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# AgroBorealis

School of Agriculture
and Land Resources Management

Agricultural and Forestry Experiment Station

# Director's Letter



Our research partners are very important to us. They are critical in bringing applied research results to assist our many clients in the state of Alaska, the United States, and the international community. Over the years partnerships between the Agricultural and Forestry Experiment Station and other university departments, state and federal agencies, and industry groups have allowed our researchers to identify stakeholder needs and assist in establishing strategies to address them. Within the university, the Cooperative Extension Service has been our closest partner. We share federal formula funds and reporting requirements. Faculty hold joint appointments in the Cooperative Extension Service and the Agricultural and Forestry Experiment Station and participate in joint research projects, workshops, and curriculum development. In addition, we share a common business office. The Palmer Research Center recently became the Palmer Research and Extension Center. At the center, extension specialists in agronomy, horticulture and natural resources carry out applied research, teaching, and outreach functions alongside their research counterparts.

We maintain partnerships with federal researchers within the U.S. Department of Agriculture. The Alaska Agricultural Experiment Station was established in Sitka in 1898. For much of the last century, the USDA funded the experiment station, and in 1948, the Palmer Station was upgraded with federal scientists from the USDA Agricultural Research Service. Over the years, ARS scientists were joined by University of Alaska Fairbanks scientists who eventually formed the basis for what is now the Agricultural and Forestry Experiment Station, housed within the School of Agriculture and Land Resources Management along with its experimental farms in Fairbanks and Matanuska and the research and extension center in Palmer. The ARS presence was temporarily abandoned in 1995, when the federal partners closed out all research programs. However, through the efforts of Alaska's senior Senator Ted Stevens, the USDA-ARS partnership has been reestablished, with scientists located both on campus at Fairbanks and at the Palmer Research and Extension Center. These new federal projects include the Arctic Germplasm Project in Palmer and the Integrated Pest Management project in Fairbanks. We also work closely with the USDA Forest Service. The Boreal Ecological Cooperative Research Unit is colocated with SALRM and AFES on the University of Alaska Fairbanks campus. Agricultural and Forestry Experiment Station researchers work jointly with members of the cooperative research unit in the Bonanza Creek Experimental Forest located south of Fairbanks, and they cooperate on a number of outside-funded research projects.

The articles that follow in this issue of *AgroBorealis* describe the broad nature of our research objectives, the facilities and land base we use, and the partners who help us achieve our goals as a part of a land-grant institution.


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# Reindeer Research

## Intensive Management May Be Key

Doreen Fitzgerald
photos and map courtesy Reindeer Research Program



The fortunes of caribou and reindeer, the wild and semidomestic varieties of the species *Rangifer tarandus,* are intertwined. Both are grazing animals with a strong herd instinct, although reindeer are more sedentary, having been kept by humans for thousands of years in some parts of the north. In Alaska, caribou had long been an important subsistence animal on the Seward Peninsula, but by 1891 had virtually disappeared from the region, due in part to an influx of outsiders, changes in settlement patterns, and hunting pressure. Reindeer herding was introduced then, with the idea of providing the Native people with a substitute resource. Today, a century later, caribou have returned to the region.

Most Alaska reindeer are still located on the Seward Peninsula and on Nunivak and Umnak Islands. There are also village herds on the Bering Sea islands. Small herds in Palmer, Kenai Peninsula, and Delta Junction are on ranches, a relatively new development in the history of reindeer in Alaska.

Reindeer research at the University of Alaska Fairbanks, with a thirty-year history, has focused on problems of animal health, management, and production, evolving to meet the changing needs of the herders and their industry. "We originally focused on animal health, but the emphasis has changed," said Greg Finstad, research associate and leader of the UAF Reindeer Research Program. Finstad joined the program at its inception in 1981 and since 1996 has led its activities. The program is managed under the School of Agriculture and Land Resources Management (SALRM) as a long-term project with the Agriculture and Forestry Experiment Station (AFES).

## The Reindeer Industry

Reindeer are managed for the production of meat and antlers. On the range, they are brought into corral systems twice a year, where they receive veterinary care, velvet antlers are harvested, and demographic and nutritional status information is gathered and recorded into a central record keeping system. During a roundup, or handling, research staff collect data to identify obstacles to maximum production and help herders remove their effects.

In 1996, antler sales generated approximately $564,000 for local economies, a figure that has ranged from a high of $772,000 to a low of $177,000, according to Alaska Agricultural Statistics. Unlike other members of the deer family, both male and female reindeer and caribou produce antlers, and even young calves have spike antlers their first summer. In the years 1993–2000, the value of annual reindeer meat sales ranged from $648,000 to $158,000. Meat production is accounted for by comparing total body weight to carcass weight. In a study of Seward Peninsula reindeer, carcass weight compared to total body weight ranged from 50.3 percent in adult males, 54.2 percent for adult females, and 56.2 percent for steers.

At a handling, a helicopter is used to herd the reindeer into pens. The associated work includes record keeping, collecting tissue samples and productivity data, and administering vaccinations. At slaughtering, animals are sorted and decisions made about what animals to harvest. Tissue samples are used by researchers to check for contaminants such as cadmium and lead in the kidney and copper in the liver.

Research is improving herders' knowledge of how the handlings affect reindeer. As hundreds to more than two thousand animals are corralled, conditions can be

hectic and sometimes unpleasant. A model developed from handling data shows that losing productive females in a herd has a huge impact on production and income. Injuries to fawns during handling, such as broken antlers and eye injuries, even when treated with antibiotics, also greatly reduce production, because many injured fawns fail to return the following year.

The initial research focus on health led to the successfully development of a brucellosis vaccine and pioneering the use of Ivomec to treat animals for parasites. Brucellosis, caused by a bacteria found in many bovids, cervids, and other mammals, including humans, is a major concern in ranching. After the vaccine was developed, losses associated with this disease dramatically declined. A review of data collected from the Davis herd since 1982 shows that the percentage of animals testing positive from brucellosis fell from 33 percent to zero.

## The Reindeer Range

For the past century, reindeer have been the only grazing animals on the Seward Peninsula, where the reindeer range consists of fourteen areas permitted by the U.S. Bureau of Land Management. After herders recognized that mismanagement of the grazing system in the 1920s and '30s had degraded it, they fostered working relationships with state and federal agencies and the University of Alaska Fairbanks to apply modern range management and animal husbandry concepts. The resulting range has been in good condition, although the return of caribou could change this.

Understanding the relationship between reindeer grazing patterns and the forage base is critical for proper management of the grazing system, which on the Seward Peninsula is diverse and very productive. In 1996, the research program began comprehensive range evaluation that will complement a range inventory conducted by the Natural Resources Conservation Service (NRCS).

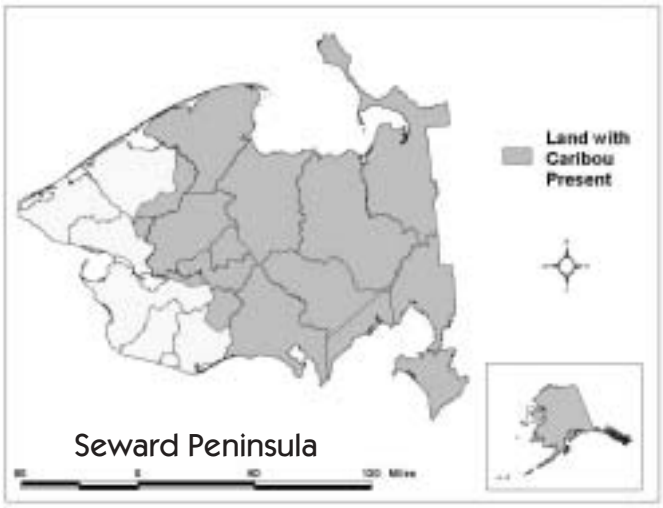
Range utilization is investigated using radio telemetry. This research uses fixed-wing aircraft throughout the year to locate radio-collared reindeer. Seasonal patterns of movement and habitat selection are monitored to identify and evaluate critical foraging areas. Ground crews travel to established foraging locations to survey plant community composition and monitor usage by reindeer. The identification of critical foraging habitats and long-term usage patterns will help herders and land managers implement optimal grazing plans. Research has shown that reindeer nutritional status is highly attuned to changes in forage plant availability and quality throughout the season and particularly during spring when females are lactating.

To learn more about the link between reindeer foraging strategies and animal production, data is collected on the production of each forage plant species in the different habitats during the growing season, documenting biomass production as the season progresses. Plants are sampled at ecosites originally described and mapped by the NRCS. Data loggers are used to monitor growing degree days in conjunction with biomass estimation.

During 2000, eight habitat types were sampled to document changes in forage production of six to eight major forage plant species. Plant samples were weighed and analyzed for nitrogen, fiber, and mineral concentrations. This information, along with plant quality data already collected, increases understanding of which habitats and forage plants may be critical for reindeer use at different times throughout spring and summer.

In the winter, both caribou and reindeer subsist on lichen. Of concern for future research is that uncontrolled grazing by caribou may damage lichen areas that are critical winter forage for reindeer. Another subject of interest is that removal of lichen may change the albedo of much of the Seward Peninsula, which could affect the surface energy budget and possibly influence regional climate.

In areas where vegetation types are already identified, it is possible to learn how the animals are feeding on the range by tracking collared animals. Knowing what the reindeer are eating throughout the year can help identify important forage plants and critical grazing areas.




## Return of the Caribou

Caribou herds experience drastic fluctuations in size. From 1976 to 1996, the Western Arctic Caribou Herd increased from about 75,000 to 463,000 animals. At the same time, winter range use of this herd shifted westward onto traditional reindeer ranges of the Seward Peninsula. In autumn 1996, roughly 100,000 caribou migrated through the central Seward Peninsula to the eastern edge of the Noyakuk range. They were found as far west as the Kougarok road, where hunters harvested caribou for the first time in over 100 years. By the year 2000, as many as 250,000 appeared in the central peninsula region and moved even further west.

This dramatic influx of caribou onto the reindeer ranges threatens to destroy reindeer herding as a viable economic activity. When the migratory caribou appear, an entire reindeer herd may join them. Lured away from their home range, they seldom return and often perish, due in part to animal and human predation. Since 1987, over 16,000 reindeer have disappeared, a direct loss of $9 million to the reindeer industry. Six herders have lost all of their animals, other losses range from 45 to 85 percent. About 1,500 reindeer are required for a economically viable herd.

The Reindeer Research Program has responded by working with herders, introducing such new concepts and technologies as reindeer refuges, real-time, on-site weather information, satellite telemetry, and the Internet and Geographical Information Systems (GIS) to cope with this tremendous disturbance of the grazing system.

"If these caribou continue to winter on the Seward Peninsula, reindeer owners with viable herds must adopt new and intensive management strategies," said Finstad. "Herders will need to collaborate with state and federal agencies to track caribou movements and maintain tighter control of their animals."

One approach to the caribou problem is to move reindeer from areas used by caribou to secluded refuges, at least a temporary method to avoid loss of an entire herd. One herder, Tom Gray, is using this technique to hold a small herd out of the path of migrating caribou. To reinforce site fidelity, the herd was held there during calving. If caribou continue to migrate onto reindeer ranges, the comprehensive range research may help in designating refuge areas where reindeer can be held without compromising nutrition.

Locating and tracking reindeer on remote ranges when caribou are present is critical. In January 1999, herders were given satellite radio collars, which were placed on large dominant female reindeer. Research program staff used a GIS workstation to create real-time reindeer location maps. These were placed on a dedicated web site that herders and researchers can access through the Internet. A university program for herders showed them how current reindeer locations can be integrated with ongoing herding activities and explored with them alternative range management strategies.

Last year two remote weather stations were established, one at Pargon Creek in the McCarthy marsh area and the other at Rocky Point. Because reindeer herding is not permitted in the McCarthy Marsh area, it is a good location to investigate the interaction of weather, forage, and the activities of caribou without the presence of reindeer. The Rocky Point site is on a small peninsula along the southern coast, where Gray's herd is held—a good location for investigating the interaction of weather and land use patterns of a herder holding animals in a small reindeer refuge. Weather data is collected hourly, transmitted, and forwarded to the Reindeer Research Program, where it is archived and posted on the program's web site.

