Initial fieldwork was conducted in June 1991 to assess the health, population dynamics, and nutritional status of the herd as well as the effectiveness of the handling facilities. Obvious health problems were not observed. Range quality varied greatly across the island and may have an effect on the regional nutrition and productivity of reindeer. At present, the reindeer population is static but there is potential for a population decline or moderate growth depending upon future management decisions.

• *Greg L. Finstad, and Lyle A. Renecker*

Observations of Chukchi Reindeer Husbandry Practices in Russia

Domestication of reindeer has been practiced in Asia for thousands of years. In August 1991, Greg Finstad of the UAF Reindeer Research Program and two Seward Peninsula reindeer herders traveled to Siberia to observe reindeer husbandry practices of the Chukotka Peninsula. The Chukchi Natives regard reindeer herding as a way of life rather than a business venture. Indigenous customs, social structure, and daily life all revolve around reindeer. The intensive, close-herding approach at reindeer husbandry practiced by the Chukchi people could benefit the Alaska reindeer industry.

• *Greg L. Finstad*

Reindeer and Game Farming at the University of Alaska Fairbanks

Recently, there is a growing interest in Alaska to raise reindeer under an intensive farm situation. The UAF Reindeer Research Program has worked closely with individuals who are attempting to establish reindeer as a farmed agricultural animal. Present and future research projects with reindeer will provide the public with valuable information on feedstuffs, meat quality, transport of animals, and husbandry techniques.

• *Greg L. Finstad and Lyle A. Renecker*

Congenital Defects in Reindeer: A Production Issue

Productivity of a reindeer herd is largely dependent upon high rates of female fecundity, followed by offspring survival. Selection pressure is evident in both wild and captive populations; predators, environment and man's harvest strategies are a few forces which can influence the characteristics of animals. In free-ranging reindeer, animals are often selected for breeding on the basis of color (white color). In 1991, postmortem examinations were conducted on two albino reindeer calves (from a total of 25 albino calves) collected near Shaktoolik. All animals had a completely white hair coat with no evidence of pigment in the hooves. The other most striking feature was a retracted lower jaw (2 cm shorter than upper jaw) which prevents suckling and thus results in 100 percent mortality of calves affected. The solution to this problem is probably outbreeding (the introduction of new genetic lines). This could be accomplished through the addition of new breeding bulls or complete replacement of sires with males from an unrelated herd.

• *Lyle A. Renecker, John E. Blake, and Cheryl L. Chetkiewicz*

Quantitative Excretion of 3-Methylhistidine in Reindeer

Three adult reindeer were injected with 14C-labeled 3-methylhistidine to evaluate the quantitative excretion of 3-methylhistidine in urine. Sixty percent of the label was recovered in the urine after five days. Further evaluation of the injectate and urine is continuing.

• *Raymond Case, Robert J. Hudson, and Lyle A. Renecker*

Urinary Indicators of Changing Body Composition in Reindeer

Six reindeer were placed on each of a high and low protein diet. Serum and urine samples were taken monthly and nitrogen balance was evaluated in early, mid, and late winter. Striated muscle mass was evaluated based on creatinine coefficients. Samples will be analyzed to determine if urinary urea nitrogen:creatinine or 3-methylhistidine:creatinine ratios reflect changing body composition.

• *Raymond Case, Robert J. Hudson, and Lyle A. Renecker*

Sexual Segregation in Reindeer on the Seward Peninsula

Sexual segregation is common among north temperate ungulates and has been investigated for a number of species. Adaptive advantages of this behavior remain a matter of debate. On the Seward Peninsula, initial radio-tracking data and observations of habitat use began in 1987 with the primary purpose to locate animals for herding and handling as well as to describe seasonal movements. At the time, herding strategies were relatively intensive in that bulls, cows and parturient cows were maintained in areas close to the corral and evidently disrupted any pattern of sexual segregation. Data from 1990 indicate minimal herding, and observations and radio-tracking data have begun to suggest more defined habitat differences especially during calving. The implications of this segregation are nutritional and possibly predator avoidance by parturient cows. It was concluded that tracking data could be used to illustrate segregation patterns and herders could maintain groups of segregated bulls away from parturient cows and handle them for removal of velvet antler without unnecessarily harassing and handling females until later in the summer.

