AgroBorealis

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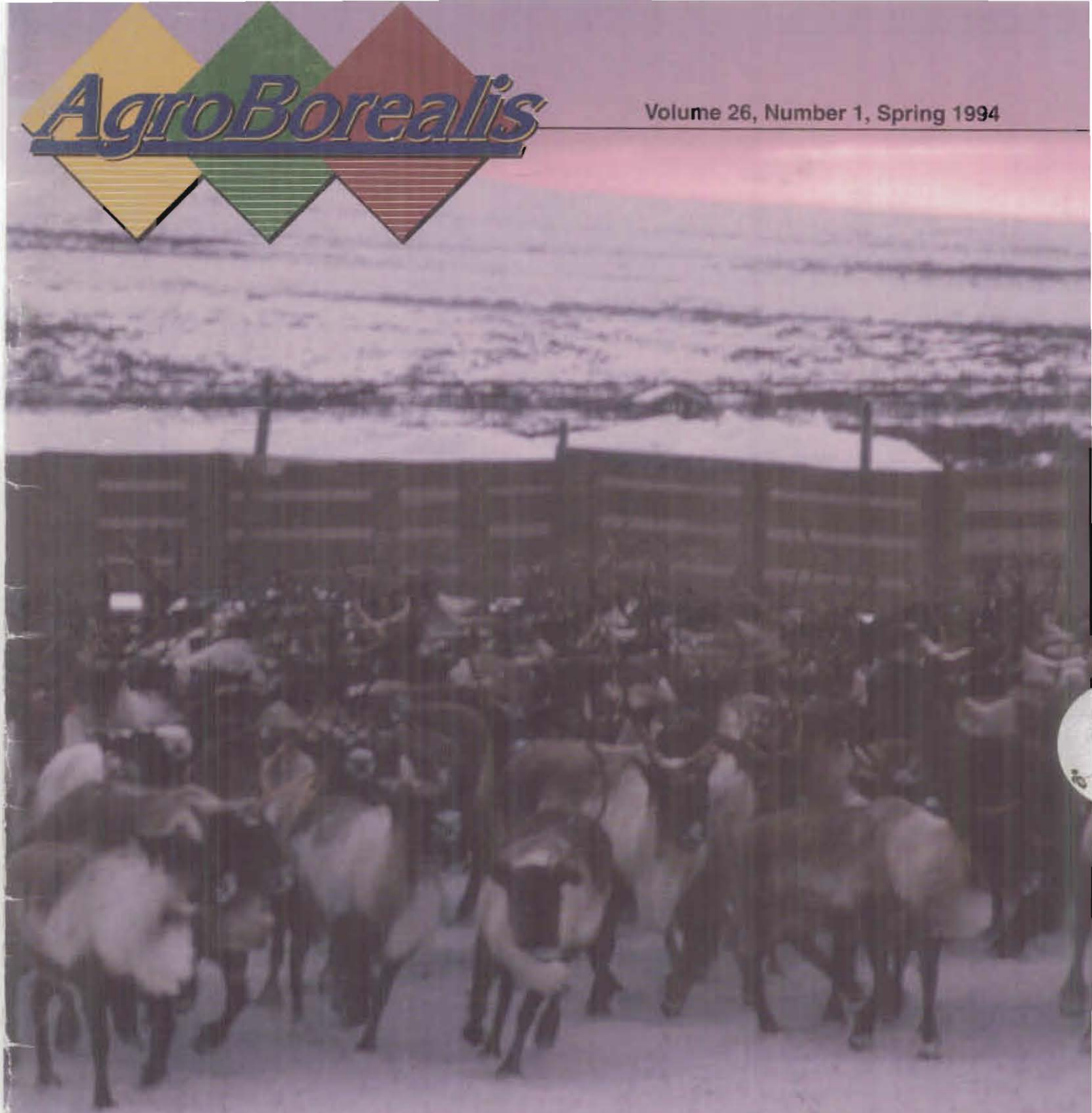

School of Agriculture and Land Resources Management
Agricultural and Forestry Experiment Station

University of Alaska Fairbanks

Front cover:
Reindeer mill around during winter handling on Alaska's Seward Peninsula (Photo by Gretchen Kerndt).

Back cover:
A caribou photographed in front of the pipeline in Prudhoe Bay (AFES photo).

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In this issue

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Dean reports on school's strategic plan, focus


Dr. James V. Drew

Our scientists work directly with people connected with sustainable agriculture, forestry and the environment to provide answers through research that will benefit them and the state.

This issue of *Agroborealis* highlights some recent accomplishments at the Alaska Agricultural and Forestry Experiment Station, School of Agriculture and Land Resources Management. In his editorial on the next page, Allen Mitchell outlines examples of laboratory analyses that the Palmer Research Center provides. This work is essential for the successful management of Alaska's soil and water resources.

We know that for research to justify itself, it must be taken to the people. We are dedicated to ensuring this happens. Allen's second article—beginning on page six—relays effective efforts between scientists and farmers. Page 34 and 35 covers our annual Delta Field Day where AFES scientists and Alaska Cooperative Extension agents meet with Delta Junction farmers. During this community meeting, scientists update farmers on research results, researchers and farmers have the opportunity to personally discuss any questions or problems they might have, and future research areas are developed.

In subsequent articles in this issue, results from the Fairbanks Research Center are highlighted for application in improving outdoor recreation, reindeer production, forest ecosystem management, and interpretation of global change in Alaska.

These and other research needs are all part of a strategic plan for the school and the experiment station that we are currently preparing. As this issue goes to press, all academic units at the University of Alaska Fairbanks are developing action plans to focus on challenges facing the university over the next five years. Before the plan for the School of Agriculture and Land Resources Management is adopted, it will be reviewed by our Board of Advisors. Our goal is to insure that the directions identified are in line with the needs of our constituents.

The plan emphasizes new directions for the instructional program of the school. I am pleased to report that our proposal to offer the plant, animal and soil sciences option in the bachelor of science degree in natural resources management, University of Alaska Fairbanks, at the Palmer Research Center has been approved. Courses in the major will be taught by our Palmer faculty. Students may take supporting courses in physical, biological, and social sciences, and humanities at the nearby Matanuska-Susitna College or at the main campus of the University of Alaska Anchorage. This will permit students in Southcentral Alaska to earn the bachelor's degree with emphasis on plant, animal and soil sciences and will involve the cooperative use of courses and facilities among the campuses of the university. We are scheduled to begin in the fall semester 1994.

In view of the importance of natural resources in the economy and society of Alaska, we are committed to defining and implementing a strategic plan that will provide effective education and research for the management of Alaska's forest, agricultural and related natural resources.

Associate dean discusses new research, new methods, new tools

Over the past 76 years, USDA and university scientists at the Palmer Research Center have conducted applied research in support of the Alaska agriculture industry. Today the role continues with research in animal science, agronomy, plant breeding, horticulture and soil science.

However, in recent years, the research mission at Palmer has expanded to include projects related to revegetation and reclamation of disturbed areas resulting from resource extraction, effects of global climate change on carbon flux in arctic soils, bioremediation of hydrocarbon-contaminated soils, and other national and state research priorities resulting from public concerns over environmental degradation. To meet these new research challenges, Palmer scientists have not only had to revamp their research protocols, but also have acquired new methodology and sophisticated instrumentation.

Dr. Allen Mitchell

New approaches to revegetation are being developed by Dr. Jay McKendrick's Prudhoe Bay work—funded by British Petroleum—and by Dr. Dot Helm at various mining sites throughout the state. Although working on separate projects, both scientists recognize the importance and unique requirements for land stabilization, wildlife habitat development, and plant species diversity in Alaska. Indigenous plant materials, largely untested in early revegetation research, have been found to meet these requirements.

Dr. Chien-Lu Ping, in a project funded by the National Science Foundation and in cooperation with scientists from other states, is attempting to identify and quantify bioactive soil carbon compounds in arctic soils that are precursor to methane and carbon dioxide (greenhouse gases) evolution as affected by possible global warming. This work has required the application of a sophisticated tandem XAD-8/XAD-4 resin isolation system originally developed to study acid rain effects in surface waters and applied to soils and soil water systems by Dr. Ping's lab. This resulted in acquisition of a state-of-the-art resin chromatography system and a new total organic carbon analyzer. The Palmer lab is the only university laboratory in the United States with the XAD-8/XAD-4 resin isolation system for soils research.

Dr. James Walworth, in a cooperative project with the Army's Cold Regions Research and Engineering Laboratory and with partial funding by the Alaska Science and Technology Foundation, is studying bioremediation of oil contaminated soils in Alaska.

Funding is available to upgrade our laboratory's gas chromatograph with a data acquisition system and new chromatograph columns thus enhancing our capabilities in hydrocarbon analyses.

Additionally, capital funding from the legislature allowed the laboratory to purchase a Carbon-Hydrogen-Nitrogen Macrosample Elemental Analyzer that will not only enhance our analytical capabilities, but also reduce the waste stream generated by the old method of plant analyses.

These new laboratory acquisitions added to other modern instrumentation such as the atomic adsorption spectrophotometer, inducively-coupled plasma spectrophotometer, and autoanalyzer system broaden the capability of the Palmer laboratory. It also provides faculty and graduate students new and better tools to address researchable problems in agriculture, resource management and the environment.

Researchers go to the farm

Scientists take experiments to the people

By: Dr. Allen Mitchell
Associate Dean & Director

A common complaint among farmers in Alaska as well as elsewhere is that experiment station research is not completely valid. Some of the reasons cited include: "it doesn't approximate the true farm situation," "the plots are too small which allow for certain practices to be used that would not be practical on a multi-acre field," "experiment stations have different soil types," "their weather patterns are different than ours," and "all we see is a written report at the end of the season because we can't afford the time to come to the experiment station to see the progress of the crops or animals as the season progresses."

Many of these criticisms are valid. Although costs and logistics will continue to keep most research on experiment station lands, experiment station researchers and extension specialists and agents located at the Palmer Research Center and the Palmer District Extension office have been "going to the farm" increasingly over the past few years as is the trend nationwide.

The concept of sustainable agriculture has attracted federal funding through the Cooperative States Research Service (CSRS) in a program entitled Sustainable Agriculture Research and Education (SARE). This program funds research carried out by a partnership of university researchers and extension people and private farmers or farm organizations. Most of the research and demonstration activity is carried out on private farms and emphasizes reducing off-farm inputs such as pesticides and fertilizers for crops and feeds in the case of livestock. The other emphasis of the program is to demonstrate profitability since obviously an enterprise will not be sustainable without being profitable.

Alaska has its own version of SARE in the Alaska Science and Technology Foundation (ASTF). Although ASTF funding is not restricted to agricultural projects, the Agricultural and Forestry Experiment Station has joined with private producers in developing research and demonstration projects that generally have a component of the work carried out on the private farm.

Dr. Steve Dofing, Palmer plant breeder, joined with Delta Junction farmers Dennis Green and Paul Knopp in an ASTF project entitled "Use of Alaska-Grown Canola in Dairy Cattle Diets." The objective of the study was to determine the feasibility of replacing expensive imported protein and fat supplements with canola, a crop that can be grown in Alaska. The canola was produced on Dennis Green's farm using university production recommendations and incorporated into dairy cow diets on Paul Knopp's farm and the experiment station farm at Palmer.

Preston Pyrah, Pioneer Peak Farm, applies wavelength selective plastic mulch to vegetable fields. He is assisted by Andrea Robb, agricultural assistant with the Alaska Cooperative Extension (courtesy photo).

First year on-farm trials showed diets containing canola were as economically efficient as non-canola diets using imported supplements. The investigators concluded in AFES Research Progress Report No. 30 that, "Adding canola to the list of commercially viable Alaska feed

crops increases the state's economic diversification, adds stability to the agriculture industry, and more fully uses Alaska's natural resources."

Vegetable and potato producers in the Matanuska Valley have benefited from on-farm research and demonstrations carried out by experiment station researchers and Alaska Cooperative Extension specialists and agents. Another ASTF funding on-farm demonstration project was carried out cooperatively by ACE District Agent Jerry Purser and Palmer area farmers Ted and Preston Pyrah of Pioneer Peak Farm. This project investigated the potential benefits of wavelength selective plastic mulch in the production of a wide range of vegetables including some that can not be commercially grown in Alaska without artificial warming of the soil.

"This project demonstrated that warm season crops such as summer squash, green beans, pumpkins, and cucumbers can be successfully and consistently grown using plastic mulch technology," said Purser.