## The Research Herd

An important development for the reindeer program was the 1997 founding of a research herd at the AFES farm on the UAF campus. Seventeen female calves born on the Seward Peninsula were purchased and flown to Fairbanks. The herd, which has nearly doubled in size, makes possible research that could not be readily conducted with foraging animals. It has been used for several research projects, including feed trials and other studies on nutrition and growth. At least one herd member, Elsa, is making contributions as the

*Greg Finstad, Elsa, and schoolchildren.*

most interesting element of the expanded outreach program. Elsa visits Fairbanks area schools, and in conjunction, students learn about reindeer biology and ecology, the history of reindeer herding in Alaska, and the cultural significance of herding to Alaska Natives.

## Locally Produced Feed for Captive Reindeer

Rather than foraging, reindeer in captive herds must be fed, and the feed must be cheap enough to make the enterprise worthwhile. Commercially prepared reindeer diets are available to Alaska reindeer producers, but they contain at least 60 percent imported ingredients, making their cost prohibitive. Reindeer program research has resulted in the development of a reindeer diet consisting almost entirely (99 percent) of Alaska-produced ingredients (barley, brome hay, and fish meal). They are now working to refine the feed, and research on reindeer nutrition and growth is ongoing.

"We have learned that reindeer will consume a predominately barley-based diet, gain weight, and be reproductively successful," Finstad said. "Results from our initial feed trials are being used to test diets containing different concentrate sources."

Reindeer, like cattle, sheep, and other deer are ruminant animals. They partially digest food in the first compartment of their stomach, the rumen, then regurgitate it for further chewing. They demonstrate rapid growth in spring and summer, then lose weight during the early winter months. This winter weight loss is a complex phenomenon that during research occurred regardless of the feed provided. It is probably due to a reduction in rumen mass, rather than tissue loss, although this cannot be firmly established without measuring the rumen. The weight loss is thought to be a winter survival strategy related to lowered metabolism and energy conservation. Diets need to be evaluated during both the summer growth phase and winter dormancy, because there may be different responses to diet according to season.

Research on reindeer feed included a barley feeding trial from October 1 to December 14, 2001, using animals in the Fairbanks herd. Two groups of pregnant females were provided with identical feed, except for the barley variety used, which was either Thual or Finaska. The trial showed that higher digestibility feed (Thual) does not ensure less winter weight loss. Reindeer fed a higher fiber diet (Finaska) maintained a greater winter body weight than those fed the Thual variety. Another study compared six Alaska-grown barley varieties.



Intensive herd management may offer solutions for herders and is the norm on ranches, but its cost is high. A successful Alaska-produced diet could reduce costs and give Alaska grain growers new markets, tying two groups of producers together.

A subject for future research on the Seward Peninsula is supplemental feeding, which may help herders reduce reindeer outmigration by allowing them to pen reindeer when caribou are present. Reindeer on the range would be converted to a food supplement. If caribou threatened the reindeer, the animals could be penned and fed the supplement as a total ration. On the range when caribou are absent, a supplement could be used to improve nutrition and increase range fidelity. Animals that build an association with feeding stations may show reluctance to leave with caribou. Finstad said that this type of supplemental feeding has a proven track record in Scandinavia.

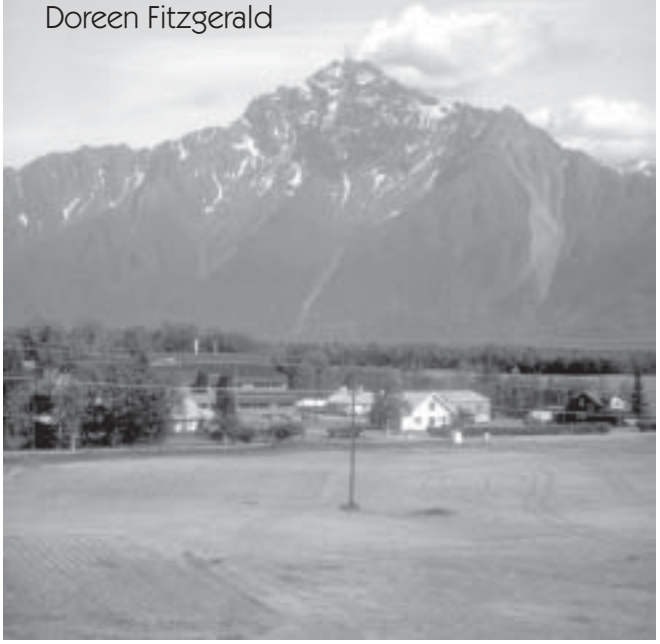
Analysis of reproduction and weight data shows how reindeer are doing nutritionally and also how other factors influence production. Winter snow depth, timing of snowmelt and green-up, and summer temperature all vary from year to year and all influence production. When this type of data is used to predict the percent of lactating yearlings the predictions correlate very closely with the observed number of lactating animals. When calf weights were compared from 1991 through 2001, it was seen that during the springs of 1999, 2000, and 2001, calf body weights fell, which coincided with late snow melt and green-up in these three years. Body weight of male calves during in the highest year was near 30 kilograms, while in the lowest year it was about 20 kilograms.

This year the Reindeer Research Program continues to maintain its research herd and related projects in Fairbanks, attend handlings and slaughterings. The range assessment and diet composition work are ongoing, as is implementation of the radio telemetry program and educational outreach.

*To learn more about the Reindeer Research Program and its staff, visit their Web page at http://reindeer.salrm.uaf.edu.*

# Palmer Research Center

Doreen Fitzgerald



New research directions and expanded possibilities for commercial growers have resulted from $1.5 million in USDA grants received by the School of Land Resources Management and the Agricultural and Forestry Research Station over the past three years. At the Palmer Research Center, which includes the Matanuska Experimental Farm, several projects reflect these new directions, including studies related to specialty salad greens and devil's club as crops, and turf grass production. Throughout the UAF agricultural program, the grants also have provided new opportunities for students and research technicians.

Palmer facilities include offices, laboratories, and the Matanuska Experiment Farm, which provides a southcentral Alaska site for research and outreach in sustainable agriculture, land reclamation, and other natural resource issues. The farm, 36 miles north of Anchorage, includes 260 acres of cultivated land and 800 acres of forested land for research or demonstration purposes. Emphasis for field research includes plot land for applied research in horticulture (potato and vegetables), turfgrass, forages, and grains.

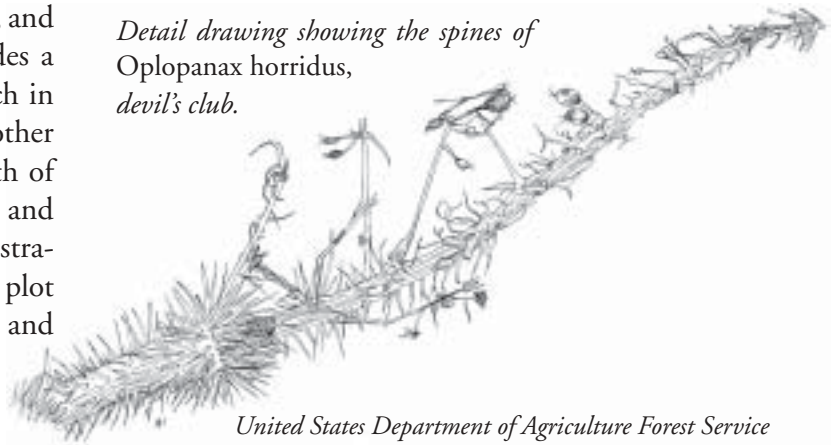
## The Devil You Know, the Devil You Don't

Thorny devil's club, well known for the pain inflicted by its sharp spines, is less familiar as a cure, but it is historically an important medicinal plant among aboriginal people, and is used today in homeopathic medicine. Considered a pain reliever, tonic, digestive aid, and blood purifier, devil's club has been used to treat diabetes, arthritis, rheumatism, digestive disorders, colds, and skin problems. One British Columbia company markets dried chipped devil's club root for $52 a pound; root bark found for sale on the internet sells for $16 an ounce. A sprawling shrub, the plant is a member of the ginseng family, and is sometimes called Alaska ginseng.

Handling this plant requires care; the yellowish spines on stems can be up to one-half-inch long, and veins on the underside of leaves also have spines. The spines tend to break off in the skin and wounds can easily become infected.

Professor of plant pathology Donald Carling is directing a project to investigate devil's club in the wild and as a cultivated plant. The medicinal potential of the wild-harvested plant is under study, as are questions of propagation as nursery stock and the quality of plant produced under Alaska conditions. The plant can be propagated by layering, and also self-propagates through root-crown sprouting.

In the wild, devil's club forms dense thickets in moist woods, mainly in mature or old-growth forests, ranging from south-central Alaska coastally to California, but can be cultivated elsewhere. Sometimes the plants are huge, growing up to eight feet tall; a leaf can span more than two feet. The plant flowers in June or



*Detail drawing showing the spines of* Oplopanax horridus, *devil's club.*

*United States Department of Agriculture Forest Service Collection, Hunt Institute for Botanical Documentation, Carnegie Mellon University, Pittsburgh, PA.*

July, producing small, whitish blooms. The numerous blooms in compact heads are arranged in pyramidal terminal clusters, which are showy when the shiny, bright-red berries ripen. Bears seem to like the fruits, which are not edible by humans.

## Improving the Turf

During Alaska's short summers, people want to be outside, often in yards or on playing fields and golf courses, and that means on the grass. The quest for better grasses for ground cover, grasses with strong survival characteristics, is underway at the Palmer Research Center.

"These grasses must possess the same survival characteristics as their forage cousins," said Allen Mitchell, interim director of the research center. "In fact, many early turf grasses evolved from pasture grasses and were known by such descriptors as village greens and bowling greens."

Examples of turfgrasses used on golf courses in Alaska and elsewhere include bluegrasses, bentgrasses, perennial ryegrass and bermudagrass.

Varieties developed in Alaska, such as Nugget bluegrass and Arctared fescue are finding their way into winter hardy lawn mixes marketed in Alaska. However, the unadapted types of seed are still quite prevalent and the occasional severe winter usually finds them with varying levels of winterkill. During winter of 2001–2002, severe damage occurred on most golf course greens and some fairways resulting from winterkill, ice formation, and snow mold disease. Expensive and time consuming reseeding was required to repair the damage.

Working cooperatively with greenskeepers from local golf courses and using federal Special Grants and Hatch funds, research was initiated in 2001 at Palmer to identify promising varieties and management practices for turfgrasses on greens and fairways. Wanted are grasses that will overwinter, green early, possess good density and fine texture, and tolerate close and frequent mowing. Greens are particularly problematic, requiring a fine textured grass that produces a smooth putting surface, such as the very popular creeping bentgrasses used at lower latitudes.

In early results on a sand-based green meeting US Golfing Association specifications, Nugget Kentucky bluegrass demonstrated superior winter hardiness, while the bentgrasses performed poorly. Although a number survived, they were spotty at best, slow to green, and were not playable until well into the summer. One possible exception was the variety 18th Hole, a bentgrass developed at the University of Manitoba in Canada. It was the most adapted bentgrass and will be included in future trials.

*This checkered pattern shows how different turfgrasses responded to the same winter conditions.*

*Photo courtesy Palmer Research Center.*



In 2002, the poor performing grasses were over seeded in a split-plot arrangement to test recovery of the green over the summer months. Twenty-four turf varieties also were seeded for assessment as fairway, sports fields, and lawn grasses.

A second green was established at the Palmer Golf Course in 2002 and will be seeded with the most promising varieties from the 2002 trials. This demonstration green will be observed by golfers playing the course and will be the site of a golf course superintendents field day in July, 2003.

In Alaska, the total area in production for lawns and recreational fields has not been quantified, but it is clear that many Alaskans will benefit from grasses proven for the climate.