• *Cheryl L. Chetkiewicz, Lyle A. Renecker, Robert Dieterich, and William Thompson*

Blood Cortisol: An Indication of Handling Stress in Reindeer on the Seward Peninsula

The reindeer industry on the Seward Peninsula has the potential to become a viable and sustainable production system. Handlings for the removal of velvet antlers in the summer was investigated as a source of stress with negative implications for animal survival. The identification and measure of an animal's response to environmental stressors are confounded by sampling efforts. Although there has been success with analyzing and quantifying fecal and urinary cortisol, as non-invasive techniques, blood cortisol remains a widely used technique. Cortisol samples from calves handled in June of 1990 were analyzed and a significant correlation between stress and cortisol levels was found ($p<0.05$). Weight and sex had non-significant effects although sample sizes were small ($n=10$). Comparisons to other studies on reindeer and bighorn sheep (*Ovis canadensis*) suggested that cortisol levels in our study were markedly higher. It was concluded that blood cortisol is more applicable in deciding on handling strategies and should not be used to reliably quantify stress because of the confounding sampling scheme.

• *Cheryl L. Chetkiewicz, Lyle A. Renecker, and Marsha Sousa*

Techniques to Reduce Death Loss in Relocated Reindeer

Traditionally, reindeer have been loosely herded on the Seward Peninsula. Recently Larry Davis of Nome has developed a tract of land to begin an intensive reindeer farm near Delta Junction. There is a clear picture of the advantages (increased stocking rates, better nutritional management programs, more efficient production, high quality products, more economic opportunities), but appropriate technology needs to be developed to reduce animal losses from relocations. Previous studies have shown that reindeer shipped via air from the open tundra range to a farm setting experienced about a 10 percent death loss. The majority of these losses have been directly related to transport stress and inability to adjust to commercial feeds. This study will be the first to assess and resolve nutritional problems associated with translocation of reindeer to a farm setting and to evaluate the use of probiotics to reduce the compounding stresses of transportation and nutritional adjustment to a new dietary regime.

• *Raphaela Stimmelmayr, Lyle A. Renecker, and Marsha Sousa*

Phosphorus and Nitrogen Dynamics During Field Incubations in Forest and Fallow Subarctic Soils

This field study showed high N and P mineralization rates of forest floor materials, confirming results from our previous laboratory studies. Also, more net N and P were released in materials incubated in fallow than in forest soils. Nitrification was negligible in all but the moss layer buried in the field. The moss and O horizon in black spruce forests, usually removed in the land clearing operations, are valuable resources of N and P.

• *Elena B. Sparrow, Stephen D. Sparrow, and Verlan L. Cochran*

Growth and Nitrogen Fixation by N-Fertilized and Non-N-Fertilized Legumes

The objective of this work is to determine the potential of different legumes to produce high yields of high-quality forages in interior Alaska and to determine if legumes grown in Alaska can "fix" enough nitrogen to grow as well as legumes supplied with fertilizer nitrogen. Results at Fairbanks indicated that several legume species can produce high yields of high protein forage with or without nitrogen fertilizer added. In general, forage legume growth was much poorer at Delta Junction that at Fairbanks.

• *Stephen D. Sparrow and Michael T. Panciera*

Use of N-Fixing Plants on the Delta Bison Range

The purpose of this project is to help develop a management plan, which will include nitrogen fixing plants for the Delta Bison Range. Several nitrogen-fixing legume species were planted on the range in 1991. Long-term survival of plants as well as potential forage production is a major criteria for usefulness of a species.