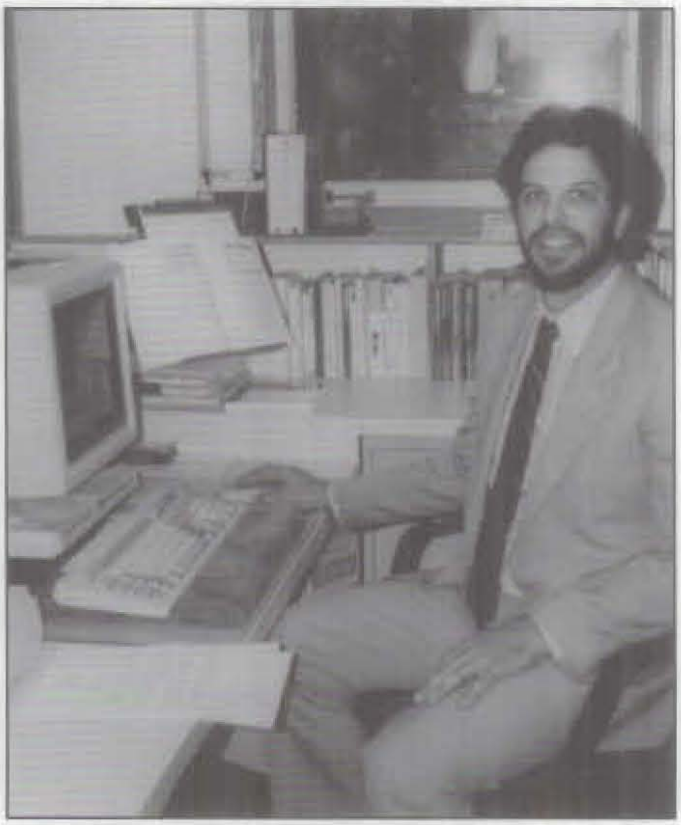
Paula Giauque, owner of Gold Nugget Farms, was assisted by Dr. Jenifer McBeath, plant pathologist, in selecting a tip burn resistant variety of lettuce for her commercial farm. Dr. McBeath arranged with Dr. Phillip Sarreal of Harris Moran Seed Company in Monterey, Calif. to set up planting of 80 lettuce varieties on the Giauque farm. While Drs. McBeath and Sarreal collected valuable research data, Ms. Giauque observed the different varieties throughout the growing season and, in consultation with the researchers, selected a promising variety for use in the majority of her plantings the following year. The variety "Alpha" proved to be a winner for Ms. Giauque.

"Alpha performed extremely well for us in nine separate plantings in 1993," said Giauque. "We had one of our best years with very little disease or tip burn. The marketability of the lettuce was outstanding."

Another lettuce producer, Ben VanderWeele, was assisted by Drs. Don Carling and James Walworth. They placed a field trial on his farm to test a soil fumigant, metam-sodium, as an agent to kill weed seeds in lettuce. While the first year results are not conclusive, they were promising enough to warrant further study.

"We don't have a really good traditional herbicide that works well for lettuce production," according to VanderWeele. "As a result, we have to resort to time consuming and expensive hand hoeing. If some combination of metam and mechanized cultivation could free us from the majority of the hand hoeing, it would be very beneficial."

Environmental concerns are also being addressed in on-farm research. In a project sponsored by the U.S Environmental Protection Agency, Dr. Walworth and Extension Agronomist Dr. Ray Gavlak are investigating the use of fish bonemeal—a fisheries



Dr. Stephen Dofing (top left) talks to farmers at Delta Junction. Dr. Jim Walworth (above) helped lettuce producer, Ben VanderWeele, by placing a field trial on his farm to test a soil fumigant as an agent to kill weed seeds in lettuce (Photos by Donna Gindle).

waste product—as a fertilizer material in trials on the Paul Huppert farm near Palmer. In addition to measuring effects of bonemeal rates on production, they are also assessing the effects of organic nitrogen source on nitrate movement and potential impact on water quality compared to man-made fertilizers.

According to the *1993 Alaska Agricultural Statistics (2)*, total cash receipts for Alaska-produced farm products, excluding greenhouse production, exceeded $10 million. On-farm research and demonstrations will continue to provide farmers with current production technology and literally show them the way to increased profits. We intend to be leading the way.

Laurie Wilson, top left, works in Palmer's lab as a soils technician. Dr. Don Carling, top right, is a professor of horticulture (Photos by Donna Gindle).

Paula Glauque, right, owner of Gold Nugget Farms in Palmer, worked closely with Dr. Jenifer McBeath, plant pathologist, in selecting a tip burn resistant variety of lettuce for her commercial farm (Photo by Dr. Jenifer McBeath).

CO_2: Better in the arctic?

By: Jennifer Edmonds
Journalism Intern

Increased levels of carbon dioxide could have a positive effect on plant productivity in Alaska. Supervisory Soil Scientist Verlan Cochran and Dr. Jeff Conn, agronomist, with the United States Department of Agriculture, Agricultural Research Service are initiating a study to determine the impact of increased CO_2.

Carbon dioxide studies in Hawaii indicate a 13 percent increase in atmospheric carbon dioxide since 1958 when monitoring began. The most dramatic change is seen in the arctic, where carbon dioxide levels are now greater than those in mid-latitudes.

Some scientists fear greenhouse gases will absorb radiation from the earth and trap it in the atmosphere, causing global warming.

Possibilities of global warming, in turn, fuel other debates. Many environmentalists and scientists argue that global warming will change climate patterns, causing a redistribution of agricultural and economic bases.

Despite catastrophic effects global warming could have on some areas, Cochran and Conn believe it might benefit agriculture in Alaska. The two USDA researchers say global warming could mean longer growing seasons for Alaska. With longer growing seasons, farmers could expand their variety of crops and agricultural development wouldn't be as restricted by Alaska's continental climate.

"I think we will see a yield increase from carbon dioxide," Cochran said.

In experiments where crops were exposed to twice the current level of carbon dioxide, those crops produced an average of 32 percent more, according to a 1983 study by ARS Researcher Bruce Kimball of Arizona. However, yield increases will probably be lower in Alaska.

"Cooler temperatures and lower light levels in Alaska will probably prevent yields from increasing the entire 32 percent," Conn said.

Nutrient deficiency can also inhibit plant responses, Cochran added.

The two scientists will be the first to test carbon dioxide on agricultural plant yields in the subarctic. All previous work has been done in the southern temperate zones or in the arctic.

"Alaska is the northernmost fringe of agriculture in North America. You just can't duplicate it's climatic conditions," Conn said.

The scientists will conduct studies for the Agricultural Research Service on the University of Alaska Fairbanks campus. The research, funded by USDA as part of the annual federal budget, will cost approximately $300,000 per year.

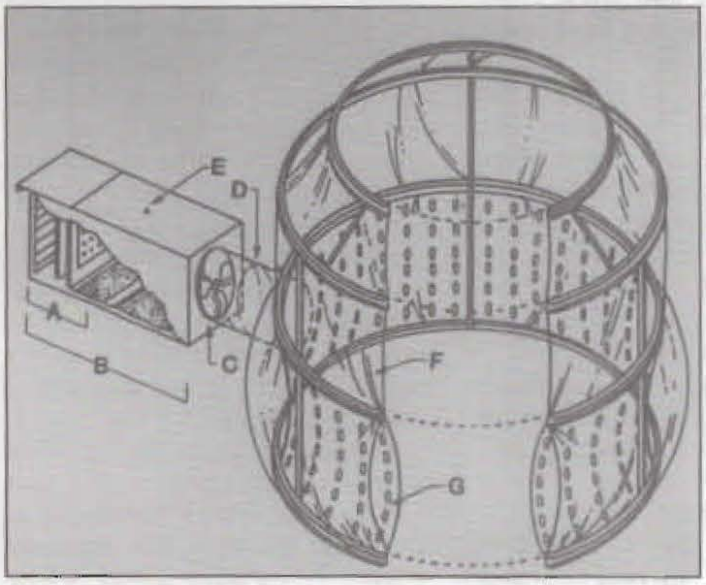
Cochran and Conn will experiment with potato and barley to determine plants response to increased carbon dioxide exposure. They will measure plant biomass, rate of development, leaf area and thickness and the number of roots, relative to carbon dioxide increases.

"Among the field crops grown in Alaska for human consumption, potato and barley bring in the most money," Conn said. "They are currently the best adapted field crops for our climate."

In addition to monitoring plants for signs of mass increase and accelerated development, they will test plants' water efficiency. When plants are exposed to higher carbon dioxide levels, stomates—openings in leaves—don't have to open as wide for carbon dioxide to diffuse. Consequently, less water is lost. Experiments with increased carbon dioxide levels in more temperate locations have shown improved water efficiency of plants and more drought resistance, according to a recent U.S. Department of Energy report.

This would be great for farmers agrees local potato farmer Paul Shoen. "There is usually not enough moisture during May and June. Whereas, in the later months we have adequate or excess moisture," Shoen said.

Despite the advantages global warming might have on Alaska in terms of longer growing seasons and possibly a warmer climate, it still wouldn't have a dramatic affect on agriculture unless the market improves.



Composite drawing of the USDA-ARS open top chambers for studying effects of increased CO_2 on plants in the subarctic.

Chamber parts:

A—*particulate filter*
B—*fan box*
C—*0.75 HP fan*
D—*connecting duct*
E—*CO_2 injection port*
F—*lower panel with CO_2 inlet holes*
G—*upper panel*

"It's not the climate which limits agricultural production in Alaska, but the market," Cochran said. "There's not enough demand for the crops we have now."

Globally, improved water efficiency would allow crops to be planted in areas that are currently too dry to farm. At the same time, water used for irrigation would decrease. Farmers could expand crop variety and improve the quantity of food available for the world's growing population.

The USDA research is scheduled to begin in May on a one-quarter acre piece of university farmland.

Once the crops are planted open top chambers, 10 feet in diameter and 6 feet high, will be placed around the crops. Three chambers of barley and three chambers of potatoes will be grown using twice the current level of carbon dioxide, three more of each are to be grown at the current amount. Potato and barley crops will also be grown on plots outside the chambers to study the effects of chambers on plant growth.

Carbon dioxide will be blown into a chamber through holes in the bottom of the wall and distributed to the plants. Air samples will be pulled out of each chamber and fed into an infrared gas analyzer, which will determine the carbon dioxide content in the chambers. Plants will be monitored by leaf photosynthesis analyzers, measuring the amount of net photosynthesis occurring at each carbon dioxide level. Every two weeks plants in one chamber will be harvested to determine plant and leaf weight. Soil will be sampled and the number of roots counted.

"Plants tend to put more of their carbon resources into root production when exposed to carbon dioxide," Conn said.

Researchers will compare the results to similar studies conducted in southern climates to see if the physical environment of the subarctic influences plant response to increasing atmospheric carbon dioxide.

Cochrans work, play, stay together

Verlan and Diana Cochran have a situation which could and would be tough on most marriages: they work together. Verlan is a supervisory soil scientist with the United States Department of Agriculture. Diana is a secretary for the Agricultural and Forestry Experiment Station. Although they don't fall into the same command channels, they have worked in the same office for three years. But rather than taking its toll on the two, to observers, they seem to be each others best friend.

"Working together has its advantages and disadvantages," said Diana. "It would not be a good choice for everyone."

Verlan was born Feb. 19, 1938 in Declo, Idaho. He earned his bachelor of science degree from California Polytechnic University in 1966 and a master of science degree in 1971 from Washington State University. Verlan's professional and research interests include solving problems in conservation tillage systems for small grains, and then there's his work with carbon dioxide studies.

"My current interest is the work we are doing now with the interaction of day length and plant nutrition on plant growth

under elevated atmospheric levels of CO_2. We will be working in the university's field using the open-topped chamber system that ARS is constructing at the Fairbanks Experiment Farm. This facility is the northern most facility of this type in North America and will allow us to study plant responses to elevated CO^2 under conditions which aren't available at lower altitudes."

Diana was born July 13, 1945 in Walla Walla, Wash. She met Verlan while she was working at WSU and Verlan was a graduate student. They were introduced by their respective roommates. That was in 1966. Three years later, on June 21, they married. The Cochrans have two sons, Dean, 22 and Vincent, 19.

A close family, their interests range from water skiing to cross-country skiing to camping.

"Verlan shares the meal fixing and the housework," explained Diana. "We don't need a bread maker because Verlan bakes bread. His mood and the weather determines the frequency of bread we get."

Diana explained that she and Verlan have separate interests also.

"I am involved with an international educational organization, do things with friends and take walks. Verlan does projects around the house and works on vehicles by himself or with the kids. Plus, his business trips gives us both the breaks we need.

"Besides, the biggest advantage of working together is that it is preparing us for retirement."

Scientist harnesses dog power

By: Donna Gindle
Editor

By day he's a research agronomist with the United States Department of Agriculture. But when Dr. Jeff Conn leaves his office, he's a different man. This scientists turns into a musher.

A quiet, soft-spoken man with a dry sense of humor, Conn hardly seems the type one would expect to own and race 60 dogs. And yet, this Tuscon, Ariz. native does just that. After accepting a job with USDA's Agricultural Research Service unit which works in conjunction with the Agricultural and Forestry Experiment Station Conn and his family moved to Fairbanks in 1980.

"Bob and Sharon Schlentner (Sharon is Conn's co-worker) gave me an old leader to use when I went skiing in the Alaska Range. After that, I bought two more dogs and started mushing. I tried racing and liked it. That was in 1983."

The 41-year-old Conn has proven he isn't a lightweight musher. His victories include running to a second-place finish in the 1987 Limited North American Championship 3-dog class; winning numerous 6-dog races from 1987 through 1989; open class points champion in 1991; winning the SuValley Open Class Championship in 1991; and finishing 10th in the Anchorage Fur Rendezvous in 1991 and 1992. His goal is to win the Open North American Championship.