## Leafy Greens

While Alaska climates can be hard on grass, research shows that the relatively cool weather favors the production of high quality salad leaf greens in a short period of time. This has spurred interest in the production of baby salad greens and other specialty leafy vegetables such as radicchio, mustard greens, and spicy greens. Greens are already produced by Alaskan commercial growers.

"Baby greens and lettuce are easy to grow," said Roseann Leiner, assistant professor of plant sciences and Cooperative Extension horticulturist. "Production is exceptional, but of equal importance are harvest methods and postharvest handling, including rapid distribution to retail markets." Local production of salad mixes has potential as a value-added product that is fresher than salad mix shipped from outside the state.

Baby lettuce and greens, often found in salad mixes, are produced by planting seeds in a thick bands

and harvesting young leaves after three to five weeks. In 2000, 31 cultivars were planted at high density, usually at least 48 seeds per foot. Leaves were cut above the growing point when they were four to six inches tall. For each plant, the number of plants and weight of leaves was recorded. In a separate trial, 12 cultivars of Brassica greens were grown.

Both lettuce and greens grew well when cultivated for baby leaves. In general, the yield of Asian greens such as mizuna, mibuna, and tatsoi was higher than the yield of mustard greens and kale. Baby lettuce had similar yields and numerous shapes of colors and leaves. Because of their presentation, yield may be less important than a variety of leaf color, shape, texture, and taste.

Cultivar trials can demonstrate which varieties are well-adapted to local growing conditions, because differences in quality and yield are compared under the same growing conditions. Varieties that adapt well to Alaskan conditions—cool weather, cool soil, and long days—may be different than those grown commercially in other states.

Head lettuce trials have been planted in the Mat-Su Valley since 1995. During summer 2000, they conducted to observe yield and quality for fourteen cultivars. Lettuce seedlings were transplanted into field plots after growing in a greenhouse for one month. When most of the lettuce heads were firm, all of the lettuce was harvested and assessed for head weight, size, and marketability (freedom from disease and defects).

In 2001, lettuce and cabbage cultivar trials were conducted on fourteen varieties of crisphead lettuce and twelve cultivars of green cabbage in plots within commercial fields. Several cultivars of lettuce show similar commercial potential to Alpha and Premiere, varieties commonly planted in Alaska. Three cultivars suited for winter production in California grew too large in the long days and will not be included in future trials.

## Palmer Laboratories

At the Palmer Research Center, a state-of-the-art laboratory facility supports university and USDA Agricultural Research Service scientists carrying out relatively basic research in plant pathology (diseases of potatoes and vegetables); molecular biological research related to viruses in subarctic native plant species; carbon flux in arctic soils in relation to global climate change; ecology of disturbed lands; and a new program in range ecology utilizing Geographic Information Systems.

A service laboratory supporting researchers from Fairbanks as well as Palmer has been important for recent studies funded by federal Special Grants in New Crop Opportunities. Among the instruments available to researchers are a Dionex DX 500 High Performance Liquid Chromatograph and an Optima 3XL Perkin-Elmer Inductively Coupled Plasma unit. These are central to research being carried out to investigate pharmaceutical products to be derived from devil's club and nutritional and antioxidant levels in Alaska grown vegetables, fruits, and berries.

*Visit the Palmer Research Center on the Internet at http://www.uaf.edu/salrm/afes/palmer.*

*Farm equipment at Palmer.*

# Northern Exposure for Hoppers

Dennis Fielding



People are often surprised to find that grasshoppers live in Alaska. In fact, at times there can be too many. A few species of grasshoppers, including ones found in Alaska, can undergo extreme population fluctuations, sometimes of biblical proportions. During such outbreaks crops can be devastated and highways can become slick with their crushed bodies.

Outbreaks like this occurred in the Delta Junction area in the late 1980s and early '90s. The grasshoppers were so dense they covered entire sides of buildings, chewed holes in laundry hanging on clotheslines, and destroyed crops. We're still not sure what brought on the outbreaks. Warm, dry summers are no doubt beneficial to grasshoppers, and perhaps mild winters or lots of snow cover might ensure good survival of the eggs. But examination of weather records for the years preceding the outbreaks showed nothing unusual that might have contributed to them. The winters were not unusually mild, snow cover did not seem to be abnormal, and summer precipitation and temperatures were normal.

So if weather conditions were not remarkable, perhaps the outbreaks were a one-time occurrence—a "flash in the pan" response to the newly created habitat of the Delta Junction agricultural project. Grasshoppers do not live within forests. Their original habitat in Alaska was probably confined to areas where trees were absent, such as grassy areas along rivers where floods had removed trees or created new sandbars, on south-facing hillsides too dry to support trees, or perhaps where fires had removed the tree cover.

Clearing land for agricultural development near Delta Junction opened up a lot of new habitat for the grasshoppers. Perhaps the hoppers rapidly colonized this new habitat before their natural enemies and diseases caught up with them. It may be that by now these natural control agents have followed them and will prevent any more outbreaks. We can certainly see that diseases and parasites are taking a significant toll. But if those outbreaks were a one-time consequence of newly created habitat, then we would not expect high densities simultaneously in their original, natural habitats.

*Grasshopper on barley head.*

Observations by Maria Berger, at the time a graduate student studying foraging habitats of bison and other wildlife species, indicated that grasshopper populations were very high in riparian areas along the Delta River. Historical accounts by early Alaska explores traveling the Yukon River describe vast numbers of grasshoppers washed up along the shoreline. These observations suggest a more widespread phenomenon, not restricted to the agricultural areas, and point again to weather playing a major role.

The precise timing of weather events may be a critical factor that doesn't show up in monthly averages. For instance, precipitation for the month of July could come in two heavy downpours or be spread out as two weeks of drizzle, but with the same monthly total in either case. Because grasshoppers rely on sunshine to increase body temperatures, two weeks of clouds and drizzle would seriously hinder their ability to fight diseases, grow, and produce eggs, even if air temperatures, as recorded in standard meteorological shelters, were not much different. In the contiguous 48 states and Canada, surveys of grasshopper populations have been made annually for 50 years, a record that spans several major outbreaks. Even with a relatively long record, correlations of grasshopper populations with weather variables are weak and, at best, only suggest very general trends and don't enable specific predictions of grasshopper population trends.

We have found seven different species of grasshopper in the Delta Junction area. The species of grasshoppers in Alaska are also found in the rest of the United States. Although the species are not unusual, they do have some interesting adaptations to the northern climate.

Because of the short growing season, grasshoppers in Alaska require two years to complete a generation. Eggs are laid in late summer, in pods of 15 to 20 eggs just below the soil surface. Temperatures soon drop and the eggs lie dormant for the winter. The following summer, the soil warms up enough for the eggs to resume incubating, develop up to a point, and then enter diapause (the stage when grasshoppers become dormant). Diapause prevents them from hatching too late in the season when there is not enough time to complete another generation. The eggs spend the second winter in diapause, which requires a period of cold temperatures to break the dormancy.

After spending two winters nestled in their pods, grasshopper eggs hatch about the first week in June and the tiny hoppers emerge into the nearly round-the-clock sunlight of an Alaska summer. They begin feeding almost immediately and grow at a rate that would be make any livestock producer envious. As they outgrow their exoskeletons, they molt—five times before reaching adult stage. Within five weeks they are fully grown and begin laying eggs by late July.

One focus of our research involves explaining how grasshoppers in Alaska grow so fast. Entomologists have long struggled to accurately predict insect development rates so that they can accurately predict the timing of important life stages of the insect. Models of grasshopper growth as a function of temperature, developed in Montana, predict that grasshoppers here do not accumulate enough degree-days of heat to reach adulthood. Of course, we know they do—but is it that they have intrinsically fast growth rates, or are they just taking advantage of basking in the sunshine to raise their body temperatures above recorded air temperatures (thermoregulation)?

*Amal Ajmi takes soil samples in the fall to determine the number of grasshopper eggs present.*

*Grasshopper killed by* Entomophaga *fungus.*

We measured the body temperatures of grasshoppers in the sunshine and found that they may be as much as 18°F warmer than air temperatures. We are also raising them at constant temperatures in the lab to compare their growth rates with populations from the rest of the United States, to see if the Alaska hoppers are genetically adapted for faster growth.

Thermoregulation is important for another reason—the elevated temperatures enable them to fight off infections. Stefan Jaronski, an insect pathologist from Sidney, Montana, infected two groups of grasshoppers with *Beauvaria* fungus and kept one group in the shade and one group in the sunshine. Survival was much lower in the shady group.

Tillage of croplands tends to destroy most grasshopper eggs, but hoppers regularly invade crops from nearby undisturbed habitats such as roadsides, field margins and fallow fields. Because they don't have functional wings until they are reach the adult stage, the immatures are not able to disperse widely. Thus crops are only damaged at the edges of fields early in the season, within hopping distance of their hatching locations.

After they get their wings, the hoppers may easily travel several miles to find more suitable feed, such as green crops. During an outbreak, a farmer may spray a field and kill 99 percent of the grasshoppers present, but the next day another swarm may arrive from elsewhere. The factors that determine when, how far, and what direction the grasshoppers fly are largely unknown.

One of the problems in studying grasshopper invasion of crops is the difficulty of counting grasshoppers within dense crop canopies. Standard methods of sampling grasshopper populations, by taking

*Cages of grasshoppers on barley, to determine effect of grasshopper feeding on barley yield.*

visual counts and sweep netting, were developed for grasslands with sparse, low vegetation. Visual counts and sweep nets are very unreliable in dense vegetation such as field crops.

We tested windowpane/pan traps as a means of sampling grasshoppers in these situations. These traps consist of a vertical pane of glass in a wooden frame, with troughs (made of plastic rain gutter) of soapy water at the base of the glass on both sides. Grasshoppers jump or fly into the glass and fall into the troughs. The soap in the water breaks the surface tension, causing them to sink.

The traps were very effective—almost too effective. We caught more than11,000 grasshoppers in 46 traps over a four-week period. A herd of bison brought our experiment to an abrupt halt in late August. They apparently enjoyed the sound of breaking glass. Further tests are planned to determine how well trap catch correlates with actual density of grasshoppers in a field, and whether there are differences among species of grasshoppers in their catchability. The advantages of these traps are that they should work well in any vegetation type, and eliminate the variation in counts due to subjective human judgment or keenness of eyesight, which is a problem with visual counts.

An important consideration when evaluating control strategies involves understanding how much yields are reduced by a given number of grasshoppers. If the cost of controlling the grasshoppers is greater than the value of the damage they would do, it's not worth attempting to control them. This is the area that Sultan Begna, a post-doctoral research associate, is investigating.

Finding out just how much damage, in dollars and cents, an insect is causing is complicated by many factors. Crops grown with enough water and nutrients may be able to sustain more damage without loss of yield compared to plants that are drought stressed or lack sufficient nutrients. Timing of the damage may also be important; at early stages of growth plants tend to be more vulnerable, before extensive root systems develop.



One of the most common effects of early season damage is delayed maturity of the crop. In the short growing season of Alaska, this could be disastrous. On the other hand, crops may be able to compensate for moderate defoliation, as this allows more light to penetrate the canopy; less leaf area means less water is required by the plant.

Weeds may also complicate matters. If the weeds are palatable to grasshoppers, weeds may divert some of the grasshoppers from feeding on the crop. Or, competition from the weeds may reduce the ability of the plant to recover from grasshopper damage. Dr. Begna has found that moderate levels of grasshopper defoliation of seedlings can significantly reduce the development of root systems, suggesting that damaged plants may be less able to successfully compete with weeds. Grasshopper feeding on leaves and awns later in the season did not reduce the number of grains, but did significantly reduce seed weight.

Are grasshopper swarms a force of nature, like the weather, which we can only talk about, but not prevent? Or can their populations be managed, like big game animals, to prevent them from exceeding their (or our) carrying capacity? I believe the answer is somewhere in between.