• *Stephen D. Sparrow and Michael T. Panciera*

Faba beans as a Green Manure Crop In Alaska

The purpose of this research is to determine the feasibility of using faba beans as a green manure crop for soil improvement in interior Alaska. Faba beans and barley were planted in 1991. In 1992, barley growth under different fertilizer regimes following barley and faba beans will be measured.

• *Verlan L. Cochran and Stephen D. Sparrow*

Improved Soil Fertility Management for Vegetable Crops in Alaska

Studies relating to potato production included the following: The effects of rates of several plant nutrients were studied in an on-going effort to determine optimal rates for potato production in Alaska. Alternative sources of fertilizers were also studied, including salmon bone meal, a fish processing by-product high in nitrogen and phosphorus. Research relating to head lettuce production included studies of fertilizer rates, and of foliarly-applied calcium (for control of tip-burn, a localized calcium deficiency). Lettuce genetic lines were tested for their resistance to tip-burn.

• *James Walworth, Stephen Dofing, Raymond Gavlak, and Donald Carling*

FOREST SCIENCES

Boreal Forest Water Balance

This project developed a water budget accounting scheme for northern watersheds that includes seasonally and perennially frozen soils. The techniques developed show promise for a variety of applications, including estimating the effects of land use and climate change on stream flow; identification and delineation of wetlands, and the planning and design of waste disposal sites.

• *John D. Fox, Jr.*

Calculation of Atmospheric Turbidity

Atmospheric turbidity was calculated by using direct solar irradiance data with a direct solar irradiance model. Analysis revealed a May maximum and a December minimum in turbidity for Fairbanks and a sensitivity to the global effects of the El Chicon volcanic eruption in 1982. The cleaning effects of precipitation was detected as well as the effects of Arctic haze and local wildfires.

• *John D. Fox, Jr.*

Daily Weather Model

A computer program is being developed that will generate statistically representative daily values for sky cover, air temperature, dewpoint, temperature, solar radiation, wind speed, and precipitation. Initial success has been experienced at reproducing patterns of sky cover and subsequently affected solar radiation. Efforts are continuing.

• *John D. Fox, Jr.*

White Spruce Stand Developmental History

This study is a new component of the Bonanza Creek Long Term Ecological Research project, and was included in the renewal proposal for the 1992-96 program of work. The working hypothesis is that both current environmental and historical factors require that pure white spruce stands reproduce only after stand replacement events (fire), and that infrequent white spruce cone crops are timed to place seeds on burned sites with minimal competition, warmed soils, and nutrient-rich conditions. Analysis of the structure, growth, and reproductive patterns in a 200 year-old white spruce forest and site burned in the 1983 Rosie Creek Fire provide preliminary support to this interpretation.

• *Glenn Juday*

Thirteen Years of Structural Change in a Pacific Silver Fir Stand

Pacific silver fir is limited to the extreme southern portion of southeast Alaska. Remeasurement of a 0.25 ha reference stand in a mixed western hemlock-silver fir stand established in 1978 revealed high levels of mortality evenly distributed among species and size classes in proportion to their abundance. However, ingrowth of new stems almost exactly replaced mortality so that the stand experienced remarkably little net change. The stability of the stand structure is probably due to its shared dominance by two climax species, a unique characteristic in Alaska. This project is a collaborative effort with the U.S. Forest Service, Pacific Northwest Research Station, and Ketchikan Area, Tongass National Forest.

• *Glenn Juday and Paul Alaback*

Structure and Development of Riparian Sitka Spruce Forests in Southeast Alaska

Two 0.25 ha reference stands were established in old-growth riparian Sitka spruce/devils club communities in the proposed Marten River Research Natural Area in southern southeast Alaska. Forests of this type growing in response to naturally regulated hydrologic systems in unmanaged Pacific coastal watersheds are rare; one remains in the lower 48 states and 20 remain in British Columbia. The older stand contains trees up to 475 years old and the younger stand had trees up to 275 years old. Our results, consistent with our findings elsewhere in Alaska, indicate that these stands are distinctly two or three-aged from flood events, contain a distinctive set of primary successional understory species, and are highly productive. This project is a collaborative effort with the U.S. Forest Service, Pacific Northwest Research Station and Alaska Region.