The Open North American has been held annually in Fairbanks in March each year since 1946 and consists of three heats held on consecutive days. The race starts in downtown Fairbanks on the Chena River and uses the Alaska Dog Musher Association trails. The race is 20 miles long on the first two days and 30 miles on the third day.

But even if he does win this particular race, chances are extremely high that his name won't become a household word. According to Conn, the glamour is in the Yukon Quest and the Iditarod.

"Unfortunately, due to the drama and range of the distance races, attention on the open class races has faded. I keep getting asked 'When are you going to run the Iditarod?' Sometimes I answer, 'When are you going to start marathon dancing?'

"I don't intend to enter the Yukon Quest or Iditarod," said Conn. "Prior to the 70s the long distance races did not exist. The Open North American and the Fur Rendezvous were the races that mushers aspired to win. The open classes, where an unlimited number of dogs can run, are still the ultimate test of speed and endurance in sled dogs.

"A good comparison of the Open North American and the Iditarod is like the Grand Prix automobile races versus the Baja Endurance race. I don't have any desire to stand on the back of a sled for days without sleep, watching dogs plod along. I enjoy the speed and thrill of driving an open class dog team that averages 20 miles an hours for 20 miles or more."

The entire Conn family is involved in mushing. Elaine—Jeff's wife—and their two children Rachel, 13, and Paul, 16, have all raced and won. Elaine won the Alaska Feed Gold Run, 6-dog class in 1991; Paul has represented Alaska in the Arctic Winter Games in 1990 and 1992 and won all races in dog mushing. He has been the 2-dog, 3-dog, and 8-dog Junior North American Champion and is currently president of the Alaska Junior Mushers Club. Rachel is treasurer of the AJM and has been the 2-dog and 6-dog Junior North American champion.

Southeast Alaska's temperate rainforests

By: Robert A. Ott
Forest Ecologist

The temperate rainforests of Southeast Alaska are characterized as having a high-frequency, low-intensity disturbance regime. In other words, the most common types of disturbances occur often, but they do not cause much damage.

Wind-created disturbances are the most frequent type of disturbance in these forests. Temperate rainforests are highly susceptible to wind damage because of the combination of shallow root systems, poorly drained soils, and high winds—usually during peak rain intensity. Wind disturbance events typically are small-scaled and involve single trees or small groups of trees. These small-scale disturbances are called canopy gaps, because tree death creates a hole, or gap, in the forest canopy. Actually the hole in the canopy is called a canopy opening and the ground under the opening is called a gap. However, large wind-created disturbances do occur. Avalanches, rock slides, debris-flows, disease, insects, and snow-breakage also disturb forests of this region.

For the past three summers I have been describing the small-scale natural disturbance regime in forests of Southeast Alaska and the influence of the disturbance regime on vegetation structure and diversity. Some general patterns are beginning to emerge, based upon preliminary results.

I determined the amount of land area in canopy gaps for numerous sites in the northern part of the Tongass National Forest. The amount of land area in canopy gaps was highly variable, with values ranging from 8 percent to 34 percent. Values varied within a particular plant association as well as between plant associations. A plant association is a group of plants that predictably grow together. This variability is probably most highly associated with soil drainage and the strength of wind to which a forest is exposed. Forests with water saturated soils and, or, exposed to strong winds are probably more prone to disturbance than forests with well-drained soils and, or, exposed to less intense winds.

Only canopy gap sizes in western hemlock and shield fern plant associations were measured. Gap sizes varied from 6 m^2 to 212 m^2. However, most canopy gaps areas were less than 50 m^2. More than 70 percent of the canopy gaps were caused by the death of several gapmakers. Gapmakers are trees whose death results in the creation or expansion of canopy gaps.

I also determined the percentages of different gapmaker types in western hemlock and shield fern plant associations. Snapped gapmakers were the most common and comprised from 64 percent to 95 percent of all gapmakers. Root-thrown gapmakers were the second most common, comprising from 5 percent to 26 percent of all gapmakers. Root-thrown gapmakers are trees that pull their roots out of the ground when they fall. Dead standing gapmakers comprised up to 15 percent of the gapmakers. Dead standing gapmakers form from the gradual death of a tree that remains standing. Leaning gapmakers were not common comprising only up to 2 percent of the gapmakers.

Estimating the proportions of gapmaker types is important because different types have different impacts on forest dynamics. Root-thrown gapmakers, and leaning gapmakers to a lesser extent, disturb and mix the soil. Some forest plants may only be able to grow on this exposed soil. Because of their gradual death, dead standing gapmakers gradually let increased amounts of light penetrate into the forest interior, and growing space and nutrients gradually become available to other plants. However, root-thrown and some snapped gapmakers form when a tree crown is quickly removed from the forest canopy. The rapid removal of the crown results in a sudden increase in the amount of light that penetrates into the forest. There is also a sudden release of growing space and possibly nutrients to other plants. When a leaning gapmaker is formed there is a sudden increase in light into the forest, but growing space and nutrient levels may not increase because the leaning tree is still alive. Plants respond differently to the different patterns of increased light levels, growing space and nutrient levels.

When gapmakers are formed, they eventually fall to the forest floor making woody material called coarse woody debris. Coarse woody debris is important in some forests as a place for trees to germinate and grow. The importance of coarse woody debris appears to vary among my study sites.

At a site with moderate drainage and a heavy moss layer on the forest floor, 56 percent of the gap trees

were growing on coarse woody debris. A gap tree is a young tree that is growing in a forest gap. At two well-drained sites with much less moss growing on the forest floor, 31 percent and 44 percent of the gap trees were growing on coarse woody debris. There is some evidence that suggests that moss inhibits successful establishment of new trees. However, I will not know how important coarse woody debris is on these sites until I calculate how much of it is on the forest floor. For example, if the site with 56 percent of the gap trees growing on coarse woody debris has 56 percent of the forest floor consisting of coarse woody debris, then coarse woody debris is not more important for tree growth than the rest of the forest floor. However, if only 25 percent of the forest floor is coarse woody debris, and 56 percent of the gap trees are growing on it, then it is probably very important for establishment of new trees.

Understanding direction of treefall is important because of the role of coarse woody debris for tree establishment and survival in some forests. In forests where coarse woody debris is important, the structure of the forest (in this case the spatial arrangement of trees) will be greatly influenced by the arrangement of this material on the forest floor. Understanding forest structure is important because it greatly influences how the forest functions. For example, in a forest where coarse woody debris is important a canopy gap may persist for many decades if coarse woody debris does not fall into the gap. This is because trees wouldn't have a good place to germinate and grow. However, a gap that persists for a long time can be a good place for blueberries and other shrubs and herbs to grow. These plants could provided food for wildlife.

I am finding that treefall direction is largely determined by the interaction of wind and topography. The directions of treefalls in forests growing on flat areas seem to be most influenced by the direction of locally destructive winds. However, treefall patterns on steep slopes can be very complex. Some trees fall in the direction of the locally destructive winds, while others fall downhill at angles of up to 90° from the wind direction. Still other trees fall somewhere between downhill and with the wind direction.

Trees growing near an existing disturbance appear to have a greater chance of being killed by wind than trees growing within a closed canopy portion of a forest. However, the direction that these trees fall is determined by wind direction and topography as discussed above.

I am also interested in how different tree species respond to small-scale natural disturbances. The two dominant tree species in Southeast Alaska are western hemlock and Sitka spruce. Western hemlock survives and even grows in low light conditions typical of the region's forests. Sitka spruce needs more light to survive. Can Sitka spruce maintain its presence in forests by growing in small-scale disturbances where the amount of light may be higher than in the surrounding forest? It appears so at one of my study sites, with Sitka spruce representing 12 percent of the replacement trees and 5 percent of the larger trees in the overstory canopy. A replacement tree is a tree that is likely to reach maturity and "replace" a gapmaker.

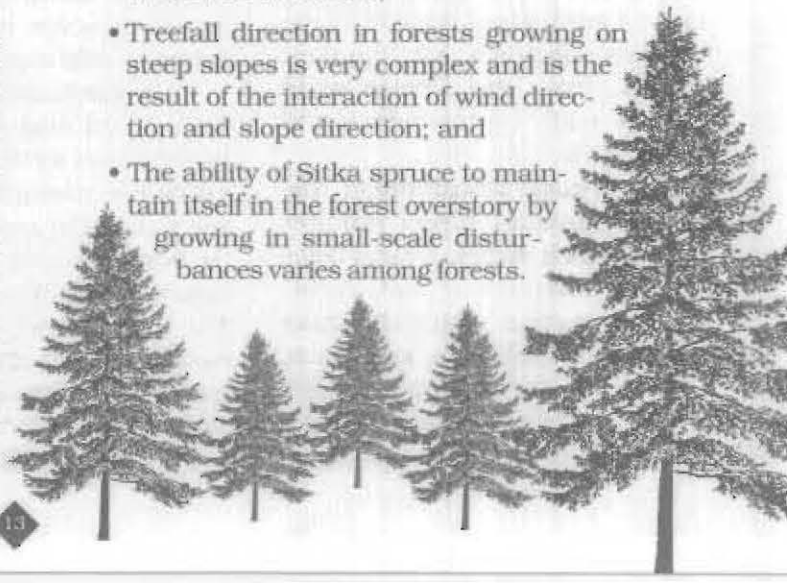
In another study site, Sitka spruce is not present in the sample of replacement trees or in the overstory canopy. The oldest trees in this forest are 300 to 500 years old, and light levels are very low. It is believed that Sitka spruce was once found in the forest, but was gradually replaced by western hemlock, because of hemlock's ability to grow in low light.

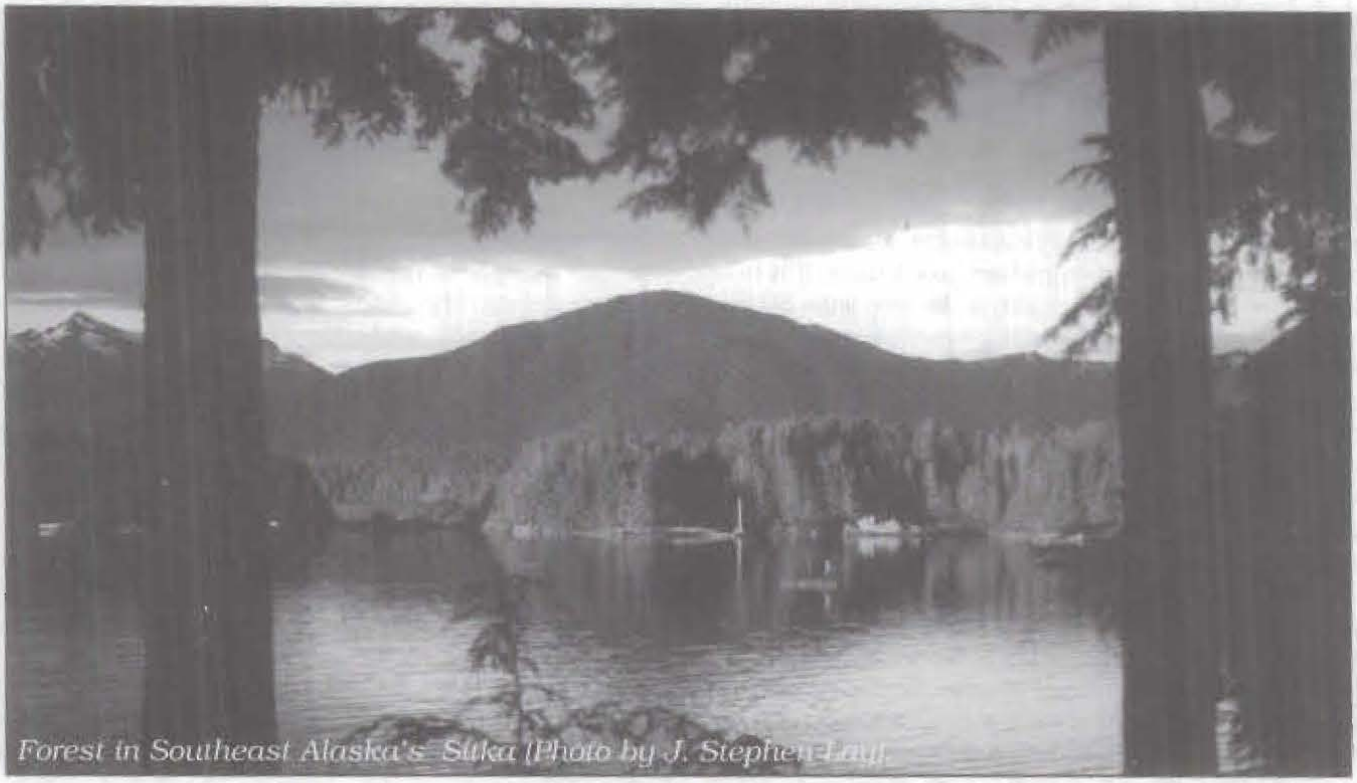
In a third study site, Sitka spruce is not present in the sample of replacement trees but makes up 9 percent of the larger trees in the overstory canopy. The mature spruce in this forest became established around the edges of rock slides. It appears that western hemlock replaces Sitka spruce trees when the spruce die. Over time the percentage of spruce in the overstory will probably decline, unless more rock slides or other large disturbances create a higher light environment that allows spruce to survive to maturity.