Obviously, we can't manage the populations by issuing more or fewer cow permits or implementing size restrictions. But, by more completely understanding their biology and ecology, by carefully manipulating habitat, and by encouraging natural predators and pathogens, we may be able to at least reduce the frequency and extent of outbreaks. And when outbreaks do occur, we will have the tools—such as insecticide-laced baits that specifically target grasshoppers—to suppress the populations effectively, economically and with minimal impact on the environment.

# The Fairbanks Experiment Farm

Stephen Sparrow

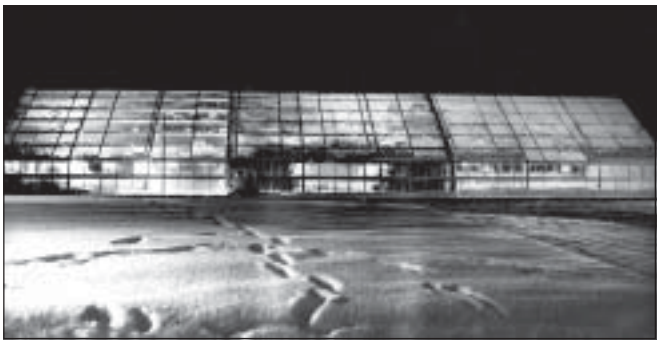


The Fairbanks Experiment Farm and its satellite facility, the Delta Junction Field Research Site, provides land and facilities for Agricultural and Forestry Experiment Station researchers and educators to solve problems encountered by farmers, foresters, and other land managers in Alaska.

## History

The United States Department of Agriculture established an agricultural experiment station near Fairbanks in 1906 as part of a network of experiment stations in Alaska. The station was opened by Charles Georgeson, who initiated research on agronomic and horticultural crops and on livestock production at several locations in Alaska. The Alaska Agricultural College and School of Mines, which was established in 1917 as the land grant college for Alaska, was built on land adjacent to the experiment station. The experiment station was transferred from federal ownership to the college in 1931; the college became the University of Alaska in 1935.

The Delta Junction Field Research Site opened with the clearing of about 80 acres of land in 1979 near Mile 1408 on the Alaska Highway. An equipment storage building/shop was built in 1980. This building was later named Knight Hall in honor of Charlie Knight, who was instrumental in securing funds and overseeing early development of the site. A small field laboratory building, in cooperation with the USDA Agricultural Research Service, was built in 1988. An additional 360 acres was recently given to the university by the state of Alaska to be a part of the site. Most of this land was under regrowth following clearing and some farming in the late 1970s. The land is currently being cleared for use by researchers. Much of the original 80 acres (except where buildings are located) have now been abandoned for research purposes because of severe erosion on the site, and because soils there are not typical of soils in most of the agricultural areas in the Delta area.



*The greenhouse on West Ridge.*
*Georgeson Botanical Garden Collection*

## Current Facilities

The Fairbanks Experiment Farm currently consists of approximately 300 acres of cleared or partially cleared land. Most of this land (roughly 215 acres) is on the old Tanana River Flats south of the Alaska Railroad tracks. Of this area, about 11 acres are used for buildings, parking lots, and related infrastructure. The remaining cleared land consists of a south-facing hillside where the Georgeson Botanical Garden and other small fields are

*The Fairbanks Experiment Farm circa late 1930s–early 40s. From left to right: animal housing and pens, slaughterhouse, hay shed, storage buildings, the barn, an old barn/storage area (the back of which is still in existence as the visitors' center and is topped with a greenhouse), staff and faculty housing, and finally, the farm manager's house. In the approximate center of the photo above the airplane's shadow is the weather station, in place and operational from 1906 to the present.*
*Georgeson Botanical Garden Collection*

located, the Smith Lake Field (southeast of Smith Lake), and the Tee Field, (north of Smith Lake). The Tee Field includes a small exotic-tree nursery, where adaptation of non-native tree species is studied. Main buildings at the farm include the dairy barn, which is currently being considered for listing on the National Registry of Historic Places (part of the dairy barn is being remodeled and will have a laboratory for animal science research), the visitor center/office building, the horticulture/ARS laboratory building, the old pig barn (currently being converted into a controlled environment facility for plant research), a small greenhouse (atop the horticulture/ARS laboratory building), the shop, the farm manager's house (a small house used for transient visitors), and several outlying buildings used for equipment storage, sample drying, and related uses. The Georgeson Botanical Garden is part of the Fairbanks Experiment Farm. The botanical garden supports research and education on horticulture and serves as a repository for germ plasm of high-latitude-adapted plants. A reindeer herd consisting of 35 animals also calls the Fairbanks Experiment Farm home. The Delta Junction Field Research Site has two main buildings plus a mobile home that serves as the residence for a volunteer caretaker.

## Research

Examples of recent or current research at the Fairbanks Experiment Farm include: cereal grain, oilseed, forage, and horticultural crop production; plant hardiness evaluations; plant propagation; soil fertility; turfgrass hardiness and management; constructed wetlands for wastewater treatment; native tree competition; native berry production; and domestic livestock production, nutrition, and management. The recent loss of the cattle and pigs and the addition of the reindeer herd changed the look of the farm from what might be considered a traditional farm to one with a decidedly Alaska flavor. The old pig barn is currently being converted to a controlled environment facility for use in greenhouse crop research. This will greatly expand the capabilities for plant research at the farm.

*Harvest.*

*Photo courtesy of the Alaska and Polar Regions department of the Elmer E. Rasmuson Library Archives, Albert Johnson Collection, accession #89-166-423.*

*Thrashing wheat.*

*Photo courtesy of the Alaska and Polar Regions department of the Elmer E. Rasmuson Library Archives, Charles Bunnell Collection, accession #UA68-50-1163.*

Research at the Delta site has traditionally emphasized applied agricultural research designed to answer questions related to agricultural production in the Delta Junction area. Projects have related to such things as conservation tillage and production of grain and forage crops, although there is currently some research being done on Siberian larch and other high-latitude-adapted tree species, and the site is used as a base facility for fire effects research. A SALRM graduate student recently used the site as part of her thesis project to study pollination of native Alaska lingonberries. The clearing of the recently acquired 360 acres will not only expand the space for field research, but will increase our capabilities for answering questions relevant to local farmers, because the soils in the new acreage are more typical of the soils currently used for agriculture in the area. A new irrigation system, which we hope to have up and running by the end of summer 2002, will enhance our ability to do research on water management for crops in interior Alaska. The facility is also available for other kinds of research and other UAF researchers are welcome to use it.

The Fairbanks Experiment Farm is the oldest existing facility at UAF. It and its satellite farm, the Delta Field Research Site, continue to serve the Alaska public and UAF students through their numerous research and educational activities.

# Research in the Georgeson Botanical Garden



Pat Holloway

Thirteen years ago, a handful of people dared to dream about developing a botanical garden for Alaska. The result of a few rather unorganized meetings was the Georgeson Botanical Garden, located on the grounds of the Agricultural and Forestry Experiment Station's Fairbanks Experiment Farm. The underpinning of this garden is new and innovative horticultural research cloaked in spectacular displays of flowers, perennials, vegetables, and herbs. What has transpired is a public garden where visitors from all over the world become an active component of research and education in subarctic horticulture.

## The Flower Trials

Few visitors realize the annual flower display gardens are an outdoor laboratory to evaluate new and interesting species and cultivars of flowers for home and commercial landscapes. Data are collected on more than 300 flowers annually. The data provide information on growth habit, flowering period, disease and insect pest problems, and adaptability to a short, cool growing season with day lengths approaching 24 hours. We compile lists of flowers that provide early season color, those that bloom nonstop all summer long, and those that thrive even after a killing frost. We compare growth statistics with published information, to provide more accurate cultural information than that found in catalogs.

*Cosmos 'Sensation' mix.*
*Photo courtesy of the Georgeson Botanical Garden Collection*

*Photo courtesy of the Georgeson Botanical Garden Collection, #GB66-6-18*

For instance, a flowering amaranth variety called Elephant Head was described in catalogs as a five-foot giant, but in Fairbanks, it bloomed and reached a maximum height of two feet. Violas, on the other hand, normally have published heights of six to eight inches at lower latitudes. In Fairbanks, plants form billowy masses of color often two feet in height and spread. Flowers such as celosia, impatiens, and vinca are not good candidates for Alaska's cool soil conditions, but many garden favorites such as pansies, calendulas, sunflowers, and snapdragons grow well.

Prior to the development of the botanical garden, the grounds consisted of field plots laid out each spring. The planting design and bed rotation varied each year, and this process helped to minimize a serious flower disease. With development of the botanical garden came permanent flower beds and a steady increase in damage caused by cottony rot, *Sclerotinia sclerotiorum.*

*Children's pond.*
*Photo courtesy of the Georgeson Botanical Garden Collection*

This disease attacks a variety of flowers, especially petunias. The plants look like they were killed by a frost in midseason. The disease can completely devastate a garden if not treated. Early research showed that petunia cultivars differed in their susceptibility to *Sclerotinia*, but cultivars change so rapidly from year to year that selection for tolerant or resistant varieties is not practical.

We conducted three years of trials with a biological control agent, *Trichoderma* sp., a soil fungus that attacks the disease. Although there was some delay in the onset of the disease, the plants still died. Dr. Roseann Leiner, horticulturist in Palmer, is studying other biological control measures that may provide a solution to a serious garden problem.

One of the favorite old-fashioned garden flowers in the Fairbanks area is cosmos. Some cosmos cultivars bloom by the first week of July, but many are very late or don't bloom at all. One reason for this late blooming habit is that flowering is controlled by the number of hours of darkness plants are exposed to early in the season. Many cosmos require a minimum of 15 hours of darkness every day for two weeks in order to set flower buds. This is not a strict requirement for all cultivars because some eventually bloom, but others like 'Yellow Garden' cosmos will not bloom at all without the dark treatment.

We experimented with providing a darkness pretreatment while the plants were still seedlings in the greenhouse. If the dark treatment was given during the first two weeks of germination and seedling growth, the seedlings were thin, spindly and difficult to transplant. If the treatment was given the last two weeks in the greenhouse, seedlings were more robust and transplanted easily. Both dark treatments promoted flower bud development. Flowering began four to six weeks earlier in dark-treated plants than in plants growing under natural day length.

We also found that a dark treatment of as little as eight days set flower buds and provided season-long color (rather than just late-season) in the garden. Home gardeners can get the same results by moving flats of cosmos into and out of a dark closet each day. Commercial growers of field-grown cut flowers can extend the flower production and cutting season by at least four weeks with the dark pretreatment.



## The Family Food Garden

The family food garden contains examples of nearly all the different kinds of vegetables, herbs, and fruit crops hardy in Alaska's Interior. Replicated variety trials are conducted on specific vegetables based on requests from commercial businesses. For the past five years we have conducted trials of red cabbage,

*'Melody' spinach.*
*Photo courtesy of the Georgeson Botanical Garden Collection, #RP-DSC-1-15*

*Raised bed.*

*Photo courtesy of the Georgeson Botanical Garden Collection, #GBG6-27-1*

broccoli, spinach, and carrots for Denali Seed Co., Anchorage. The most challenging of these is spinach which bolts four to five weeks after spring sowing. Our trials did not yield any cultivar that was more resistant to bolting than others, but 'Melody' and 'Tyee' were rated highest on appearance and taste. These cultivars are savoy type (crinkly leaves) spinach. The cultivars that ranked lower were the smooth leaf types: 'Teton', 'Medania', 'Grodane', and 'Hybrid 457'.

Most gardeners in the Interior would love to grow vine-ripened beefsteak tomatoes, but our short growing season and cool temperatures preclude the cultivation of most varieties except in greenhouses. Despite the fact that outdoor tomatoes are difficult to mature, Territorial Seed Co., Oregon, sells more tomato seeds to Alaskans than just about any other vegetable! During the summers of 2000 and 2001, we tested several cultivars of tomatoes from Territorial Seed and compared them with our locally bred 'Subarctic 25' tomato. The summer of 2000 was so cold and rainy, no tomatoes matured, not even 'Subarctic 25'. In 2001, all cultivars bore fruit, and two surpassed 'Subarctic 25' in size. 'Prairie Fire', with two-inch diameter fruit, outweighed 'Subarctic 25' by more than three times, but the total yield was the same (3.6 lb per plant). It matured one to two weeks later than 'Subarctic 25'. 'Northern Delight' produced fruit that was generally larger than 'Subarctic 25' and yielded 3.9 lb per plant. Although these cultivars have little commercial importance, they will add variety to home gardens throughout the Interior. Cultivars that did not quite measure up included: 'Oregon 11', 'Glacier', 'Kootenai', 'Stupice', and 'Moskvich'.