• *Glenn Juday and Paul Alaback*

Natural Disturbance and Diversity in Upland Forests of the northern Tongass National Forest

This project represents the first field season of a Ph.D. Thesis study with support by the U.S. Forest Service, Pacific Northwest Research Station. Data were collected from Eagle Crest and Outer Point on Douglas Island. New insights have been obtained on the importance of large logs (coarse woody debris) as a limiting rooting medium for trees in forest gaps, the role of wind in canopy gap expansion, and the exclusion of Sitka spruce in small gaps because of low light levels. At this point in the study, root-thrown trees represent only about 10 percent of all gap-maker trees. Data collection in two additional field seasons is planned.

• *Robert Ott and Glenn Juday*

Determination of the Growth and Yield Potential of Northern Forest Species in Alaska

Inadequate growth and yield data continue to be an impediment to managing the Northern Forest species of Alaska. "Minimum reforestation" standards set forth in the Forest Practices Regulations are unacceptably low despite data provided from elsewhere. Preliminary guidelines, based on Canadian data, were provided to the State of Alaska and the Alaska Reforestation Council. During 1991, annual ring counts were completed/verified for 260 balsam poplar/black cottonwood trees; draft site index curves suggest strong polymorphism; preliminary analyses suggest statistically insignificant form factor differences between regions and the state mean, however, differences between regions are suggested; preliminary total tree, cubic volume equations were developed. Site index information continues to be collected for aspen and black spruce. Bark thickness measurements were collected for conifers and hardwoods throughout the state; preliminary state and regional basal area-inside-bark equations were developed for white spruce. These

equations were used to develop first approximation volume equations for white spruce for the upper Tanana Valley Basin; 400 white spruce trees were measured at standard four-foot bolt lengths for volume.
• *Edmond C. Packee*

Forest Floor Organic Matter Chemistry as a Control of Plant Element Supply in Interior Alaska Forests

The organic chemistry of new balsam poplar litter appears to stimulate soil microbial activity sufficiently to limit the amount of inorganic nitrogen available for plant growth in later successional forests. A theoretical approach has been developed to estimating plant carbon allocation. It will be calibrated using field data on tree growth and nutrition.
• *Keith Van Cleve and John Yarie*

Successional Processes in Taiga Forests of Interior Alaska: A Long-Term Ecological Research Program for Study of Controls of Subarctic Forest Development

Heavy snowfall during winter of 1990-91 resulted in breakage of between 10 percent and 30 percent of the stems in upland and floodplain mature white spruce stands. Documenting these periodic events is important for understanding control of resource supply (nutrients) and control of forest succession.
• *Keith Van Cleve*

LINKAGES

The model LINKAGES has been calibrated to represent ecosystem dynamics for interior Alaska forest types. The revised model will estimate the current years growth based on the quantity of foliar nitrogen in the past year. A 25-year data set will be used to develop a set of deterministic model runs to predict observed tree growth from measured climatic data for each of the major vegetation types in interior Alaska. This validation procedure will represent a significant long-term validation of the revised ecosystem model. This type of validation has not been carried out for any other published ecosystem modeling exercise.
• *John Yarie*

Resources Management

An Analysis of Subsistence Use Patterns for the Wiseman Community

This study analyses current subsistence use patterns and their management implications for the Gates of the Arctic National Park. It will also examine changing patterns over time and predict future changes.
• *Harry Bader*

Incorporating Traditional Knowledge into the Resource Decision-Making Process with Scientific Knowledge for Better Resource Allocations

This is an attempt to develop a mechanism that integrates traditional knowledge and western scientific knowledge in a manner that empowers rural native Alaskans so as to improve natural resources management on public lands.
• *Harry Bader*