Results of my study in Southeast Alaska show that small-scale disturbance regimes are highly variable, in terms of both amount of land area in canopy gaps and in the distribution of gap sizes.

The following generalizations can be made about small-scale disturbance regimes in western hemlock and shield fern plant associations based upon my preliminary results:

- Most canopy gap areas are less than 50 m^2;
- The order of gapmaker types from most common to least common is: snapped, root-thrown, dead standing, and leaning;
- The importance of coarse woody debris to tree establishment and survival may be related to the amount of moss present on the forest floor;
- Treefall direction in forests growing on flat areas is largely explained by the direction of destructive winds;
- Treefall direction in forests growing on steep slopes is very complex and is the result of the interaction of wind direction and slope direction; and
- The ability of Sitka spruce to maintain itself in the forest overstory by growing in small-scale disturbances varies among forests.





Forest in Southeast Alaska's Sitka (Photo by J. Stephen Hay)

Understanding natural disturbance regimes helps forest managers make sound management decisions

By: Robert A. Ott
Forest Ecologist

Forests systems are constantly changing in both space and time. Disturbance is a major cause of these changes. Forests are disturbed by many natural causes. Large-scale disturbances disrupting relatively large forest areas include avalanches, volcanoes, earthquakes, floods, fire, and severe wind storms such as tornadoes and hurricanes.

Small-scale disturbances disrupting smaller forest patches include rock slides, debris-flows (flowing mixtures of soil, rocks, trees, and other material), insect and fungus outbreaks, ice storms, browsing by large mammals, and wind breakage of one or several trees. The same agents that cause small-scale forest disturbances can result in large-scale disturbances, and vice versa. For example, rock slides and insect outbreaks happen across a range of sizes. Ultimately, observers designate disturbances as large- or small-scale based on their frame of reference.

To understand the specific effects of natural disturbance on larger forest systems you should know the disturbance regime—the pattern of occurrence of disturbances—and the forest response to the disturbance regime. The disturbance regime can be described through the patterns of tree death across a landscape and over time. Researchers can measure the following characteristics of naturally disturbed forests and their disturbances:

- Sizes or area disturbed;
- Intensity or strength, and severity or the amount of damage;
- Frequency of disturbances;
- Regularity or predictability of disturbance; and
- Average time required to disturb the entire forest.

From an ecological perspective, understanding natural disturbance regimes contributes to our understanding of dynamics within a forest and how and why different forest types vary with regard to structure and function. Forest structure is the set of physical characteristics such as tree spacing, age, and height. Forest

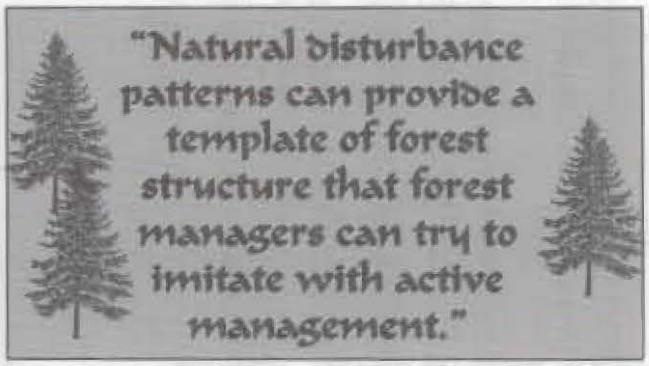
function is the movement of materials such as energy and nutrients.

Tree death is an important ecological process that influences forest structure and function in many ways. Dr. Jerry Franklin and several of his colleagues identified the following ecological changes brought about by tree death:

1) Changes in tree population structure;
2) Changes in community structure (a community is all of the populations of plants, animals, bacteria, and fungi living in a given environment and interacting with each other);
3) Conversion of live tree tissue to dead tree tissue;
4) Release of resources such as light, nutrients, and moisture;
5) Storage of resources such as nutrients by organisms that decompose dead plant tissue (nutrients are "stored" in the bodies of the organisms);
6) Creation of new resources such as snags—dead standing trees, logs, and habitat for animals; and
7) Performing work such as soil mixing by uprooting of trees.

From a forest management perspective, understanding natural disturbance regimes is important because of the link between tree deaths and ecological processes described above. Understanding natural disturbance regimes can be important to making sound management decisions.

Controversy exists as to what constitutes an old-growth forest. Traditionally, old-growth forests have been defined by the presence of structural characteristics such as large logs, snags, and large, old trees. However, if a forest is too small it can have some of the structural characteristics of old-growth but not have many important functions as an old-growth forest. Areal expanse is an important part of any ecological definition of old-growth forest. Sufficient forest size is important for preserving interior forest dynamics, maintaining old-growth microclimate characteristics—such as temperature, moisture, and relative humidity at small-scales—and ensuring long-term persistence of these forests. Understanding natural disturbance and its variability within forests can provide insights into area requirements important to natural functioning of old-growth systems. This increased understanding will allow for a more accurate identification of "true" old-growth habitat.



Maintaining biological diversity has become an important management and conservation issue. Biological diversity is the total number of species—plants, animals, fungi, and bacteria—found in an area of concern. However, applying the concept in management activities typically involves just plant and animal species.

Disturbance is believed to play a large role in the expression of plant diversity in natural ecosystems by preventing dominance by a few plant species and, or, by providing a variety of habitats that allow a variety of plant species to coexist. Natural disturbance enhances animal diversity by maintaining many structures. For example, forest structure determines habitat features such as food abundance, cover, and microclimate. Therefore, knowledge of natural disturbance regimes is important if maintaining biological diversity is a forest management objective.

Forest restoration involves restoring more natural (for example, presettlement) structural characteristics and natural processes of a forest. Knowledge of natural disturbance regimes and their effects on forest structure and function will be a valuable tool to forest managers working in restoration ecology. Natural disturbance patterns can provide a template of forest structure that forest managers can try to imitate with active management. Also, if natural processes of a forest can be restored, restoration and maintenance of structural characteristics should follow.

The concept of management of entire ecosystems and landscapes—termed ecosystem management—on both public and private lands is gaining strength. An ecosystem is a community and the physical environment—such as soil, water, and air—that it interacts with. Landscapes are sets of interacting ecosystems.

Forest ecosystem management will mostly involve forests that are under active management. If natural disturbance regimes of these forests are understood, then forest managers can attempt to imitate them through active forest management. In forests that have historically been influenced by fire, for example, controlled burns of sizes similar to natural fires can be implemented at time intervals that match those of the natural disturbance regime.

Natural resource managers will be challenged to maintain or increase the natural ecosystem processes (such as nutrient cycling and food web interactions) and interactions among ecosystems (such as large logs from a forest ecosystem falling into a stream ecosystem) while still supplying goods and services (such as wood products and recreational opportunities) demanded by society. Natural disturbance regimes may provide the answers needed to develop sound guidelines and models for ecosystem and landscape management. Ecosystem management will probably involve all the management issues discussed above and more. Therefore, understanding natural disturbance regimes and their effects on forest dynamics is increasingly important.

Doctoral candidate vows to make a difference

By: Jennifer Edmonds
Journalism Intern

With the increasing emphasis on ecosystem management of public lands, results from research of natural ecosystems will become an increasingly vital part of natural resources management. Robert Ott, a forest ecology doctoral candidate at the University of Alaska Fairbanks has plunged himself into that research.

"I'm finding that my research is timely and useful to forest managers," he said.

A native of Gowanda, New York, Ott has spent the past three summers conducting research in the northern part of the Tongass National Forest in Southeast Alaska. He maps wind patterns, describes natural disturbance patterns, measures light intensity, and studies the response of forests to disturbances. Currently, he is mapping the wind patterns of more than 275,000 acres of northeast Chichagof Island, and studying natural disturbance regimes on Douglas and Baranof Islands, as well as on Juneau's mainland.

Ott is seeking answers to questions such as: "How does wind flow across the complex topography of Southeast Alaska?" "How do wind, topography, and disturbances interact to influence treefall patterns at site and landscape levels?" "What is the size distribution of natural patches in forests?" "How do the sizes of patches vary over the landscape?" "Is coarse woody debris important for establishment of new trees?" "How do different tree species respond to natural disturbances?" "What is the importance of small-scale disturbances to the maintenance of plant species diversity?"

Answers to questions like these will help forest managers plan future activities so that wood products can be derived from the forest while maintaining natural forest processes.

Ott was born May 15, 1961 in Madrid, Spain. He hopes to finish his Ph.D. in June 1994. His goal is to continue his research on forest ecosystems in Southeast Alaska as well as expand his work to the boreal forests of Interior Alaska.

"Even as a child I was interested in the forests. I wanted to know how they work and interact with other elements of the natural world."

Ott received his Bachelor's of Science with a dual major in forestry and forest biology and his Master of Science in wildlife biology from the SUNY College of Environmental Science and Forestry in Syracuse, New York. He thinks he can make a difference in forest management by conducting timely and relevant research as well as effectively communicating new research findings to managers.

"It (forest management) must be a team effort, especially with the increased emphasis on managing the entire ecosystems and landscapes. Historically there has been a communication gap between managers and researchers. Either researchers aren't addressing the needs of forest managers, or managers are not seeing the relevance of information we give them," Ott said. "I would like to bridge that gap."

When not working, studying or writing his dissertation, Ott enjoys nature photography, hiking, identifying wildflowers, bird watching, camping, and exercising.

Researchers probe Hagemeister Island reindeer die-off of 1992

By: J. Stephen Lay
Communications Manager

Reindeer used to freely roam Hagemeister Island. Now only a few are spotted over the barren terrain. Where have they all gone?

The Alaska Department of Corrections took possession of approximately 293 reindeer to use in Project Hope teaching Native inmates reindeer management and handling practices. Project Hope is the interim caretaker for the reindeer and will be until the future of the herd can be determined. Those reindeer were the ones that escaped the rifle.

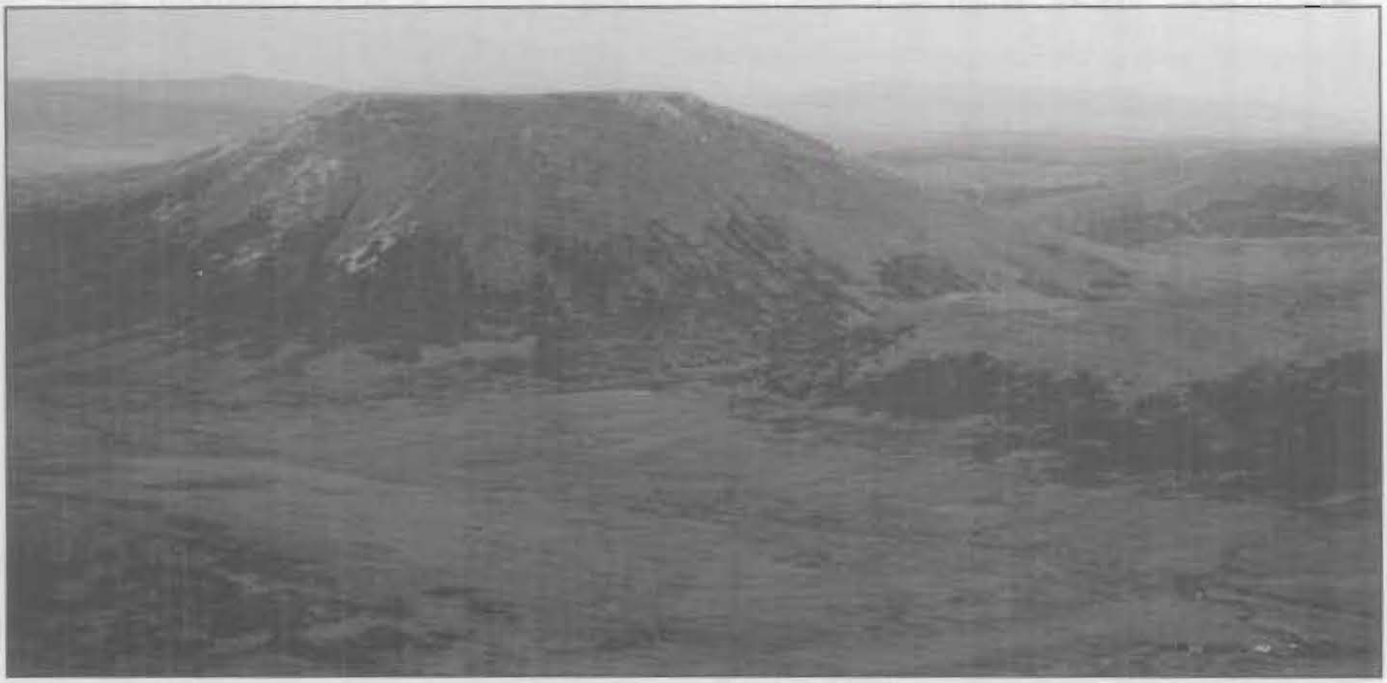
In 1992 and 1993 the U.S. Fish and Wildlife Service killed more than 700 reindeer that lived on Hagemeister. When the Fish and Wildlife Service first announced its plans to shoot the deer, controversy erupted. At first the service defended its decision on humanitarian grounds, saying it was more humane to kill the deer than to allow them to starve to death. In 1993 they justified removal to prevent further deterioration of the range from overgrazing.