Gardeners with limited mobility have followed the progress of our raised bed gardens. Each raised bed has 75 square feet of growing space. One garden is 27 inches high to accommodate chairs and wheelchairs. The second bed is 35 inches high for gardeners who prefer to stand, who may need crutches or cannot bend or kneel. The gardens are designed to provide fresh vegetables in summer and help people with limited mobility enjoy America's most popular leisure activity—gardening! We weighed the produce harvested from these beds, and it totaled nearly 46 lbs during the first season (Table 1).

*Tomato trials.*

*Photo courtesy of the Georgeson Botanical Garden Collection*

**Table 1: Yield of fresh vegetables and herbs from accessible raised beds**

| Crop | Yield (lb) |
|---|---|
| Radish | 0.7 |
| Leaf lettuce | 6.5 |
| Turnips | 2.4 |
| Cauliflower | 3.2 |
| Parsley | 0.8 |
| Herbs (basil, thyme, sage) | 0.9 |
| Zucchini | 5.8 |
| Carrots | 0.7 |
| Broccoli | 0.8 |
| Cabbage | 11.5 |
| Kohlrabi | 0.9 |
| Spinach | 0.4 |
| Beets and greens | 4.9 |
| Wax beans | 0.5 |
| Celery | 4.0 |
| Green beans | 0.7 |
| Tomatoes | 0.8 |

## Table 2: Rose trials at the GBG

### Recommended rose species and cultivars

| | |
|---|---|
| *Rosa acicularis* | Prickly rose, native, woodland gardens |
| *Rosa rugosa* | Japanese rose, rugosa rose |
| *Rosa rugosa* 'Rubra' | Rugosa rose with dark red flowers |
| *Rosa rugosa* 'Alba' | Rugosa rose with white flowers |
| *Rosa rugosa* 'Albo Plena' | |
| *Rosa spinosissima* 'Altaica' | Altai Scotch rose |
| *Rosa* sp. 'Hansa' | *R. rugosa* hybrid |
| 'Killwinning' | |
| 'Lac La Nonne' | *R. rugosa* x *R. acicularis* hybrid |
| 'Lac Majeau' | *R. rugosa* x *R. acicularis* hybrid |
| 'Prairie Wren' | |
| 'Therese Bugnet' | *R. acicularis* x *R. rugosa* hybrid |

### Not Recommended

| | |
|---|---|
| *Rosa canina* | Dog rose, hardy but invasive |
| *Rosa chinensis* | 'Angel Wings' |
| *Rosa Eglanteria* | Eglantine rose |
| *Rosa multiflora* | |
| *Rosa rubrifolia* | |
| *Rosa woodsii* | Wood's rose, hardy but invasive |
| | |
| *Rosa* sp. 'Agnes' | *R. rugosa* hybrid |
| 'Morden Centennial' | |
| 'Morden Fireglow' | |
| 'Morden Ruby' | |
| 'Topaz Jewel' | *R. rugosa* hybrid |

### Currently being tested

| | |
|---|---|
| *Rosa rugosa germanica* | |
| | |
| *Rosa* sp. | |
| 'Assiniboyne' | |
| 'Carefree Sunshine' | |
| 'Charles Albanel' | *R. rugosa* seedling |
| 'David Thompson' | Canadian Explorer Series |
| 'Dwarf Pavement' | *R. rugosa* hybrid |
| 'F.J. Grootendorst' | *R. rugosa* hybrid |
| 'Foxi Pavement' | *R. rugosa* hybrid |
| 'Hazeldeen' | |
| 'Henry Hudson' | Canadian Explorer Series |
| 'Jens Munk' | Canadian Explorer Series |
| 'Knockout' | |
| 'Martin Frobisher' | Canadian Explorer Series |
| 'Persian Yellow' | *R. foetida* |
| 'Rose a Parfum de l'Hay' | *R. rugosa* x Perpetual hybrid |
| 'Sir Thomas Lipton' | *R. rugosa* x Polyantha hybrid |
| 'Snow Pavement' | *R. rugosa* hybrid |
| 'Wasagaming' | *R. acicularis* x *R. rugosa* hybrid |
| 'William Baffin' | Canadian Explorer Series |

## Perennial trials

If we could choose only one group of ornamentals to grow and evaluate in the perennial trial plots, it would be roses. More gardeners request information about hardy roses than any other perennial ornamental. During the past ten years, nearly 50 rose species and cultivars have been evaluated for cold hardiness, flowering, fragrance, suckering habit, and moose browse potential (Table 2).



Our trials have shown that all shrub roses will exhibit stem dieback from winter injury in some years, but especially in the first four years following planting. However, many recover from buds protected by snow and provide spectacular annual displays of fragrant flowers.

Annual pruning of dead canes should be expected even on the hardiest cultivars. All roses are moose food, even the common Rugosa rose which is covered with tough thorns. Many of the hardiest roses also sucker freely and will easily grow beneath six-inch lawn edgings and other barriers. They should be planted in areas where they can spread freely.

Although the public enjoys walking around the botanical garden, sitting on a park bench on a sunny day, painting pictures and visiting with friends, there certainly is more to the garden than meets the eye. Every corner of the garden is full of experiments and plant trials designed to increase our knowledge of subarctic horticulture. Visitors help by sharing information about new plants and cultivation techniques. Many take the time to help us evaluate plants and produce. Their comments provide ideas and information for developing research projects for many years to come.

*Rosa 'Prairie Wren,' a white rose.*
*Photo courtesy of the Georgeson Botanical Garden Collection.*

# Taiga Ecology

## Natural Labs Foster Research in the Boreal Forest Zone

Adapted by D. Helfferich



The Bonanza Creek Experimental Forest, like its companion the Caribou/Poker Creeks Research Watershed, provides scientists with a window on the complex biological interactions of animals and plants with the soils, climate, and landscape patterns of the north. These two areas are the only designated forest research sites in the true boreal forest zone of the United States. Both are on State of Alaska land, with U.S. Forest Service and university research activities conducted under a long-term lease and cooperative agreement, respectively.

Located in the Tanana Valley State Forest southwest of Fairbanks, the 12,487-acre Bonanza Creek research area is a hotbed of scientific study. Because the boreal forest, or taiga, is one of the few remaining biomes where natural cycles and processes are still the norm, taiga research is critical for determining the rate of global climate change—and is thus the focus of numerous studies. Among other things, the forest is used for projects conducted under the umbrella of the Long Term Ecological Research Program (LTER), established by the National Science Foundation in 1980. Bonanza Creek joined the LTER site network in 1987.

The LTER projects concentrate on basic ecosystem processes and forest succession, but research here began long before the area was designated an LTER site. In the late 1950s, upland soil profiles were created by S. A. Wilde and H. H. Krause; in the 1960s and '70s, white spruce studies were conducted by R. A. Gregory and J. C. Zasada.

The Bonanza Creek forest includes both upland and floodplain forest types. Formally designated an experimental area in 1963 with about 8,300 acres of upland forest, it was enlarged in 1969 to include representative floodplain forests along the Tanana River.

Caribou/Poker Creeks Research Watershed is a 25,700-acre upland research site 45 km north of Fairbanks. This watershed is dedicated to research on the hydrologic regime and stream ecology in the discontinuous-permafrost boreal forest of the Yukon-Tanana Upland of central Alaska. It was established in 1969, when the Interagency Technical Committee for Alaska and the Alaska Department of Natural Resources signed a cooperative agreement designating the basin as a research watershed. The USDA Forest Service, PNW Research Station managed the site from the early 1970s until 1996. In 1993, the watershed was designated a primary research site for the Bonanza Creek LTER program. In 1996, the Water and Environmental Research Center of the University of Alaska assumed its management.

### Trees

Boreal forests in interior Alaska are dominated by young stands of trees in various stages of succession. The boreal forest zone of Alaska is a mosaic of forest, shrubland, and bogs, interspersed with patches of grassland and alpine tundra. This varied composition results from the multiple interactions of elevation, aspect, disturbance history, topography, soils, and other factors. Mature stands of trees over 200 years in age are rare, due to frequent fire or erosion. On river floodplains, which are relatively protected from fire, glacier-fed and heavily silt-laden waters erode soil from older stands and create new terraces and sandbars that rapidly become vegetated with young trees and other plants. These in turn are washed away as the currents change course.

Upland forest includes stands of highly productive aspen *(Populus tremuloides)*, paper birch *(Betula papyrifera)*, and white spruce *(Picea glauca)* on south-facing, well-drained slopes. On lowlands and north-facing slopes, low-production black spruce *(Picea mariana)* forests are dominated by permafrost and moss Floodplain forests of balsam poplar (*Populus balsamifera* L.) and white spruce are productive on recently formed deposits of gravel and silt where permafrost is absent, but slow-growing black spruce and bogs occupy the older, permafrost-underlain terraces. Approximately 32 percent of interior Alaska is forested.

Studies of tree species, forest succession, insect infestations, and tree reproduction tactics have been conducted by many University of Alaska scientists, among them P. E. Heilman and K. Van Cleve, who studied nutrient relationships and cycling in birch, white spruce, and black spruce stands; USDA Forest Service researchers Leslie Viereck and M. J. Foote and others have utilized permanent plots to study species composition, successional relationships, and soil temperature fluctuations. Current investigations involve numerous UAF faculty, researchers, and graduate students from UAF and elsewhere.

## Fire

With both detrimental and beneficial effects, wildfire is a natural occurrence in boreal forest. In the early 1780s, one or more major fires burned through most of what is now the Bonanza Creek Experimental Forest. Around 1914, another extensive fire burned through black spruce on old terraces of the Tanana River. East of the experimental forest area, the fire burned through large upland areas as well as the flats. The 8,600-acre Rosie Creek wildfire of 1983 burned extensively in the lowlands east of the forest and made a wide run through the forest's uplands, burning through large continous stands of white spruce and paper birch on about 3,400 acres and re-burning most of the area affected by the 1914 fire. Since 1983, this area has been used to study forest succession and reestablishment.

Different tree species have different tactics for surviving fire. Thin bark, branches close to the ground, or shallow roots are all factors that may make a tree vulnerable to death from fire, depending on the species. But although a tree may itself be killed, seeds may survive by being disseminated widely (birch or aspen, for example, have light seeds that can travel long distances) or, as in black spruce, cones high in the crown can retain viable seeds after a fire. Birch and aspen that survive a fire can vigorously reproduce vegetatively from underground.

The effects of fire and other disturbances on discontinuous permafrost are the focus of other studies. Changes in moisture dynamics in the face of increased fire frequency (Bob Bolton) and the transport of nutrients from terrestrial to aquatic ecosystems (Kevin Petrone) are two graduate student projects under study at the Caribou-Poker Creeks Research Watershed.

## Insect Infestations

The experimental forest has been used extensively to study forest insect biology and management. R. A. Werner, R. C. Beckwith, and others have studied spruce and Ips beetles, the aspen tortrix moth, the spear-marked black moth, and the larch bud moth. High population levels of spruce budworm *(Choristoneura fumiferana, C. orae)* were first observed in the forest in 1989. Repeated defoliation in 1991 and 1992 caused top-kill in trees and death in seedlings and saplings. Outbreaks of bark beetles also caused significant mortality in 1993. Severe kills are more common in the southern continental areas of Alaska, where the climate is slightly warmer.

## Other Studies

The effect of animals feeding on plants—herbivory—has been studed by Knut Kielland, John Bryant, Roger Ruess, and others at Bonanza Creek. Currently, the effects of browsing moose and snowshoe hares on microclimate, soil processes and pH, soil nutrients, vegetation dynamics, and higher-order interactions in primary succession are under study. For example, using an exclosure to prevent moose from entering a particular area enables researchers to study how this changes the succession of vegetation and subsequently affects the ecosystem.