Economic Impacts of Alternative Pot Limits in the Bering Sea and Aleutian Islands King and Tanner Crab Fisheries

The Alaska Board of Fisheries implemented pot limits in the Bering Sea and Aleutian Islands king and snow crab fisheries at its March 1992 meeting. This project will evaluate the impacts of alternative pot limit regimes to the economic performance of crab fishers. The analysis will focus on an assessment of both the allocative impacts to fleet harvest and the changes in season length or vessel participation time that will accompany implementation of various pot limit regimes.
• *Joshua A. Greenberg and Mark L. Herrmann*

An Economic Analysis of World Markets for Wild and Farmed Salmon

An international econometric supply and demand

model will be developed for both wild and farmed salmon. This model will be used to assess the economic impacts of legalizing salmon farming in the state of Alaska.
• *Mark L. Herrmann and Joshua A. Greenberg*

An Economic Evaluation of the Demand for Alaskan Salmon

As part of a review of the Alaska State Hatchery Program, an economic study group was developed to provide information to the Alaska State Legislature on the economic impacts of salmon hatchery production. This project will provide the demand component of the cost benefit analysis of the Hatchery Program. Demand for Alaska salmon on world markets will be evaluated, and salmon ex-vessel prices will be forecast under various salmon hatchery production scenarios.
• *Mark L. Herrmann and Joshua A. Greenberg*

An Economic Analysis of the Alaska C. *Opilio* Industry

The dramatic expansion of the Alaska *C. opilio* (snow crab) fishery has resulted in economic analysis becoming a critical input in setting fishery policy. Yet, virtually no past economic research of this industry has been conducted. This study will attempt to fill this void by developing a fundamental understanding of the international market for Alaska *C. opilio*. Subsequently, an international equilibrium supply and demand model for Alaska *C. opilio* will be built.
• *Joshua A. Greenberg and Mark L. Herrmann*

Development of a Regional Economic Database and Data Management System for Alaska

This project provides for the development of database for the Yukon-Koyukuk census region of Alaska. This database will provide the foundation for future regional economic analyses. Additionally, the framework developed in the study will facilitate construction of similar databases for other Alaska rural regions.
• *Joshua A. Greenberg and Carol E. Lewis*

Natural Resource Education: The Commons Game

A Natural Resources Management Version of The Commons Game is ready for dissemination. Research showed that the new version is useful for teaching about commons dilemmas. Three courses at UAF, regularly use the game: Natural Resource Conservation and Management, Alaskan Environmental Education, and Environmental Management. More research is needed regarding the game's application in non-university settings, but it is expected to be useful for upper-level high school students.
• *Carla A. Kirts*

Natural Resources Management Curriculum Project

The Alaska State Department of Education, Office of Adult and Vocational Education funded a two-year project to develop a secondary instructional unit entitled "An Introduction to Natural Resources Management." The units emphasize holistic resource concepts. Copies are available through DOE/OAVE or the UAF Agricultural and Forestry Experiment Station.
• *Carla A. Kirts*

Natural Resource Education: Applications of Cognitive Theory

This long-term project is in the proposal stages. The purpose is to compare the proportion of cognitive levels evident in university classes and on-the-job situations. Previous research suggests that classroom cognition is predominantly low-level. Is professional work primarily low-level, also? Does classroom cognition realistically reflect real-world cognition?
• *Carla A. Kirts*

Application of Farming Systems Research to Grain-Based Agriculture in Alaska

Farming Systems Research is directed toward solving biological, economic, social, and political problems farmers in specific geographic regions and cultural structures encounter. Four steps are used: 1) extend applied field research results, 2) investigate farm management practices, 3) analyze trends in the agricultural industry, and 4) develop qualitative, and where possible, quantitative models showing directions for future development. Expansion in the 1980s in the small-grain sector of Alaska's agricultural industry led to the establishment of applied field research addressing soil fertility and conservation. Farm management practices in this industry were addressed as well. The definition of four periods in Alaska's agricultural history provided background for three models addressing future development in the industry. The models indicate moderate state financial support and continuing commitment through a positive policy for development can be a successful approach. Present state

directives support expansion of local markets. Product and market research are presenting opportunities for producers and operators of market outlets.
• *Carol E. Lewis*