Area residents, primarily from the villages of Togiak and Twin Hills, protested the slaughter. Newspapers journalists wrote editorials; hearings were held and legislators asked questions. Emotions soared and defenders of both sides of the issue attacked each other.

The event triggering the decision to remove reindeer began in the spring of 1992. A group of research investigators from the USFWS, USDA Soil Conservation Service and UAF Reindeer and Game Farming Research Program found more than 270 dead reindeer. The majority of the examined carcasses were in a curled, prone position scattered over a relatively small area behind a group of hills. Ninety-five percent of the dead animals were bulls. In June 1992, the entire live Hagemeister Island herd consisted of approximately 70 percent cows, 8 percent bulls and 22 percent calves.

An aerial survey of the island on May 1, 1992 revealed 493 live deer and 163 carcasses. Observers reported that most of the live deer appeared to be in poor condition; they said they could see their backbones from the air. As part of the survey, USFWS landed and examined the range and one carcass.

The examination revealed that lichens and willows were grazed down to the soil. The carcass leg bone marrow filled less than 25 percent of the cavity



Hagemeister Island lies about 19 air miles southwest of Togiak in Bristol Bay. It is 23.25 miles long and seven miles wide at its midpoint. Its land area is about 67,500 acres or about 105 square miles (Photo by J. Stephen Lay).

and was red and watery, a clear sign of starvation.

In June 1992 the School of Agriculture and Land Resources Management's Reindeer and Game Farming Research Program joined the search for answers. A university graduate student and veterinarian, Raphaela Stimmelmayr, examined the carcasses, but they were so badly decomposed that little could be determined. To determine the animals' body condition or if the heard had a disease problem the graduate student and investigation team killed and examined six bulls. The autopsies revealed that the animals were in good condition for the time of year. There were no signs of malnutrition or disease-related suffering.

While this was happening, researchers were also examining the range. Their findings show that the non-lichen ranges rated from good to excellent. However, ranges with lichen growth weren't doing so well. Researchers found that lichens were almost nonexistent and only stubble and bare soil remained in some former lichen areas.

Lichens are a key in both the health of the island and the reindeer. It covers the ground and prevents erosion and is usually the primary ingredient of reindeer winter diets. In a little more than three decades, the reindeer had consumed hundreds of acres of lichens.

Since the reindeer were found in an area where lichens previously grew, the question was asked if the '92 die off was related to this loss of lichens.

Documentation exists that proves that in maritime climates—like that of Hagemeister Island—lichens, although a preferred food, are not a necessity. On Umnak Island, South Georgia Island and in Scotland, reindeer live and thrive without lichens.

Another fact disputing the lichens critical effect was that season's successful birth rate. Researchers counted 200 calves; approximately 31 percent of the females had calves. Among healthy, free-ranging reindeer and caribou herds the percent of cows having calves can vary from a low of 8 percent in yearlings to 91 percent in adults.

In caribou when a population lacks sufficient food, reproduction drastically drops. Fewer females become pregnant and the few calves born generally have lower birth weights. Birth weight significantly affects calf survival.

In May, July and September 1993, SALRM's reindeer researchers sent other teams to the island to follow up on the animals' health. Five animals were shot and examined in July. All five were in very good condition. Reindeer, like caribou, build body fat during the summer. The fat reserves carry them through the winter when food is scarce.

From the five animals shot, the two bulls had extensive fat reserves. The females had less fat but that would be expected since they were still lactating. Females tend to add fat throughout the summer with the primary build up after they completely wean their young. Males, on the other hand, gain their fat early. They also deplete it earlier. During the breeding season they quit eating and

Reindeer on Hagemeister Island
A Chronology

1928	Estimated that Hagemeister would support 300 reindeer year round.
1945	Lichen cover averaged 50% and reached 90% in areas.
1965	BLM issued 10-year grazing permits to three Togiak residents.
1965	BIA estimated that the island could support 1,000 to 3,000 reindeer.
1965	71 reindeer introduced to the island.
1967	73 additional adult female deer introduced to the island.
1973	BLM survey found lichens ranges deteriorated and gully erosion serious, advocate reducing herd from 1,000 to 450.
1980	Island became part of the Alaskan Maritime National Wildlife Refuge with passage of Alaska National Interest Lands Conservation Act (ANILCA).
1980	Management transferred from BLM to the U. S. Fish and Wildlife Service.
1987	Range survey finds 80% of lichen producing acreage in poor condition and deteriorating. Estimates 150 years for lichens to recover even if all grazing is halted.
1990-91	Several hundred animals die in winter.
1991-92	Several hundred animals die in winter (estimated 800 died during the two winters).
1992	276 reindeer found dead, apparently from starvation.
1992	120 reindeer removed; 80 killed and meat salvaged.
1992	USF&WS kill estimated 570 deer; an estimated 193 live animals left on island.
1993	293 reindeer removed.
1993	USF&WS kill 135 deer.

begin sparing with other males. This uses their fat reserves. After breeding they begin eating again but don't have enough time to replace the fat burned up during the breeding competition.

Consequently bulls enter the winter with depleted fat reserves. Even in normal winters more males die from weather and malnutrition than females.

When piecing the gathered information over the two years' research, Dr. Lyle Renecker, reindeer and game farming research program director, said this behavior coupled with extreme weather conditions could have caused the die off in 1992. From their aerial census, researchers determined calves had been born later than normal.

"We think that for some reason the females conceived later than normal but the bulls began their breeding behavior at the normal time. As a result they depleted their energy reserves and faced winter with less body fat than normal," Renecker said.

Winter in Alaska also arrived early in 1992. Weather conditions bunched the bulls together and held them in a compact area where they died.

Every winter animals die. Alaska's caribou populations yo-yo with extreme population swings. Food, disease and predation all play a part in these swings. But on Hagemeister Island, if the limiting factor was solely food, then many more cows would have died. The surviving cows would have mothered few, if any, calves.

Instead, on both university visits, the herd contained healthy animals. No diseases were found and the animals' body conditions were appropriate for the time of the year.

Why did so many Hagemeister Island bulls die during 1992? The answer remains unclear and we may never really know. The secret could partially lie in the fact that the Hagemeister animals were also part caribou, which could explain a later breeding season.

However, a few reindeer apparently escaped the shooting and live on the island's gullies and hills. The island remains virtually lichen free. If these undetected animals thrive then maybe a partial answer will emerge.

This bull, left, shot by researchers in July 1993, had extensive fat reserves. The bull was in extremely good condition and showed no evidence of disease (Photo by J. Stephen Lay).

Hagemeister Island Reindeer Population

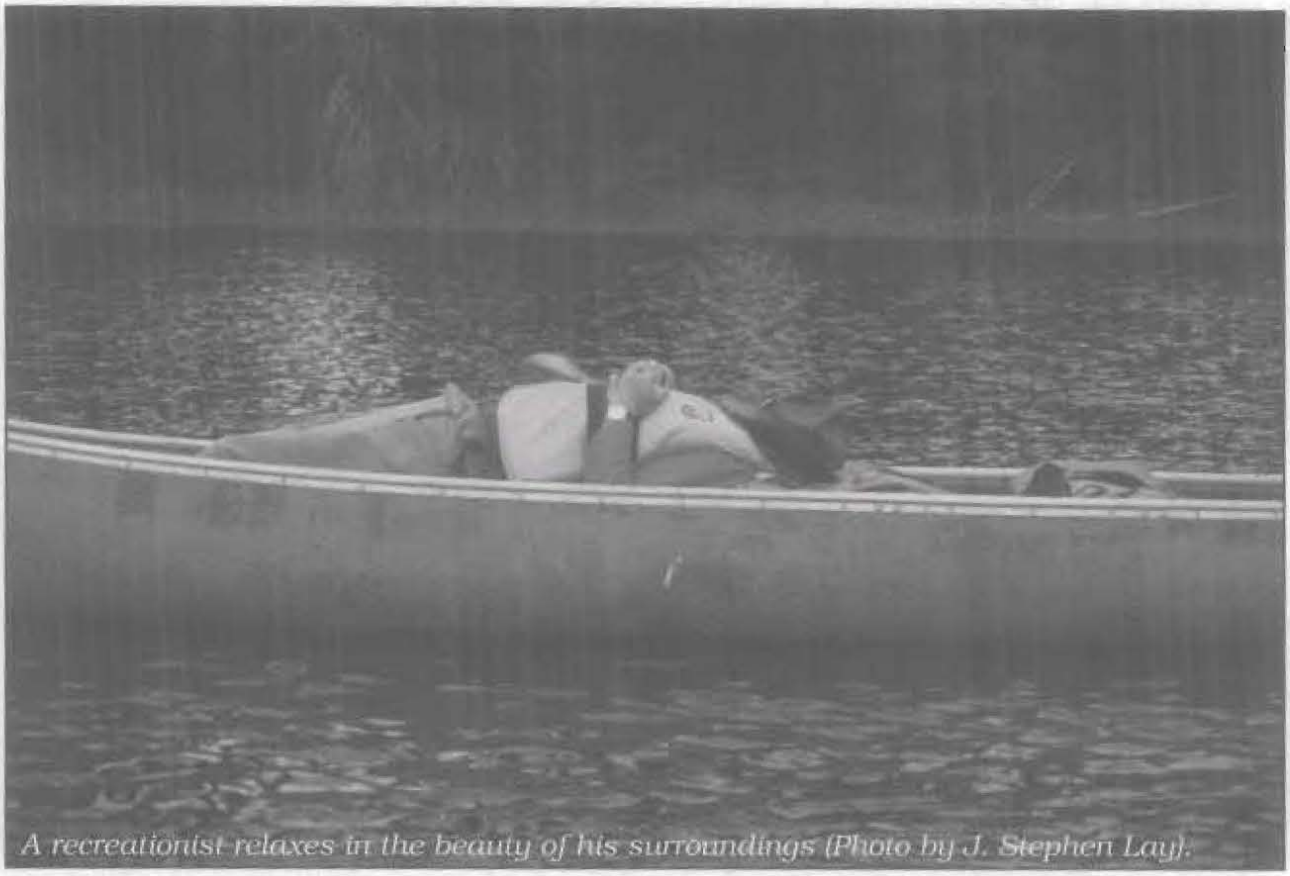
Year	Herd size	Acres per reindeer
1965	71	951
1966[1]	140	482
1967	178	379
1968	234	288
1969[1]	300	225
1970	443	152
1971	1011	66
1972	760	89
1973	435	155
1974	867	78
1975	867	78
1976	854	79
1977	760	89
1978	600	113
1979	650	104
1980	650	104
1981	700	96
1982	700	96
1983	770	87
1984	590	114
1985	733	92
1986	650	104
1987	773	84
1988	1061	63
1990	1530	44
1991	952	71
1992[2]	728[3]	93[5]
	163[4]	

[1]Estimated; [2]Third survey on June 11; [3]Live; [4]Dead; [5]Acres per live animal.

Sources:

Swanson, J.D. and D. LaPlant. 1987. Volume II. *Range inventory of Hagemeister Island.* USDA-SCS Report.

Van Daele, L. 1992. *Reindeer survey of Hagemeister Island-winter mortality.* ANWR Report.



A recreationist relaxes in the beauty of his surroundings (Photo by J. Stephen Lay).

Alaska: Don't kill the goose that lays the golden egg

By: Dr. Alan Jubenville
Professor, NRM

Alaska's outdoor recreation is essential to our—and certainly to our visitors'—well-being and enjoyment of this great and diverse landscape.

The perceived wildness, unique geological and ecological features, exotic critters, and unusual recreational activities ranging from dogmushing to Aurora gazing, gives Alaska tremendous visitor appeal. Without those attributes, the state might attract people who would endure but not find much to enjoy. Nor would they want to stay or return in the future. In sum, there would be fewer people and even less of an economy. To ignore this means Alaska will become less and less a place to live or visit.

Non-resident tourism contributes nearly $1.15 billion annually to Alaska's economy. This makes it the number two industry in the state, based on contributions to the economy. But the contribution to recreation resources goes well beyond the non-resident tourist dollars.

Alaskans also participate in these unique recreational opportunities, consequently contributing to regional and local economies throughout the state. For example, while there are many nonresidents fishing the world famous Kenai River, local residents from Kenai, Anchorage and even Fairbanks also fish it. Thus, recreation in terms of services (guided fishing to bed and breakfasts), equipment (boat sales to backpacks), and supplies (film to fish bait) is important to the economic well-being of Alaska and the individual regional economies. In turn, the long term health of those natural resources is a critical underpinning of the economy.

This is especially true along our limited road system. Protection of the visual qualities along the roads, even while we develop our resources, is critical. This is made even more so since most people's limited perception of Alaska is formed through a looking glass we call the windshield.

Development for services needs to be tastefully done at nodes. We must prevent the strip development, that has been used in some of Alaska, from becoming widespread. This does not mean other resource activities are inappropriate between nodes; it simply means that they may have to be modified to minimize the visual and ecological impacts.