*Web sites of interest relating to the experimental forest and Long Term Ecological Research projects include:*
*Bonanza Creek: www.lter.uaf.edu*
*The LTER network: www.lternet.edu*
*The National Science Foundation: www.nsf.gov*
*Sources for this article include text from these Web sites and links to related pages.*

*Photo of view from Caribou Peak toward Murphy Dome, overlooking Caribou/Poker Creeks Research Watershed.*
*Dave Valentine*

# A Trip to Iceland

D. Helfferich
photos by Steve Sparrow



*Gullfoss, gold falls, on the river Hvitá.*

The Fourth Circumpolar Agricultural Conference, held in Akureyri, Iceland, in August 2001, drew 107 participants, among them 16 people from Alaska, along with some of their family members and friends. Countries represented at Akureyri included Canada, Denmark and Greenland, Finland, Iceland, Norway, Russia, Sweden, and the United States (Alaska). The theme of the conference, "Legacy and Vision in Northern Agriculture," drew presentations on wide-ranging topics such as: overviews of northern agriculture, horse, goat, and sheep husbandry, aquaculture, rural tourism, aboriginal economies, stall construction, grasshopper management, tillage, animal and plant genetics and diversity, reindeer herding, eider ducks, beef production, crop fertilization, and others.

Thorsteinn Tómasson, former president of the Circumpolar Agricultural Association and currently of the Agricultural Research Institute of Iceland, posed the essential query behind the conference: "What is the value of the historical and culturally specific aspects of habitation and agricultural practice in the north—recent as

*Conference attendees at the traditional site of the Althing, a great gathering or general assembly of the autonomous chieftancies. Every chief had to arrive punctually (or risk forfeiting his office), take part in the deliberations, be present for voting, and explain his vote on each issue. The sole official of the Althing was the Law-speaker, whose duty was to recite the entire body of law. Should he omit something and attention not be called to it, that part of the law was no longer valid.*

*Information on the Althing drawn from* Iceland: Isle of Light, *by Erich Spiegelhalter and Sigurdur A. Magnússon, 1995, Fjölvi Publishers, Reykjavik.*

Attendees from Alaska (not including family and friends who also came):

*Sultan Begna*
*Jim Drew (former SALRM dean)*
*Dennis Fielding*
*Greg Finstad*
*Pat Holloway*
*Natalie Howard*
*David Ianson*
*Tom Jahns*
*Charlie Knight*
*Carol Lewis*
*Heather McEachen*
*Milan Shipka*
*Elena Sparrow*
*Steve Sparrow*
*Bob Van Veldhuizen*
*Stoney Wright*

*Below: hayfields.*

*Iceland, the second-largest island in Europe, is bisected by and rises from the mid-Atlantic ridge. Iceland is characterized by significant volcanic activity. The ridge can be seen cutting its way across the landscape, forming a broad valley where the island is literally being forced apart.*

well as old—and how can these aspects be applied to build a foundation for future development? How will our cultural heritage help or hinder us in adapting to future needs?"

The Circumpolar Agricultural Association (CAA), sponsor of the conference, is a non-governmental organization founded in 1995 that, as its name suggests, focuses on circumpolar agriculture science, practice and policy. The First Circumpolar Agricultural Conference was held in Whitehorse in the Yukon Territory in 1992, with the theme, "Sustainable Development in a Circumpolar Environment." From the ideas of this conference arose the association and the subsequent conferences. The mission of the association is to encourage the exchange of information, material, and technology of agriculture and rural development in circumpolar areas; the conferences are a significant means of achieving this end. Steve Sparrow of the University of Alaska Fairbanks and former vice president of the CAA, who chaired the opening of the Fourth Circumpolar Agricultural Conference, sums up the association's view of agriculture: "[It] defines agriculture broadly to include traditional crop and animal production as well as nontraditional pursuits such as game herding, ranching, farming and subsistence agriculture, controlled environments, revegetation, and aquaculture. Those interested in symbiotic industries such as forestry and mining are welcome." Institutions and individuals interested in circumpolar agriculture are welcome to join the association.

Prior to the conference, a two-day bus trip around the western coast up to the north of Iceland and back down through the middle of the island, guided by Tómasson, gave a thorough grounding in the landscape and agricultural practices of Iceland. Tómasson spoke

*Below: "Raven and Plough," by Magnus Tómasson.*

*Right: rural village and farms.*

*Above and below right: geysers.*

of Iceland's history, discussed the problems of soil erosion due to wind and almost two thousand years of overgrazing by sheep, pointed out the historic sights, and skillfully incorporated lore from the famous Icelandic sagas into his talks. Iceland is volcanically active, straddling the mid-Atlantic ridge, and relies on geothermal energy for about 80 percent of its power. Geysers, spectacularly visible evidence of geothermal energy, are individually named in Iceland, and the name of one particularly famous spout, Geysir, gave rise to the English word *geyser*. The Icelandic language is very old, and closely related to Old Norse, the linguistic parent of the modern Scandinavian languages. The tour, agreed many attendees, was a significant highlight of the meeting.

The conference's opening address was given by Iceland's Minster for Agriculture Gudni Agustsson, and was followed by the keynote address, "Legacy and Vision in Northern Agriculture" by Thorsteinn Tómasson. Participants at the conference ran the gamut of working subsistence farmers to academic theorists and researchers, and the mix of people and subjects allowed for a good interchange of ideas.

The plenary lectures for the first day included four overviews of northern agriculture: "Development of Agriculture in the Russian North," by Nikolai Mikhailov of the Agricultural Research Institute in Magadan, Russia; "Agriculture in Iceland," by Sigurgeir Thorgeirsson, the Icelandic Farmers' Association; "A Tale of Two Agricultures," by James Drew, University of Alaska Fairbanks and the Alaska Board of Agriculture; and "Agriculture in Greenland," by Kenneth Hoegh, Greenland Agricultural Advisory Service, and Vibeke Rosenbeck, Greenland Department of Industry.

Two concurrent sessions, "Plants and Soils" (chaired by Elena Sparrow) and "Animal Husbandry" (chaired by Milan Shipka), occupied the conference participants during the first day, and dinner and song (the Norwegian

Presentations by Alaskans:

*"A Tale of Two Agricultures" (plenary session): James Drew, University of Alaska Fairbanks and the Alaska Board of Agriculture*

*"The National Arctic Plant Genetic Resources Unit (NAPGRU), Palmer, Alaska": David C. Ianson and Nancy Robertson, Alaska Plant Materials Center, Palmer*

*"Foraging Circumpolar Boundaries": Thomas R. Jahns, Cooperative Extension Service, Soldotna, Alaska*

*"Native Plant Collections Ready for Commercial Production in Alaska": Stoney Wright, Alaska Plant Materials Center, Palmer*

*"Grasshopper Pest Management in Alaska": Dennis Fielding, Sultan H. Begna, and Linda DeFoliart, University of Alaska Fairbanks*

*"Long-term Tillage Effects on Barley Yields in Interior Alaska": Charles W. Knight, Stephen D. Sparrow, and Carol E. Lewis, University of Alaska Fairbanks*

*"Long-term Tillage and Soil Properties in Central Alaska": Stephen D. Sparrow, Charles W. Knight, and Carol E. Lewis, University of Alaska Fairbanks*

*"Pre-college Student Participation in Long-Term Ecological Research": Elena B. Sparrow, University of Alaska Fairbanks*

contingent got up and sang for the assembled guests both on this evening and at the closing banquet) at the Modruvellir Agricultural Experiment Station hosted by the Icelandic Ministry for Agriculture kept many entertained that evening.

The conference's second day began with "Tælting into the Future: The Icelandic Horse, Past and Present," by Agust Sigurdsson, Icelandic Farmers Association. *Tæltle* is the term for a gait particular to Icelandic horses. There are some 175,000 horses and about 250,000 people in Iceland, almost one horse per citizen. An afternoon excursion later saw horses put through their paces for an admiring but rather windblown group at Holar Agricultural College, a center for horse breeding in Iceland.

Iceland, being geographically isolated from the rest of Europe, has retained genetic strains of relative purity in its livestock. Horses, cattle, and sheep descend from the original Viking imports, and are a source of national pride—such that a proposal to use Norwegian red cattle to improve the milk production of Icelandic cattle has created a furor. Many oppose the dilution of the native breeds, and the issue has been brought all the way to the desk of the prime minister.

Arni Snaebjörnsson, also of the Icelandic Farmers Association, gave a talk, "The Use of Eider Duck in Icelandic Agriculture," describing how farmers encourage wild eider ducks *(Somateria mollissima)* to nest on their farms, collecting their down (renowned for its excellent insulating proerties) after the ducks have left the nest, sterilizing and cleaning it, and producing approximately 3000 kilos of down per year in a mutually beneficial relationship that protects the ducks and their nesting habitat and provides the farmers with an important source of income.

The concurrent sessions for the second day were "Historical Agriculture and Culture and Agriculture"

*Horse and rider at Holar Agricultural College.*

(chaired by Carol Lewis) and "Diversity and Change." Dinner was held at Holar Agricultural College, which, in addition to research on horses, also has programs devoted to the development of aquaculture (arctic char) and agrotourism. The group dined on arctic char grown under the college's aquaculture auspices, and, reports Dennis Fielding, it came cooked several different ways and was very good.

The final day of the conference concentrated on tourism and policy questions, opening with two plenary sessions: "Rural Development and Tourism in Iceland," by Guðrun Thóra Gunnarsdóttir, Holar Agricultural College; and "Canada's NRC: Fostering Northern Innovation," by David Rideout and Patricia Loder, National Research Council, and Kristi McBride, Canadian Technology Network, Newfoundland, Canada.

The concurrent sessions, "Rural Development and Tourism" and "Agriculture Policy, Research and Management," were followed by a closing meeting on the future of the CAA and a general discussion led by CAA President Thorsteinn Tómasson. Lars Ericson from the Swedish Agricultural University in Umeå was elected the CAA's new president. The Fifth Circumpolar Agricultural Conference will be held in Umeå in 2004.

*A complete listing of speakers and presentations is available at the Web site, www.svs.is/caa/2001/default.htm. For more information on the Circumpolar Agricultural Association, go to www.svs.is/caa or write to: CAA Secretariat, Stefansson Arctic Institute, Nordurslod, 600 Akureyri, Iceland.*

*Left: downtown Akuyeri, where the conference was held.*

# A Field Trip to Hawaii

D. Helfferich
photos by John Yarie



In a state known for tundra, taiga, and permafrost, it may seem odd that a class on tropical ecosystems is taught at the University of Alaska Fairbanks—although the idea of a field trip to Hawaii during the Alaska winter can be delightful. John Yarie explained that the marked contrast in the kinds of ecosystems and, consequently, the different issues to be dealt with and approaches to management necessary provide a good contrast to Alaska and a wider context for UAF students. There has been a national push in recent years, he said, to give students a broader understanding of ecosystems, and a movement away from concentrating solely on the local landscape. The course, Landscape Management of Tropical Ecosystems, is offered every other year, and information drawn from student research will strengthen the work of successive classes.

*Above: Current vegetation structure in the dry forest after years of cattle grazing and wildfire.*

There are, naturally, significant contrasts between Hawaii and Alaska. The issues that are of urgency in Hawaii include protection of ecosystems from invasive species, both plant and animal, and work toward the reestablishment of native ecosystems that have been disrupted. This contrasts sharply with the main issues of concern in Alaska, such as effects of climate warming on permafrost, forest insect infestations in south central Alaska, future development of gas fields and the building of a gas pipeline, oil exploration in the Arctic National Wildlife Refuge, etc. Prior to the field trip, the class prepared itself by studying Hawaiian physiography and climate, vegetation, soils, ecosystem management, social issues and the impact of human development on Hawaiian ecosystems, and the potential for development of a Hawaiian forest industry.