Alaska's Agricultural Industry: A Microsystem of the Circumpolar North

Alaska's agribusiness industry is a component of that in the circumpolar north. Previous work has documented its relationship to the multiboom economy of the state. Historical evidence has shown that despite fluctuations in revenue and its changing profile, there has been an upward trend in overall receipts. This upward trend may continue if positive directions can be found for future development. A number of locations in the north began agricultural production in a manner similar to that in Alaska: to meet a critical need for food by those engaged in extraction of nonrenewable resources for delivery to a central government. The manner in which development took place in these regions is being investigated with a view toward: 1) summarizing historical agricultural development in circumpolar areas similar to Alaska in physical geography, settlement patterns, and use of extractive resources, 2) comparing development in the agricultural industries in other circumpolar regions with that in Alaska to determine commonalties and differences, and 3) suggesting directions for development in Alaska.
• *Carol E. Lewis and W. Pearson*

AFES-Russian Federation: Cooperative Agreement

The Agricultural and Forestry Experiment Station and the Russian Academy of Agricultural Sciences, Siberian Branch continued cooperation in germplasm exchange, and economic problems of northern areas. Another continuing area of interest was in musk-ox research. Emphasis in 1991 was on one-on-one projects between researchers and students. In November, work continued in soil microbiology. One scientist from Novosibirsk visited Fairbanks to continue work on a joint grant proposal in this research area. Another scientist from Novosibirsk visited the Palmer research station to continue work associated with Rhizoctonia in potato. Plans were made to receive a Ph.D. student, returning after nine months at SALRM in 1990. The projected area of research is in international salmon marketing. Joint musk ox research between UAF's Cooperative Wildlife Unit and the Institute of Extreme Northern Agriculture continued through scientific exchanges.
• *Carol E. Lewis*

Wrangell-St. Elias National Park Subsistence Eligibility Study

A study of subsistence eligibility policy in the Wrangell-St. Elias National Park and Preserve found that Congress intended that Park subsistence eligibility be primarily determined on a community-wide basis, but also that population growth of some local communities provides reason to consider some changes to an individual or family-based system.
• *Randy R. Rogers and Alan Jubenville*

Quality Assessment of Alaskan Reindeer

Effects of antioxidant level (AO) and frozen storage on grilled restructured reindeer steaks were evaluated by sensory panelists at two-week and four-week intervals over a storage period of 22 weeks. Meat forequarter muscles were flaked with a cutting head, then mixed for 10 minutes and formed in steaks. The steaks were vacuum-packed and stored at -18°C after freezing in a freezer. AO (1:1 mixture of BHA and THBQ) at 0, 0.01 and 0.02% of the fat was incorporated. Generally, gamy flavor decreased with storage. Scores for off-flavors decreased from 2 to 18 weeks, increasing thereafter to 22 weeks. Steaks without AO appeared to be more well-done as storage time increased; less change was seen over time in the presence of AO. Minimal effects on textural characteristics were found with AO and storage. Frozen storage of restructured steaks containing AO may improve flavor and quality.
• *Ruthann B. Swanson*

Readability of Recommended Nutrition Sources

Readability of books recommended to consumers by professional nutrition and dietetics organizations was determined. Representative text samples from 32 publications were evaluated. Writing style was assessed with microcomputer analysis. Flesch human interest scores were calculated by two evaluators. Mid-range human interest scores reflect the use of how-to information and examples preferred by consumers in nutrition print materials. Publications containing more passive sentences tended to be more difficult to understand and were slightly less personalized. For many consumers, the comprehension and application of the concepts presented in these recommended books will probably require interaction with professionals.
• *Ruthann B. Swanson and Cathy A. Birklid*