Alaska's state and federal agencies are attempting to accomplish this by providing facilities such as roadside exhibits, viewpoints, campgrounds, boating access, trails and specialized services like

the Watchable Wildlife Program and regional visitor centers. Such interpretive programs enhance the recreationists' experiences by providing information, guided and unguided tours and unique viewing opportunities.

Beyond all this, agencies must encourage the private entrepreneur to provide specialized services allowing more people to enjoy the Alaska landscape, yet minimizing the associated hazards. The specialized services, recently labelled ecotourism, offer the customer unique opportunities that would otherwise not be available. They range from the ultra-adventures of lodge-based fishing to guided whitewater rafting, to simple boat-in day trips for viewing wildlife.

Certainly there are still many unfilled niches in the spectrum of commercial recreational ventures. However, agencies must recognize that many resource areas in the state are very sensitive to recreational use, and usage needs to be monitored and managed to minimize the impact on arctic and subarctic soils and vegetation. Even states in the more temperate climates have realized that without careful management, one could "kill the goose that laid the golden egg."

In that regards, we need to address the following long-term research questions:

- What are the economic impacts of different types of recreational opportunities, including consumer surplus—benefits that accrue directly to the participant beyond what one purchases?
- What are the limits of the resources in sustaining these recreational opportunities over time? Are these limits different for different recreational activities?
- What are the best management strategies for managing these resources for recreation? Can we enhance the durability of those resources for recreational use?
- How can we encourage entrepreneurship on public lands, within identified constraints?
- How can we develop effective partnerships in this public and private interface?
- What are the trade-offs, other than commercial, when we develop specifically for recreation and tourism?

For this professor, recreation's more than a job it's a way of life

Alan Jubenville was first introduced to the wilds of Alaska in 1964, while an Army captain stationed at Fort Wainwright, in Fairbanks. His three-year tour of duty just wasn't enough for him. That's why, he said, he went to the "Trouble of getting a doctoral degree in wildland recreation management at the University of Montana so that I could return.

"I wanted to make myself more employable in Alaska. After all, Alaska is the great, wild playground of America."

And return he did on Jan. 1, 1979, driving the Alaskan Highway when temperatures were -72°F.

"I am happy to report that Alaska is as exciting as ever and recreation **is** the dominant land use—if there is such a thing spread over the state's 375 million acres," said Jubenville, a natural resources management professor for the School of Agriculture and Land Resources Management.

"Many new parks, refuges, wildernesses, recreation areas, and other conservation units have been added here; certainly more will be dedicated in the future. Regardless of the type of area, my concern from the beginning was the proper management of unique natural resources and the recreational opportunities they provide. Since all of the basic management models have serious flaws, my graduate students and I are developing an offshoot called Equilibrium Theory. This model is taking focus and is underpinned by sound management theory, and addresses the serious flaws in the other models.

"People management is, and will be for the foreseeable future, the enigma of the public land manager. There is hope on the horizon. Research is beginning to focus on understanding the linkage between recreation management programs and how the visitor responds. That kind of knowledge would give the manager the 'lever to pull' to create any desired patterns of use of the landscape."

Jubenville was born in Portsmouth, Va. April 22, 1940. "I am a Virginian by birthright but an Alaskan by the grace of God!"

Examining a part of the forest ecosystem puzzle

By: Tricia L. Wurtz
Research Ecologist

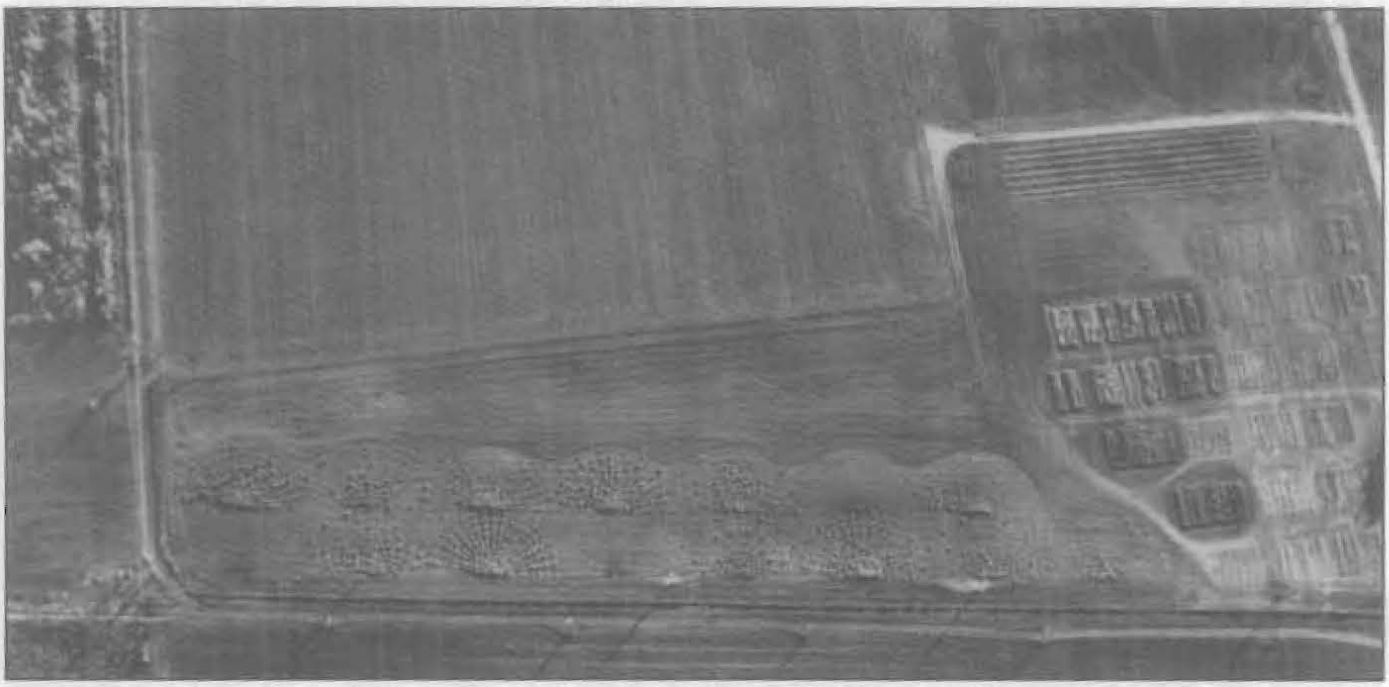
If you rode the Alaska Railroad past the UAF Agriculture and Forestry Experiment Station Farm a few summers ago, you may have noticed thousands of blue and yellow pin-flags arranged in "seashell shapes" across one of the farm's fields. That field is a special research plantation that, over the next 20 years, will be used to examine interactions between two common, long-lived boreal forest species. Since that first summer, the sea of yellow and blue pin-flags has been replaced with a sea of white spruce and alder seedlings.

Why study interactions between white spruce and alder? White spruce is our most valuable timber species. Most of the timber harvested annually in the Tanana Valley is white spruce; the logs are exported, milled locally for lumber, used to build log houses, and burned as firewood.

Interior alders, on the other hand, have no value as timber. Their short stature and numerous spreading stems seem primarily designed to tangle up hikers and skiers. But alders have at least one ability that makes them important members of the boreal forest ecosystem. They fix large amounts of atmospheric nitrogen and add it to the soil. The sustained yield and the overall health of our forests depends—to a large degree—on protecting and replenishing the nutrients in the soil.

Despite their nitrogen-fixing abilities, not everyone holds the alders in high esteem. As early successional species, alders can quickly colonize harvested areas. They grow more quickly than young spruce trees, producing a shady canopy that can seriously slow the growth of the young trees beneath it. Many forest managers view alders as undesirable competitors with regenerating stands of crop trees. The primary goal of the experimental farm plantation is to examine the balance of positive and negative interactions between alder and white spruce in the early stages of stand development.

The reason we are conducting the research at the experiment farm rather than in the forest is because forest ecosystems are extremely complex. Understanding a portion of the puzzle can require isolating it from all the other variables. The comparatively simple, controlled environment of the experimental farm is the perfect setting to examine a portion of



The plantation consists of a total of 15 plots and almost 6,000 trees. Alders are more visible than spruce in this aerial photo (Photo by Tricia Wurtz).

The primary goal of the experimental farm plantation is to examine the balance of positive and negative interactions between alder and white spruce in the early stages of stand development. The plantation was laid out in 1990 using yellow pin-flags for spruce tree locations and blue flags for alders (Photo by Tricia Wurtz).

the puzzle. In some respects, the plantation can be thought of as a 3.7-acre laboratory experiment.

The "seashell" plantation design being used in the study is called a Nelder plot, after the British statistician J.A. Nelder. In Nelder plots, individual plants are arranged in concentric circles or portions of circles. The radii of the circles follow a geometric progression, so that the space available to an individual plant increases from one radius to the next by the same factor.

Nelder plots are an efficient means of examining the effects of density on plant growth because trials of many different densities can be done in a small amount of space. In this study, Nelder plots have been combined with another experimental plantation type called a replacement series, in which the proportions of two species are varied through a series of plots, while keeping the total number of plants constant. The plantation includes five different species mixtures. The ratios of spruce to alder percents are: 100 to 0; 75 to 25; 50 to 50; 25 to 75; and 0 to 100. Each species mixture is replicated three times for a total of 15 plots and almost 6,000 trees. The newly installed orange fence is designed to discourage snowmachiners from traveling through the plantation in the winter. Snowmachine traffic could damage trees that are just beginning to show above the snow.

The plantation presents an excellent opportunity to address a wide variety of additional questions of interest to forest managers and ecologists. Questions on the effects of spacing and species composition on soil characteristics, tree architecture, tissue nutrient content, sub-canopy light environment, and alder reproductive output can all be addressed. Because trees are long-lived organisms, understanding them requires long-term study. The experimental plantation will thus increase in utility and value over time.

Tricia Wurtz is a research ecologist with the USDA Forest Service, Institute of Northern Forestry; she is an affiliate assistant professor of forest ecology with SALRM.

Art meets science

By: Donna Gindle
Editor

What happens when science and art meet? In the case of a lab technician who works for the Agricultural and Forestry Experiment Station, the answer is abstract. Abstract art, that is.

Darleen Masiak turned her double major of biology and art into her lifestyle. While it may seem that art and science are at the opposite ends of lifestyles, Masiak proves that isn't necessarily the case.

"I've always enjoyed art, science and the outdoors," she explained. "My job allows me to incorporate the three."

In contrast to Masiak's artistic endeavors, her work in both the field and the lab requires that she keep good records and be capable of doing repetitive work accurately. It also requires precision: weighing samples down to the thousandth of a milligram and working with acid digest solutions and other chemicals. And Masiak loves it.

"I have a great boss—Steve Sparrow. He's allowed me to grow in the job and treats me with respect," Masiak said. "I feel like I continually learn. Plus I have the chance to work with students at the university which can be very stimulating."

Masiak's enthusiasm is contagious. Dr. Stephen Sparrow, Masiak's supervisor since 1984, had this to say about his lab assistant.

"I see where we benefit from Darleen combining her art talent with her science work. For example, she sees things in the field that most people wouldn't notice. I really believe it is because of her training as an artist.

"I also think it complements her skills as a problem solver. When procedures don't work as protocol says they should, she improvises and finds another way. If we don't have the right tool or piece of equipment, she still finds a way to do the job. This is especially important when we are doing field work in Delta Junction. We're out in the middle of nowhere. We can't just jump in the car and drive the 90 miles back to Fairbanks to pick up something we forgot."

When the 41-year-old native of Newton, Wis. isn't working at the university, she's probably immersed in her painting at her cabin located on Chena Hot Springs Road.

"It's my way of relaxing and unwinding."

But don't think you are going to walk into Masiak's cabin and find the walls lined with scenic "Alaska-na." Masiak said she doesn't consider that to be a true reflection of nature.

"The world just isn't a picture captured in time. Water is moving, the wind is blowing, there's color and there's movement. Abstract art shows these changes, these movements. When I think of summer, I think of color. It is a feeling rather than an image."

And this feeling is expressed in the painting she titled, *Autumn Snowstorm*. This is Masiak's attempt to capture 1992s early snow fall that caught Mother Nature by surprise, dumping almost 3 feet of snow on trees clinging steadfastly to their leaves.

The canvas is covered with a layer of white paint. Then, like a child set free with finger paint, Masiak splashed blues, greens, reds and golds amidst and on top of the snow. The effect is dizzying, yet indicative of change.

Masiak's artistic talents aren't limited to painting. She recently studied welding and now builds wind chimes. And then there's her wood cuts. She carves pictures into Shina plywood, rolls ink on top of it and runs it through a printing press. The result is a black-ink print.

"Next I want to learn to do abstract sculptures," she said.

Status quo and conformity will never be descriptive words for Masiak. In fact, she's not a person who is easy to sum up. This football addict, who is devoted to *Monday Night Football* and is an avid Green Bay Packers fan, listens mostly to classical music. She loves curling up to a good science fiction on a cold day, and reads anything she can get her hands on the rest of the time.

She grew up on a farm and after graduating from Beloit College in 1975, she wanted to live in New Mexico. However, a job opportunity brought her to Alaska that same year.

"That's when I met Michael and the rest is history." They were married in 1980.