This March, John Yarie, Marilyn Walker, Lola Oliver, and Daniel Nidzgorski, along with eleven students, went for a ten-day trip to the Big Island, Hawai'i. They visited Mauna Kea, Hakalua Forest National Wildlife Reserve, Hawai'i Volcanoes Park, an orchid farm, the Parker Ranch, the Natural Energy Laboratory of Hawaii, and other places, studying the native forests and vegetation, the geology associated with volcanic activity, primary succession in volcanic areas, bird ecology, commercial flower growing and distribution, cattle ranching, energy production, forestry dynamics in eucalyptus plantations, and the challenges associated with forest rejuvenation.

There are more than 700 species of invasive organisms in Hawaii, and in part as a result of their success, well over 200 of the native species are classified as endangered—and numerous species are now extinct. Hawaii had no mammals other than a species of bat

*Nene geese, an endangered bird species in Hawai'i.*

*Participants in the field trip for the Landscape Management of Tropical Ecosystems class.*

and the Hawaiian monk seal prior to the arrival of human beings. Animals deliberately introduced as livestock, such as cattle, pigs, goats, and sheep, have caused significant damage, and massive fencing programs encompassing thousands of acres, along with hunting drives, have helped to gradually get them under control, sheep in particular. Pigs and goats are still problematic. Other species, such as rats and mongooses, continue to be a serious threat to native species.

At the Hakalua forest National Wildlife Reserve, the group learned about the interaction between global warming and the impact of introduced organisms: avian malaria is causing serious losses in local bird populations. Native birds previously common at lower elevations are now restricted to elevations higher than 4000 feet—a height beyond which the mosquitoes that carry the malaria do not go. Mosquitoes are not native to Hawaii. Hawaiian birds are extremely susceptible to malaria, and can die within two weeks of being infected by the bite of a carrier mosquito. Even a very small rise in temperature can increase the range of the mosquitoes, and many are concerned that this may completely wipe out some native bird species as the insects climb to higher elevations that were previously too chilly for them.

Grasses from Australia and Africa introduced in the mid-1800s for cattle have crowded out native species and changed the character of the landscape, making it more susceptible to fire. Unlike in Alaska, where most fires are caused by natural events, Hawaiian fires are usually started by humans. The last four years have been drier than normal, and this has rendered the landscape more vulnerable. Cattle, although very destructive to native vegetation, have not caused the damage that other domestic animals have, as they have not been allowed to range freely. Apparently Hawaiian grasses and young trees are quite tasty to bovines, so where cattle graze the native plants have been unable to replenish themselves.

The second-largest cattle ranch in the United States, the Parker Ranch, is on Hawai'i, and here the group studied the particulars of range management and the economics of raising beef in Hawaii. Cattle are no longer routinely slaughtered at the ranch—instead, the young animals are shipped to locations in Canada and elsewhere for fattening prior to slaughter, then the meat is imported back to Hawaii. It is more profitable for the rancher to ship the cattle off-island, in part because, as in Alaska, the infrastructure in the state is not economically viable, and the primary markets are in Colorado and Florida. In addition to beef production, the Parker Ranch also raises pheasants and other game birds, and provides hunting permits for

*Above: Gravel mining at the Parker Ranch. The material will be used primarily for road construction.*

*Below: Ohi'a* (Eugenia malaccensis *L.*) *tree within the Volcanoes National Park.*

swine, goats, birds, and other game for up to $5500 30-day passes. Gravel is also a source of income.

There is currently no forest industry in Hawai'I (not even any sawmills), but there are a few people exploring the possibility. Of the native trees on Hawaii, two varieties are of note with regard to possible commercial application. Koa is a slow-growing tree (a tree takes about 100 years to get big enough for timber), highly prized for the beauty and durability of its wood. There is no real management of koa forests in Hawaii, and they are in jeopardy. On private lands, the wood is harvested and sold, and on public lands, the trees are often stolen. Another species of tree, the ohi'a (pronounced o-hee-ah), can also be harvested for its wood, but this tree is even more slow-growing, taking 200 years to reach harvestable size. The ohi'a is not really a timber tree, and is a pioneer species, growing on lava.

Timber management programs have resulted in plantations of invasive but useful varieties of trees. Two types of trees in particular that have been introduced to

*Timber harvesting class in a eucalyptus stand. The stand is 20 years old with trees about 160 feet tall and 18 inches in diameter.*

Hawaii have proved valuable in helping combat soil erosion, as they are very rapid growers. Albesia, a hardwood, is a nitrogen fixer, and of significant help in enriching the soil. The Big Island, being the youngest of the Hawaiian islands, has nitrogen as its limiting nutrient. The older islands, such as Kauai, have limited phosphorus in their soils. Eucalyptus, an Australian tree, was heavily planted in the 1980s for an anticipated need in renewable energy sources, the trees to be chipped and either burned or digested for biofuels production. There are several species of eucalyptus, which is a very fast-growing tree, reaching marketable size in only ten years. In twenty years, the trees are 160 feet tall and anywhere from 12 to 20 inches in girth. A log cabin made from eucalyptus logs on the

*Interior and exterior of a log structure that it being built with eucalyptus logs harvested from the stand shown at left.*

plantation premises provided an example of potential uses to which Alaskans could relate.

Eucalyptus has not, however, been of much use as an energy source in Hawaii, although the plantations were primarily geared toward this end. Windmills and solar energy are much more promising—there are, on average, a good 320 days of sunny weather on the dry side of the island. The politics of energy production, Yarie's comments suggested, may be more of a problem to solar energy development than the actual viability of the technology, as it's hard to get a market advantage on the sun. Geothermal energy is not, apparently, much explored as a viable power

*A series of windmills being used to supply electricity, primarily for water pumps at the Parker Ranch.*

*A trial out-planting of Sugi pine (*Cryptomeria joponica *(L. f.) D. Don) on the slopes of Mauna Kea.*

*Orchid farming.*

source, but at the Natural Energy Laboratory of Hawaii, research on heat pumps has resulted in a burgeoning aquaculture industry—as well as the intended development of a new, clean source of electricity. The laboratory built a pipe down to the cold water off the steep shelf of Hawai'i, hoping to capitalize on the temperature differential between the warm waters above and the cold water below. (Fins on underwater turbines that are strong enough and can transmit heat properly are still being developed, but the technology is almost ready for practical application.) The cold, clean, and nutrient-rich waters that were reached by the laboratory have attracted the interest of some 30 corporations, and now such things as abalone and sea horses are grown there, and lobsters transported to Japan via Hawaii get a chance to recover from the trauma of their trip—and thus recover the tastiness of their flesh, which declines when the crustaceans become distressed.

Yarie described a dry forest restoration project, supported by a developer hoping to gain both a good public image and a backdrop for a potential housing development. The project started with five acres of steep land, and involves fencing off sections of land to protect it from roving livestock, the painstaking removal of all non-native species within the fenced area, and then the planting and cultivation of indigenous species. The project, a National Forest Service and Nature Conservancy experiment which has been going for about ten years, has now expanded to 70 acres.

Commercial flower growing is big business in Hawaii, and, accordingly, the group went to visit an orchid farm near Cape Kumukahi and, in Hilo, a commercial greenhouse that specialized in wholesale tropical flower production for sale to retail outlets around the world. Shipping flowers off-island poses problems, both for keeping them fresh and for preventing the spread of noxious insects. The commercial grower that the class visited has developed a special method of sterilizing the flowers that requires no pesticides and helps keep them fresh longer: the flowers are put into a hot, steamy room for about two hours, then immersed in hot water. This method works only with tropical blooms. The orchid grower, in contrast, imports young plants from Thailand and raises them. Genetic manipulation of orchids is also part of their business.

Other aspects of natural resources management, such as the tourist industry and small produce growers (coffee, macadamia, avocado, and other fruit) were not explored, but there's only so much a group can absorb in ten days. A similar course, possibly in Oregon, will provide further contrasts with Alaska's resource management issues in the future. A seminar open to the public was held after the travelers returned.

*A view over the Kilauea Caldera on a cloudy day.*

# News & Notes

## new researcher

**Carrie Bucki** began her current full-time position as caretaker of the reindeer herd at the Agricultural and Forestry Experiment Station in December 2001, but started working for the reindeer program in May 2001 as a seasonal employee, spending the summer working in Nome sampling vegetation and participating in reindeer handlings. Her work involves determing reindeer nutritional requirements, something well known for other domestic animals such as cattle or goats, but virtually unexplored for reindeer. (Bucki termed them 'captive animals' rather than 'domestic', distinguishing their semi-wild nature from that of animals long bred and influenced by human genetic selection.) She is also working on the development of commercial feed formulas palatable to the deer, using Alaska-produced ingredients such as fish meal from Kodiak and Delta barley.

Bucki came to Alaska two years ago after receiving her masters degree in wildlife ecology from Michigan Technological University in Houghton, Michigan, where she researched predator-prey relationships and population dynamics of wolves and elk in Yellowstone National Park. Her husband, Adam, is here working on his master's degree in geophysics at the Geophyscial Institute.

## new staff

The editorial staff of the publications office doubled in March with the hire of **Deirdre Helfferich** as half-time publications assistant. Helfferich, who is from the Fairbanks area, has been actively involved with publishing for fourteen years, working primarily for book publishers and bookstores. She is the founder and editor of a local monthly newsmagazine, *The Ester Republic*, and owns a publications design business. She is a graduate of UAF, and earned her B.A. in foreign languages (French, German, and Danish) in 1998.

**Mist Mashaney** was hired in February as an accounting technician. She comes to SALRM with a background in the aviation industry, and her passion for flying is evident: "Whenever an aircraft flies overhead I play 'identify that aircraft!' My favorite aircraft that flies out of Fairbanks is the C-46, and next in line is the DC6—Radials Rule! All-time favorite aircraft would have to be the P38-J Lightning."

Mashaney assists the SALRM and the CES fiscal officers by researching account inquiries, receiving and depositing all revenue, and providing DSD Qmenu training to faculty and staff. She also handles all the telephone line and equipment connect and disconnect and outgoing toll charges.

**Crystal McAlpin** was hired in December as a half-time recruitment technician for both SALRM and the

*Left to right: Susan Phillips, Crystal McAlpin, and Mist Mashaney.*

Cooperative Extension Service (CES). She was born and raised in Alaska and has recently returned to Fairbanks after receiving her B.A. in business management. McAlpin works with Holly Drygas assisting faculty and staff in all stages of the hiring process. She can be reached in the business office.

**Steve Peterson** is the new computer guru who shares the publications office with Helfferich and Muirhead. He maintains the computer labs, and prefers PCs over Macs—alas for the publications office!—but he works on both platforms. Peterson was born and raised in Fairbanks, and has a family of his own with two children (one and three years old). He attended the DeVry Institute of Technology in Kansas City, studying telecommunications management, and is currently working toward becoming a Microsoft-certified systems engineer.

**Susan Phillips** started her position of payroll and personnel technician for the CES/SALRM Business Office on October 22, 2001. Phillips, born and raised in Fairbanks, came to UAF after spending over 15 years in the travel industry and owning her own small travel agency in North Pole for three and a half years. She is excited to be starting a career with UAF.

# student awards

## Outstanding Students of the Year

The Outstanding Student awards are given annually to undergraduate, full-time students (with the exception of those in the College of Rural Alaska, who are part-time students). Lydia Anderson, the coordinator of the awards committee, described the award as academic in nature, although several diffferent kinds of awards are given at the ceremony, which was held April 27. The purpose of the award is to recognize those students who have excelled academically and to encourage other students to do the same. The committee is composed of five students and four faculty. Awards presented at the ceremony are: Outstanding Graduating Man, Outstanding Graduating Woman, Outstanding Nontraditional Student (often awarded to those who have had to interrupt their studies for family reasons and have returned to school much later in life), Outstanding Faculty, Outstanding Staff Member, Scholar Athelete, and Outstanding Student (from each department). Anderson observed that departments do not always choose a student each year—it depends on whether a student is found who truly stands out.