Grants and Special Funds (Fiscal Year 1991) July 1, 1990 - June 30, 1991

James Drew	Morrill-Nelson Funds for Food and Agricultural Higher Education	USDA
Glenn Juday	Documentation of Alaska Research Natural Areas	USDA; Forest Service
Donald Carling	Persistence in Alaskan Soils of Herbicides Used for Controlling Weeds in Potatoes	USDA; CSRS
Jenifer McBeath	Cooperative Agriculture Pest Survey	USDA; APHIS
G. Allen Mitchell	FY91 AG Development / Statistical Reporting	Ak. Dept. of Natural Resources
G. Allen Mitchell	Senior Community Service Employment Program	Ak. Dept. of Administration
Edmond Packee	Forest Products from Alaska Native Trees	Alaska Science & Technology Foundation (ASTF)
Stephen Dofing	Development of a Malting Barley Industry for Alaska	ASTF
Patricia Holloway	Demonstration Conservation Windbreak	Ak. Dept. of Natural Resources
Dot Helm	Soil Mycorrhizal Inoculation of Young Alder for Mine Soil Stabilization	Ak. Dept. of Natural Resources
Stephen Sparrow	Legume Plant Material Trials in Interior Alaska	Ak. Dept. of Natural Resources
Jenifer McBeath	Hard Red Winter Wheat Development	Ak. Dept. of Natural Resources
Patricia Holloway	Job Training Partnership Act; Summer Youth Employment and Training Program	Fairbanks Private Industry Council
Dot Helm	Usibelli Vegetation Studies	Usibelli Coal Mine, Inc.
Chien-Lu Ping	Soil Resource Baseline Study in the Hoseanna / Lignite Valley Area	Usibelli Coal Mine, Inc.
Jay McKendrick	1989 Gravel Vegetation Study	BP Exploration (Alaska), Inc.
Thomas Gallagher	Kellogg Grant	W.K. Kellogg Foundation
Keith Van Cleve	Successional Processes in Taiga Forests of Interior Alaska: A Long-Term Ecological Research Program (LTER) for Study of Controls of Subarctic Forest Development	National Science Foundation
Meriam Karlsson	Photoperiodic Control of Vegetative and Reproductive Growth in 'Nonstop' Cultivar Series of *Begonia* x *tuberhybrida*	American Floral Endowment
Dot Helm	Reestablishment of Woody Browse Species for Mined Land Reclamation	Idemitsu Alaska, Inc.
Glenn Juday	1990 Alaska Research Natural Areas: Monitoring and Publications	USDA; Forest Service
Glenn Juday	10 Years of Successional Change on the Hugh Miller Inlet Plots	National Park Service
Meriam Karlsson	Controlling Flower Formation in *Primula Vulgaris* by Environmental Factors	Fred C. Gloeckner Foundation, Inc.
Carla Kirts	Natural Resource Curriculum	Ak. Dept. of Education
Jay McKendrick	Arctophila Revegetation	BP Exploration (Alaska), Inc.
Meriam Karlsson	Growth Regulator Effects in Seed Propagated *Begonia* x *Tuberhybrida*	American Floral Endowment
Frederic Husby	Nutritional and Feeding Value of a Salmon Protein Hydrolysate in Diets for Weanling Pigs	Ak. Fisheries Development Foundation, Inc.
Patricia Holloway	Botanical Garden	U of A President's Special Projects Fund
Dot Helm	Vegetation Sampling Tutorial	Ak. Dept. of Natural Resources
Patricia Holloway	Vegetative Propagation of the Lingonberry, *Vaccinium vitis-idaea*	International Plant Propagator's Society
Chien-Lu Ping	Wet Soils Monitoring Studies in Alaska	USDA; SCS
Anthony Gasbarro	Forest Research Program FY91	AK. Dept. of Natural Resources
Lyle Renecker	Techniques to Reduce Death Loss in Relocated Reindeer	ASTF