"Michael cooks, I clean," Masiak explained, smiling after saying that she hates to cook. She doesn't put much stock in material possessions and doesn't mind living in an unfinished cabin with plywood floors, walls that haven't been sheet rocked or having no indoor plumbing.

"I'm not bound by material things. I'm usually oblivious to them."

What she is bound to are the

Darleen Masiak, left, poses in front of her sauna. She explains the dynamics of her painting, Autumn Snowstorm, *above. Masiak is a lab technician for the Agricultural and Forestry Experiment Station. She paints to relax and unwind (Photos by Donna Gindle).*

Darleen, left, at home surrounded by her art supplies and paintings in various stages of completion. Darleen and Tracey Papenfuss, 1993 student assistant with the USDA (above), count the number of legumes within a meter at the Fairbanks Research Farm (Photos by Donna Gindle).

things in life that really count: her husband, her friends, and "her Packers." She readily admits that she has a great life, and that her husband is her dearest and truest friend. However, Masiak generally likes everyone.

Dr. Sparrow highlighted her ability to interact with people as being an incredible plus for him.

"She trains the student lab assistants. When they make mistakes Darleen will always correct them, but she does it in such a way that they never feel bad or stupid. She has a lot of patience and great people skills."

This slender, green-eyed, dark complexioned, 5-foot-9-inch brunette, emanates cheerfulness around her. She is happy, optimistic, easy going and extremely caring. Her enthusiasm is contagious, her charm endearing. Life is full of adventures to her and she wants to experience as much as she can.

"If I had to tell you what was the most pleasing aspect of working with Darleen, it would have to be her cheerfulness," Sparrow said. "She's a delight to work with; she works well with other people and she's a good learner."

During the summer of '93, she spent 17 days hiking the Brooks Range with two other painters and three mountain climbers. One of her friends, Bill Brody, who is also an art instructor, arranged the trip that gave Darleen a chance to record the continental divide as an abstract painting.

While most people might have been tempted to exercise and train to get in shape, not Masiak. She just wanted to enjoy the adventure, explore the beauty, photograph the mountains for future paintings, and have fun. No fuss, no hassle.

Masiak's next adventure is a trip where she will ski into the White Mountains. Her husband and "the in-laws" are planning to mush in and she'll follow on skis.

"I just don't know yet if I will be able to ski 20 miles in one day," she explained. "But I'll give it a good try."

Students ask questions, question all answers

By: J. Stephen Lay
Communications Manager

Bioregionalism? Is it a meaningful concept? Or is it a term that has filtered into the natural resource manager's lingo without a determinable definition?

These are the questions that students in NRM 495 are asked the first day of class. They spend the rest of the class trying to find the answer.

"We ask the students to try to determine the meaning of bioregionalism. We give them a theory and encourage them to apply it to situations and then decide for themselves," said Professor Harry Bader, one of the course instructors.

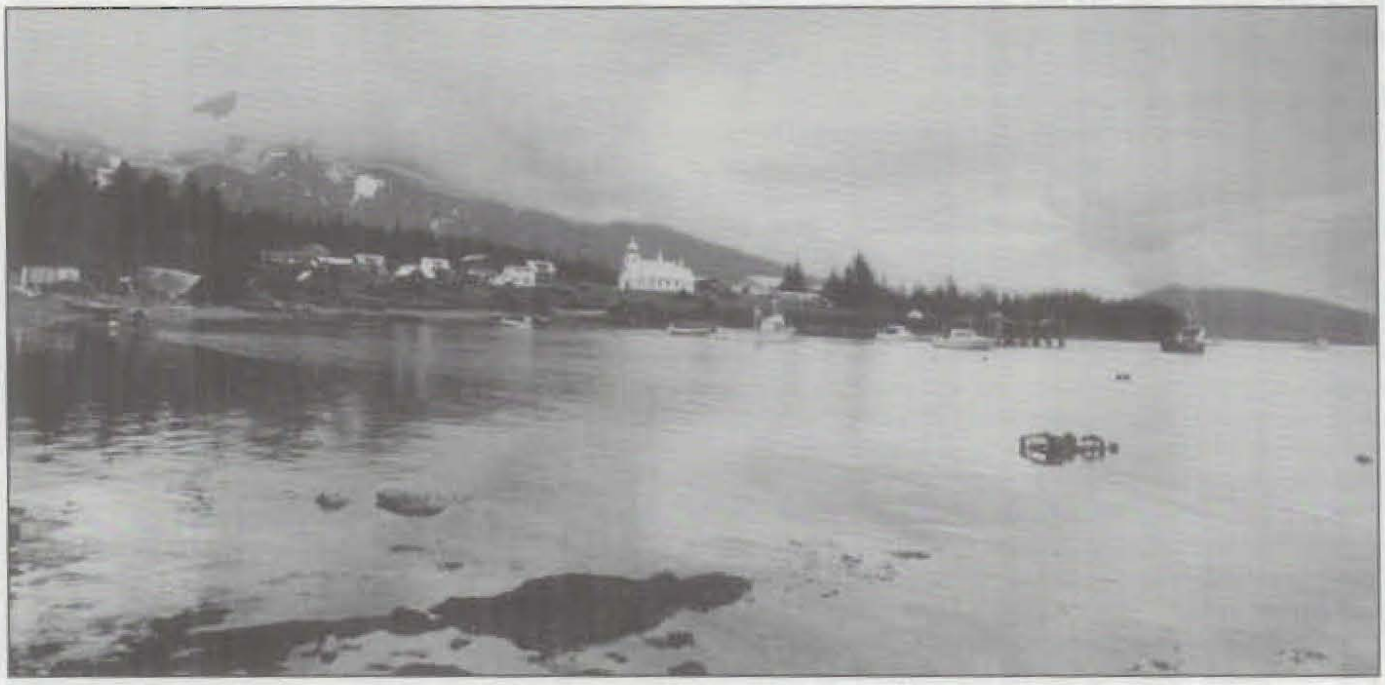
For three weeks last summer—including one week where the students visited Prince William Sound—nine natural resources students searched for the meaning of the Sound's bioregion. They read their books and papers. They questioned scientists, agency managers, fishermen, hotel owners, politicians, whistle blowers, charter boat captains and others. They returned from their field trip with a myriad of answers and more questions.

"We designed the class to work like a fact finding committee assigned to investigate a problem and then find answers. In fact it was much like a congressional or legislative hearing process. Once we were in the region Mara and I stepped back and left the process to the students," said Bader.

Co-instructor Mara Kimmel Hoyt added. "And I was pleased with the students probing. They listened and searched for answers rather than merely asking questions to reinforce their personal beliefs. One student who I know is strongly pro-environment, challenged environmentalists' statements, pressing them for answers not cliches. Another more pro-development student took proponents of development to task."

Prince William Sound readily meets the standard definition of a bioregion. Ecologically the entire sound and its surrounding lands, islands and waters are related and interdependent. What happens in one spot can have consequences 50 or 100 miles away. The Exxon Valdez oil spill dramatically demonstrated the regional interrelationships.

Economically the region depends on its natural



The village of Tatitlek lies between Cordova and Valdez in Prince William Sound. The community, which relies heavily on marine resources, is losing population (Photo by J. Stephen Lay).

NRM 495 students during their quest to determine the meaning of bioregionalism (Photo by J. Stephen Lay).

resources—specifically the sea. Fishing forms the region's traditional economic foundation and continues today as a major employer. While the region itself represents a single and distinctive unit, the communities within exhibit considerable variation.

The class, offered annually during the first summer session, visited four communities, Valdez, Cordova, Tatitlek and the ghost town of Ellamar. Residents of each depend on the bioregion, but their impacts are significantly different. Each sees the future through its past. As a result, they see different futures for the same region.

Valdez is the least dependent on fishing of the three active communities. Founded in 1898, the city has always played an important role as the gateway to the Interior. Gold miners hiked through Thompson Pass on their way to Interior Alaska's placer fields. For many years it was the port for almost all winter transportation between the Interior and locations outside Alaska.

Today, petroleum dominates the Valdez economy, trailed by tourism. As the terminus of the trans-Alaska oil pipeline, Valdez exports billions of dollars of oil every year. Pipeline terminal jobs are the highest paying in the community and actively sought. Local property taxes on the terminal facilities contribute millions of dollars to the community, underwriting the costs of a significant local infrastructure. The community's public buildings are new, large and well-maintained.

Through their meetings with Valdez residents, the students learned the community holds very mixed feelings about Alyeska. Alyeska had the responsibility for the cleanup operations after the oil spill.

"We heard everything from 'Alyeska's destroyed Valdez...It'll take a century to recover' to 'There's no real pollution...and what little there is, is the price we pay for these jobs,'" summarized one student.

Leaving Valdez, the class took the midnight ferry to Cordova. In contrast to Valdez, Cordova has fewer modern building. It has fewer facilities for visitors than its tourism-oriented neighbor. But residents seem to like it that way.

Cordova is a fishing town. It lives and dies by the volume of the catch and the price fishermen receive. It's also a town very worried about its future. A major reason is that the price of fish is plunging. In 1988, Cordova pink salmon sold for 77 cents a pound. In 1993 the price was 12 cents, or less than half the cost of catching the fish.

It's a town in transition and no one knows the direction it's moving. Debate rages on rebuilding the highway connecting Cordova with the rest of the state. One side sees the highway destroying Cordova residents' way of life. The other side argues the highway means tourism and jobs.

"The people here are very much in touch with the environment," said Mayor Weaverling. "We don't want to see Winnebago caravans invading Cordova." Weaverling is the only elected official in the nation who is a member of the Green Party.

Hotel owner Margy Johnson took the opposite stance. "Unless we find a substitute for fishing—and very quickly—this town won't be here. For people to live in Cordova, they have to have jobs. The only thing I see on the horizon is tourism."

Both supporters and opponents of the highway connection feel the town is divided almost evenly with half on each side of the debate. Interestingly, when asked if the highway would be built, proponents felt it would not; the opponents felt it would.

But neither side felt the decision would be made in Cordova. Both felt Juneau or Washington D.C. would make it and ultimately the courts would decide.

Tatitlek has already made its decision. It was—and continues to be—extremely painful. Tatitlek is a village inhabited by about 100 Native Alaskans. Like other Alaskan Native communities, it received land under terms of the Alaska Native Claims Settlement Act. These lands were given to the communities to provide an economic base.

Tatitlek, out of economic necessity, sold timber rights on some of its lands. Some areas have been cut, leaving large areas of clearcut visible from the ocean. Harvesting continues on other acreage.

Village leader Gary Kompkoff said making that decision was one of the most painful of his life. But he had to do it for the sake of Tatitlek's people. Under the same circumstances he would do it again. Tatitlek had no other way of meeting its needs.

The village values traditional ways. Yet economic changes are forcing more than the sale of timber rights. Village members are now considering ways to lure tourists to the community. A Russian Orthodox Church could provide the main attraction. It is a painful step since Tatitlek has fiercely protected its traditional lifestyle, accepting minimal influence from outside values. Subsistence is the norm, not the exception. To buy anything, villagers travel to Cordova or Valdez as there is no store in Tatitlek.

But times are changing. The Alaska Marine Highway system begins service to the community in 1994. Commercial fishing offers fewer opportunities. It's not just fish prices.

According to Kompkoff, residents own "about three" limited entry fishing permits. That number is down from "20 or so" when limited entry started. He expects all to be sold before the end of the century. Limited entry permits are required licenses for commercial fishing.

Leaving Tatitlek, the class hiked along the beach to Ellamar a few miles west; they spent the final night of the field trip in Ellamar's original school house.

Ellamar has changed with the times. Established in 1898 as a copper mine, the community flourished until the mines gave out. People left and until a few years ago Ellamar had only occasional residents. A real estate syndicate reincarnated it, selling building lots. A few of the lot owners have built vacation homes.