Below are the four students in the School of Agriculture and Land Resources Management who will be presented with this award this year. SALRM chooses students who have not only a high grade point average, but also excel in the areas of student service, research, and involvement related to coursework, university and club events, department and school events and activities, and so forth. Outstanding students show strong academic, fellowship, and leadership skills.

### Yvette O'Connor, Department of Geography

Yvette O'Connor has consistently maintained an outstanding academic record, and she has served the geography department and students as the president of Gamma Theta Upsilon (International Honorary Geographic Society) during the past year. She graduated with a B.S. in geography May 2002.

### Craig Bosveld, Department of Forest Sciences

Craig Bosveld graduated in spring 2002 with a B.S. in natural resources management in forestry. Bosveld came to Alaska with the U.S. Army, and selected summer employment opportunities at Fort Wainwright that strengthened and expanded his academic experience, working on vegetation surveys with Colorado State University's program to monitor military lands. He showed excellent leadership skills and commitment to natural resources management, and was leader of his survey crew during his second year. Later, with Dr. Edmond C. Packee, he worked for the Agricultural and Forestry Experiment Station's Forest Growth and Yield program establishing permanent-sample plots throughout the state. Consequently, Bosveld is well qualified for the national job market and has been successful in making the interview

*Craig Bosveld.*

shortlist for several highly competitive employment opportunities. In addition, he is an ambassador for UAF. He has applied and interviewed for a state forestry job in Wisconsin, where he is from and to where he plans to return. He intends to work in the forestry industry, preferably in fieldwork.

### Stephen Winslow, Department of Plant, Animal, and Soil Sciences

Stephen E. Winslow was raised in Norridgewock, Maine. In 1995 he found employment as a fishing guide on the Aniak River in Alaska and developed a love of the state. He graduated from Skowhegan Area High School in 1998 and began attending the University of Alaska Fairbanks on an Army ROTC scholarship that fall. Always an outdoors enthusiast, he has enjoyed living and working in Alaska while attending the university. He has earned numerous ROTC awards during his time at UAF, including the 2001/2002 George C. Marshall Award as the most outstanding cadet of the UAF ROTC program. Winslow majored in natural resources management with a Plant, Animal, and Soil Sciences option, and graduated in May. Concurrent with his graduation, Winslow was commissioned as a second lieutenant in the United States Army Corps of Engineers; he plans to work on a master's degree while in the service.

*Steve Winslow.*

### Jennifer Arseneau, Department of Resources Management

Jennifer L. Arseneau comes from Ishpeming, Michigan, and transferred to UAF from Northern Michigan University at Marquette in the fall of 1998. Arseneau has been active in several student organizations, including the Resources Management Society (RMS) and the Gold Key Society. She was an exceptional leader as the president of RMS during the 1999–2000 academic year. Arseneau returned in the fall of 2001 following a one-year exchange program to Finland, where she participated in the Arctic studies program at the University of Lapland, Rovaniemi. She has extensive work experience with the National Park Service and has worked as a park ranger in national parks in both California and Alaska. Arseneau has been employed in a number of research-related positions including serving on an international field crew last summer in Russia. In the future, Jen hopes to continue to explore the north through seasonal resource work and to travel as much as possible.

*Photo provided by J. Arseneau*

## faculty news & grants

### Computer Model of Fire in the Boreal Forest

The first major fire science federal grant awarded to Alaska has been received through the efforts of Dr. Scott Rupp, Forest Measurements assistant professor with SALRM/AFES. The $441,675 three-year grant represents a substantial collaborative effort between Alaska federal and state agencies and researchers at the university. Collaborators will include representatives of the Bureau of Land Management, the U.S.

Fish and Wildlife Service, the U.S. National Park Service, the U.S. Geological Survey, and the Alaska Department of Fish and Game.

A computer-based fire management and planning model will be developed that can be used as a day-to-day management tool for land managers designing fire management plans that can balance the needs of both natural ecosystems and humans living around and in them. The model will take into account things such as fuel management, human-fire interactions, and wildland fires in boreal forests.

## Long-Term Ecological Research (LTER)

Researchers at SALRM/AFES are among an elite group of researchers collaborating on the long-term consequences of changing climate and disturbance regimes in the Alaska boreal forest. Terry Chapin, who is a faculty member of the Institute of Arctic Biology as well as an adjunct with AFES, heads this project. SALRM faculty researchers involved in LTER are John Yarie, Glenn Juday, David Valentine, David Verbyla, Scott Rupp, and Elena Sparrow. SALRM/AFES research associates who are involved are Lola Oliver, Tim Quintal, Jason Downing, Jessica Garron, Rob Solomon, Val Barber, and Jonathan Henkelman. Masters-level graduate students involved are Paul Duffy and Sarah Masco. Our Ph.D. graduate student is Jason Vogel. To date this year $933,651 has been awarded from the National Science Foundation.

## Other grants:

### Pest Survey

Jenifer McBeath received $20,000 from the Animal & Plant Health Inspection Service.

### Agricultural Research Service Support

Dennis Fielding received $10,000 from the Agricultural Research Service for general support.

### Abandoned Mined Land Evaluation, Reclamation, and Monitoring

Dot Helm received $18,961 from the Department of Natural Resources (DNR) for reclamation, and in a separate grant from DNR, $7,650 for revegetation monitoring. She also received $6,043 from Usibelli Coal Mine, Inc., for revegetation evaluation of Gold Run Pass and Poker Flats.

### NRCS Cooperative Agreement

Greg Finstad received $39,900 from the Natural Resources Conservation Service.



### Improving Understanding of Global Change Variability

Elena Sparrow received $220,567 from DNR.

### Revised Universal Soil Loss Equation Data

Stephen Sparrow received $50,000 for work on the collection of plant data in high-latitude region soils, to aid farmers and conservations in planning soil conservation practices.

### Reindeer and Satellite Telemetry

Greg Finstad received $36,069 from the Bureau of Indian Affairs for work with satellite telemetry, supplemental feeding, and technology transfer to support the reindeer industry in Alaska.

### New Crops Research

Carol Lewis received from the USDA, in three separate grants: $397,042 with Charlie Knight, and $463, 964 for new crops opportunities, and, most recently, $595,927 for research into both new crops and new markets for them. The first two grants are for 13 and 11 projects respectively.

## Canadian Studies Program

As a geographer, Assistant Professor Cary de Wit firmly believes that Canada is a foreign country. To communicate this conviction to the wider public, he has embarked upon the first steps to creating an interdisciplinary Canadian Studies program at UAF.

In July of 2001, de Wit traveled throughout Alberta with 11 other academics from universities in Alaska, Washington, Oregon, and Idaho. The Alberta Summer Research Institute was sponsored by the Canadian Consulate, and spots were awarded on the basis of competitive proposals to American academics who teach Canadian content in their courses. The trip included visits to the Calgary Stampede, the oil sands of northern Alberta, and dinner with First Nations elders of the Blood Tribe near Lethbridge. Through this institute, de Wit was able to visit with government

and business leaders, and with academic representatives all across the province, each of whom offered a different perspective on Canadian and Albertan economics, politics, government, and culture.

De Wit also represented UAF at the annual Pacific Northwest Canadian Studies Consortium Executive Board meeting, held in Vancouver, B.C., February 8–10, 2002. The consortium is made up of institutions throughout Alaska, the Yukon Territory, the Northwest Territories, British Columbia, Alberta, Washington, Oregon, Idaho, and Montana. Its mission is to foster research and teaching exchanges between Canadian and American universities and to facilitate the development of Canadian studies at institutions of higher education in the American and Canadian Pacific Northwest. It sponsors international student and faculty exchanges, undergraduate and graduate student participation at professional meetings on Canadian topics, funds research projects by American graduate students and faculty who have an interest in Canada, and funds faculty development projects for American scholars who teach Canadian content in their courses.

With help from the other members of the UAF Canadian Studies Committee—Professor Amy Lovecraft (Political Science) and Professor Louann Rank (Alaska Native and Rural Development)—de Wit secured $1,900 in grants to fund travel for the three of them to UAA to participate in "Canada Weeks," a series of events sponsored by the Canadian Consulate to encourage development of Canadian Studies programs in Alaska. They were able to consult with the UAA Canadian Studies Program director, Professor Dorn Van Dommelen, on how UAF could develop its own program, and on possibilities for collaborative projects between UAF and UAA. They also met with representatives of Yukon College (Whitehorse) to discuss possibilities for research collaboration, faculty and student exchanges, and curriculum coordination to enhance Canadian studies.

Recently, the Canadian Studies Grant Program gave $4,000 to de Wit for research on the cross-cultural politics of Nunavut, thus furthering the Canadian Studies program on UAF.



# Women in Agriculture

The Alaska Women in Agriculture Award was presented to **Mary K. Andrews** of Delta Junction at the 2001 Alaska Agriculture Symposium. The School of Agriculture and Land Resources Management and the Agriculture and Forestry Experiment Station present the annual award to recognize outstanding agricultural contributions to Alaska.

*Mary Andrews, left, receives her 2001 Women in Agriculture award from Carol Lewis, center, and Allen Mitchell, right.*

Andrews, who has been involved in vegetable and potato farming and since her childhood in Wisconsin, operates the Coldspot Farm in Delta Junction with her husband Andy. In Delta they originally produced table stock potatoes and vegetables, then certified seed potatoes. She has conducted many vegetable variety trials, enthusiastically sharing her production knowledge with others and promoting Alaska Grown produce and seed potatoes. She has conducted tours of Coldspot Farm for many people, including delegations from Taiwan and mainland China.

Active in the Delta Chapter of the Farm Bureau, Andrews assists with the popular Farm Forum potluck and the annual Delta Farm Tour. Along with her agricultural activities, her community service includes working as a Boy Scout leader and with the Delta schools.

The 2002 award will be presented at the Alaska Agricultural Forum, November 16, in Anchorage. This year the forum is being held in lieu of the traditional symposium, to bring together agricultural practitioners with directors of the ten agencies vital to Alaska agriculture.

# A Tribute to Marsha Melton



*Marsha Melton, board member, at the autumn 2001 SALRM Board of Advisors meeting.*

Marsha Melton, one of the founding members of SALRM's board of advisors, died in December 2001, but her long years of service to the school continue to show their good effect. Marsha has long been a champion for agriculture in Alaska. She became a SALRM board member in 1993, helping to establish bylaws and hone the responsibilities of the board. Her background in Alaska agriculture, from her homesteading days near Anchorage from 1947 to her diary and beef cattle experience in Palmer to her management of the Alaska State Fair, gave her ample knowledge from which to draw on to aid the school. Her community involvement included acting as the Wasilla Parent-Teacher Association president, board member of the Matanuska Youth Activities Council, board member of the Greater Palmer Chamber of Commerce, board member of the Palmer Kiwanis Club, secretary/treasurer of the Alaska Farmers & Stockgrowers Association, member of the Palmer City Council, and a member of the statewide committee for agriculture in the classroom.

Her years of outstanding service were recently recognized with an award presented at the November 2001 board meeting. At the Agriculture Symposium that same month she received a certificate of appreciation from Allen Mitchell and Carol Lewis for her hard work and unflagging enthusiasm for Alaska agriculture. Her presence will be missed.

*Marsha, left, at the Agriculture Symposium in Anchorage, November 2001, with Allen Mitchell, center, and Carol Lewis, right.*

*Marsha Melton and Steve Ulvi, above, recipients of awards for outstanding service. The plaques read:*

***In Recognition And Appreciation Of Outstanding Service***
***As A Founding Member Of The***
***Board of Advisers***
***School of Agriculture & Land Resources Management***
***Agricultural & Forestry Experiment Station***
***1993–2001***

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*Clockwise from far left: sunbow over the University of Alaska Fairbanks, (D. Helfferich); one of several species of anthurium grown by a commercial tropical flower supplier in Hilo, Hawaii (John Yarie); alpenglow in Akuyeri, Iceland (Stephen Sparrow); Icelandic wildflower (possibly* Armeria maritima*, thrift) (Stephen Sparrow); rainbow over the Gullfoss, Iceland (Stephen Sparrow). See related stories inside.*

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