Stephen Sparrow	Use of N-Fixing Plant to Improve Forage Quality of Delta Bison Range	ASTF
Jenifer McBeath	Biotechnology of Biological Controls for Plant Diseases	U of A Natural Resources Fund
Stephen Dofing	Request for Continuation of a Program in Plant Breeding and Genetics	U of A Natural Resources Fund
Stephen Sparrow	Measurement of Methane Emission and Consumption by Agricultural Soils in Interior Alaska	U of A Natural Resources Fund
Verlan Cochran	Research Support Agreement	USDA; ARS

Formula Funds (Fiscal Year 1991) July 1, 1990 - June 30, 1991

Hatch General

Donald Carling	Potato Variety Comparisons and Evaluations of Rhizoctonia Disease on Potato	USDA
Leroy Bruce	Management of Alaska Beef Cattle to Maximize Forage Use	USDA
Ruthann Swanson	Quality Assessment of Alaskan Reindeer	USDA
Michael Panciera	Maximizing Forage Quality at Northern Latitudes	USDA
Patricia Holloway	Propagation and Cultivation of Alaska Native Plants	USDA
Meriam Karlsson	Effects of Irradiance and Temperature of Growth and Development of Greenhouse Produced Plants	USDA
Jay McKendrick	Vegetating Man-made Gravel Structures within Arctic Wetland Plant Communities	USDA
Paul Windschitl	The Effect of Fish Meal in Ruminant Lactation Diets on Milk Production and Composition	USDA
Chien-Lu Ping	Soil Classification in Alaska	USDA
Donald Carling	Cultural Practices for Field Grown Lettuce	USDA
Stephen Sparrow	Crop Uptake of Residual Fertilizer Nitrogen in a Subarctic Agricultural Soil	USDA

Hatch Regional

Fredric Husby	Characteristics and Feed Value of Barley and Western Protein Supplements for Swine	USDA
Alan Jubenville	Benefits and Costs in Natural Resource Planning	USDA
Stephen Dofing	Plant Genetic Resource Conservation and Utilization	USDA
James Drew	Regional Research Planning and Coordination, Western Region	USDA
Jenifer McBeath	Biological Suppression of Soil-Borne Plant Pathogens	USDA

McIntire-Stennis

John Fox	Simulation of Climatological Input to Forest Hydrologic Models	USDA
Keith Van Cleve	Forest Floor Organic Matter Chemistry as a Control of Plant Element Supply in Interior Alaska Forests	USDA
John Yarie	Prediction of Landscape Level Effects of Global Change on the Alaskan Boreal Forest	USDA
Edmond Packee	Determination of the Growth and Yield Potential of Northern Forest Species in Alaska	USDA
Edmond Packee	Predicting the Growth and Yield of Forest Stands in Interior Alaska	USDA

Financial Statement

Expenditures — July 1990 through June 1991

The following is a statement of expenditures of federal and state funds for the fiscal year beginning July 1, 1990, and ending June 30, 1991 (FY 91).

		(% of total)
Federal		
Hatch Regular Formula Funds	$ 558,741	8.5
Hatch Regional Formula Funds	73,541	1.1
USDA–Agricultural Research Service	89,646	1.4
McIntire–Stennis Formula Funds	327,955	5.0
Other Grants and Contracts	866,190	13.1
State Funds	4,680,991	70.9
Total	$ 6,597,064	100.0%

Publications List for 1991

Books

RENECKER, L.A. and R.J. HUDSON (eds.) 1991. *Wildlife Production: Conservation and Sustainable Development*. University of Alaska, Fairbanks. AFES/SALRM. University of Alaska Fairbanks. 601 pp. Misc. Pub. 91-6. $70 per copy.

Chapters in Books

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Journal Articles

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