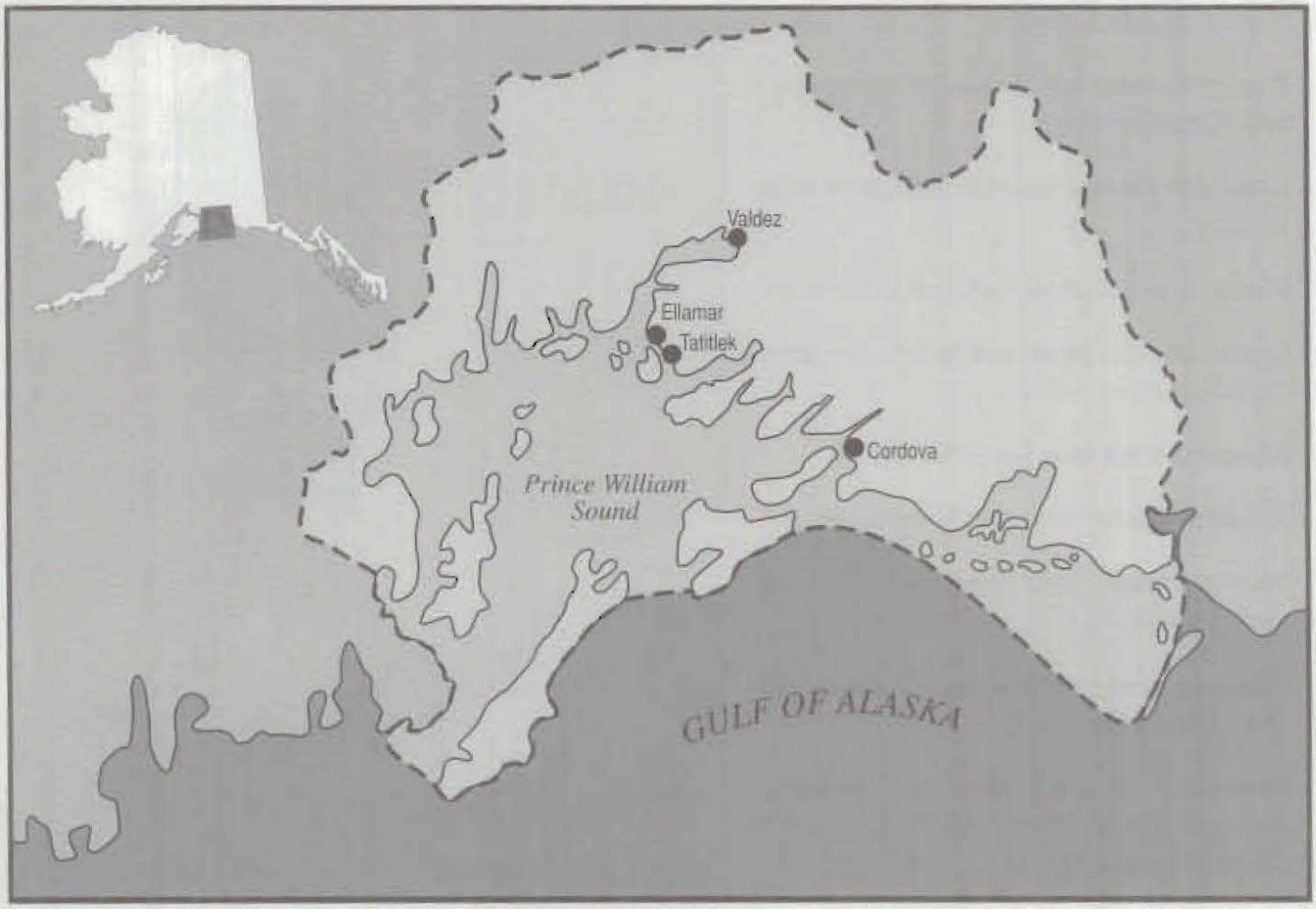
Returning to Fairbanks, students spent the final week of class analyzing their findings and evaluating their first-hand look at Prince William Sound as a bioregion. The final day of class they presented their findings.

"All in all it was a great class," said one participant. "I learned a lot, but I think for every answer I found, I now have at least a half-dozen questions."

So what is bioregionalism?

"Most students come to the conclusion that there isn't a definition for bioregionalism. That's what happens when you get people involved in nice clean academic answers. There are few right or wrong answers," said Bader.

"It's never that simple. Perhaps that's the most important thing we learned."



A map and overview of places the natural resources management class visited during their week long field trip (Graphic by Keith Swarner).

Graduate profile

Birgit Njastad on top of the world

Age: 27

Hometown: Trondheim, Norway

High school: Ringue Videregaende Skole, Trondheim

University: University of Oslo 1986-1988; University of Alaska Fairbanks: 1988-1991: B.A. Northern Studies; 1991-1993: M.S. Natural Resources Management

Clubs and civic organization: Girl Scouts (Norway), Young Norwegian Catholic Association

Graduate research topic: Landfill Siting in Fairbanks North Star Borough, Integrating the Technical and Human Aspects

Career plans: Planning and environmental work at a local level in Norway

Latest accomplishment: Successfully completing masters degree

Favorite plant and animal: Arctic poppy and the polar bear

Last book read: *A Republic of Rivers* John Murray, ed.

Favorite publication: *National Geographic*

Interests: Outdoor activities, reading, environmental work

Favorite composer: Antonio Vivaldi

Favorite movie: Map of a Human Heart

Favorite food: Fresh cod with liver and boiled potatoes

Favorite place in Alaska: Gates of the Arctic National Park

Favorite place outside Alaska: Aunegrenda, Norway (where my family's cabin is located)

Greatest lesson ever learned: My ABCs-where would I be without them?

Greg Robbe: A flair for music, an interest in natural resources management

Age: 32

Hometown: Eureka, Montana

High school: Lincoln County High School, Eureka, Mont.

University: 1979-80 University of Montana, Missoula; 1981-83 Spokane Falls Community College, Associate in Applied Science, Musical Instrument Technology; 1989-93 University of Alaska Fairbanks, Bachelor of Science in Natural Resources Management (general option with emphasis in outdoor recreation and interpretation)

Clubs, volunteer and civic organizations: Member and past president of Christ Lutheran Church, currently serving as organist/pianist; president of Lutheran Brotherhood Northern Lights Branch; president and performing member of the Fairbanks Red Hackle Bagpipe Band; Member of the National Association of Professional Band Instrument Repair Technicians

Interest: Music

Course that feel will be most relevant in your future? Specific interest: NRM 461, Interpretive Services; General Interest: NRM 304, Perspectives in NRM

Career plans/ambitions: School or public educational programs with multimedia emphasis

Latest accomplishment: Completing my BS in four years while holding down a full-time job, staying married, and tactfully losing countless games of *Candyland* to my oldest daughter

Favorite plant and animal: Plant: *Pseudotsuga menziesii*, Interior Douglas fir; Animal: wolverine.

Last book read: Nonfiction—*North Pole Legacy: Black, White and Eskimo* by S. Allen Counter; Fiction—*Real Ponies Don't Go Oink!* by Patrick McManus

Favorite publication: *Organic Gardening*

Interests: Vermiculture, bike riding, canoeing, vegetable gardening, eradicating diamond willows, bagpiping, Scottish country dancing, Alexander Dumas

Favorite composer: Sean Davies

Favorite movie: *Being There* and *Monty Python's Life of a Brain*

Favorite food: Anything with butter, vanilla and sugar in it

Favorite place in Alaska: Along the Chatanika River

Favorite place outside Alaska: Tuchuck Mountains in Northwest Montana

Greatest lesson ever learned: You never learn anything when your mouth is open

Family members: Wife: Vicki; Daughters: Miriam Rose, 4, and Elle May, 2

AFES...faces in the news,


Dr. Jenifer McBeath

International patent

Dr. Jenifer **McBeath** received a New Zealand patent for her biocontrol research using a parasite found in Alaskan soils applied as an anti-fungal agent.

International delegate

Dr. Edmond **Packee**, associate professor of forest management, joined the Alaska Office of International Trade forest products delegation visiting Heilongjang Province, China this past fall. He gave presentations in Harbin and at the Northeastern Forestry University.

USDA grant

Drs. Carol **Lewis** and Joshua **Greenberg**, natural resources management, received $50,000 from the United States Department of Agriculture National Research Initiative Grants Program for "An Inclusive Regional economic Model for Rural Alaska," a study linking cash and non-cash or subsistence economies in rural Alaska.

International presentation

Dr. Lyle **Renecker** and Teresa **Tomany**, reindeer researchers, presented "The Alaska Reindeer Industry: Tradition versus Meat Quality and Product Development" at the World Wilderness Congress in Tromso, Norway, this past fall. They also gave guest lectures at the Agricultural University of Norway and the Swedish Agricultural University.


Dr. Lyle Renecker

Service recognition

The following people were recognized in December 1993 through the Employee Service Recognition Program for continuous permanent service with UAF.

20 years

John D. **Fox**, Anthony F. **Gasbarro** and Carol E. **Lewis**

15 years

Charlie **Knight**, Timothy **Quintal**, Laurie **Wilson** and John **Yarie**

10 years

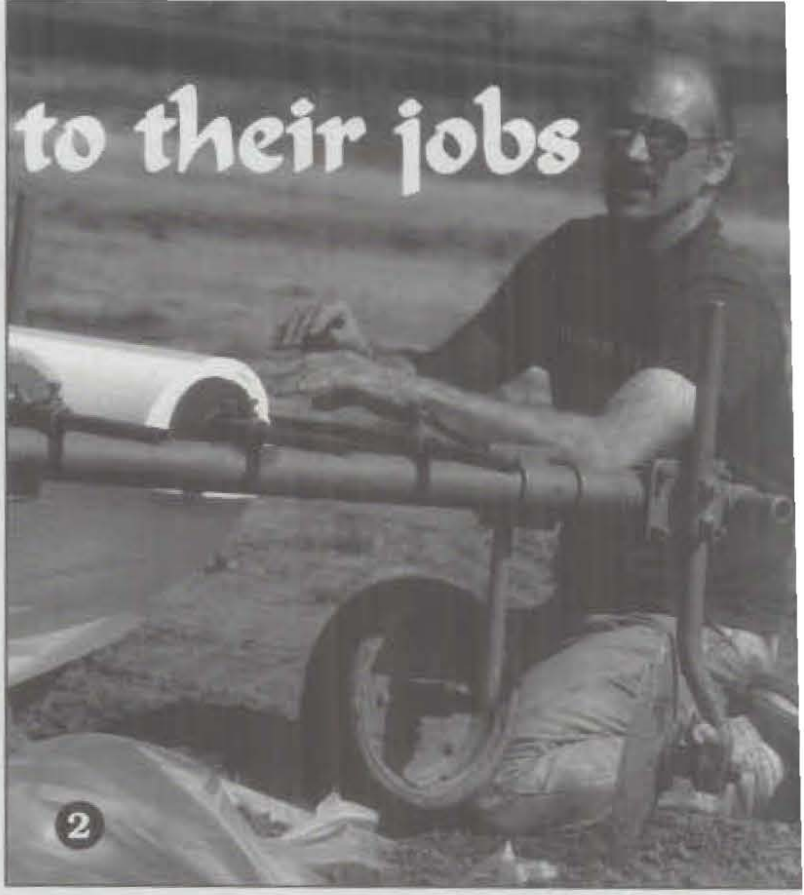
Martha **Bartley**, KC **Christensen**, Thomas **Malone** and Edmond **Packee**

5 years

Rudy **Candler**, Warren **Fiscus**, Meriam **Karlsson**, Michael **Panciera**, Kirsten **Randall**, Robert **Solomon**, Steven **Spores**, Gwendo-Lyn **Turner** and Gidget **Wensel**


Palmer's office staff. Deb Bates, Peg Banks and Gidget Wensel, with Dr. Allen Mitchell, associate director of AFES (photo by Donna Gindle).

those dedicated to their jobs



1. *Dr. Rudy Candler, laboratory supervisor in Palmer, earned his master and doctorate degrees from UAF (Photo by Donna Gindle).*
2. *Grant Matheke adjusts the roller as he lays plastic sheet to heat the soil in a strawberry trial (Photo by J. Stephen Lay).*
3. *Kate Brainard, laboratory technician, checks for fungal damage on lupine seed (Photo by Donna Gindle).*

Delta Junction's

1. *Delta Junction community members, Agricultural and Forestry Experiment Station researchers and Alaska Cooperative Extension agents gathered for the annual Delta Field Day in August 1993.*
2. *Bob Van Veldhuizen, research assistant, Larry Burke, Fairbanks farm superintendent, and Ronnie Riesgaard, Delta farm manager participated in the Delta Field Day.*
3. *Dr. Charles Knight, assistant professor of agronomy, talks about alternative crops.*
4. *Dr. Stephen Sparrow, professor of agronomy, Steve DuBois, Delta Fish and Game, Scott Schultz, Delta farmer, and others listen to Dr. Knight.*

Photos by Donna Gindle.

field day

Scientists on location to share research findings, answer questions

The Agricultural and Forestry Experiment Station and the Alaska Cooperative Extension hosted an open house at the Delta Junction Experiment Farm this past summer. Approximately 40 people from the Delta Junction community attended the event.

The farm, located at Mile 1408 Alaska Highway, is the site of agricultural research for the experiment station. Scientists updated farmers on their research and received questions and comments from community members.

According to Dr. Jim Drew, AFES director, both the community and the experiment station win through this cooperative endeavor.

"Contacts with the Delta Junction community help identify agricultural research needs that are important locally," said Dr. Drew. "Then, our field research near Delta Junction gives our scientists the opportunity to demonstrate their research results first-hand."

Faculty members and their topics included:

Dr. Charles Knight, assistant professor of agronomy, "Planting dates for barley alternative crops, crop quality and marketing, spring tillage and moisture conservation."

Dr. Stephen Sparrow, professor of agronomy, "Legumes and green manure crops for Alaska."

Mr. Verlan Cochran, USDA research soil scientist, "Optimum tillage practices for small grain production."

Dr. Jeff Conn, USDA research agronomist, "Atmospheric greenhouse gases and crop production in Alaska."

Dr. Stephen Dofing, associate professor of agronomy, "Plant breeding," and

Mr. Don Quarberg, Delta Junction Alaska Cooperative Extension agent, "Potatoes, rye grass and alternative crops."

The open house is an annual event where scientist and farmers are able to talk, exchange information, and discuss future experiments. The event wasn't all work as participants enjoyed an old-fashioned hay ride and social gathering immediately following.

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