AgroBorealis

Vol. 28, No. 2: The Annual Report *Summer/Fall 1996*
School of Agriculture and Land Resources Management
Agricultural and Forestry Experiment Station

AFES Acting Director | Palmer Research Center | 533 E. Fireweed | Palmer, AK 99645

June 30, 1996

The Honorable Tony Knowles
Governor of Alaska
P.O. Box 110001
Juneau, Alaska 99811-0001

Dear Sir:

I submit herewith the annual report from the Agricultural and Forestry Experiment Station, School of Agriculture and Land Resources Management, University of Alaska Fairbanks, for the period ending December 31, 1995. This is done in accordance with an act of Congress, approved March 2, 1887, entitled "An act to establish agricultural experiment stations, in connection with the agricultural colleges established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and also of the act of the Alaska Territorial Legislature, approved March 12, 1935, accepting the provisions of the act of Congress.

Very respectfully,

G. Allen Mitchell

G. Allen Mitchell
Acting Director

AFES Statement of Purpose

The Alaska Agricultural and Forestry Experiment Station (AFES) provides new information to manage renewable resources at high latitudes, and to improve technology for enhancing the economic well-being and quality of life at these latitudes. While foresters, farmers, and land managers use our research results, all Alaskans benefit from the wise use of land resources. Our research projects are in response to requests from producers, industries, and state and federal agencies for information in plant, animal, and soil sciences; forest sciences; and resources management.

Experiment station scientists publish research in scientific journals, conference proceedings, books, and in experiment station bulletins, circulars, newsletters, research progress reports, and miscellaneous publications. Scientists also disseminate their findings through conferences, public presentations, workshops, and other public information programs.

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

AgroBorealis

EDITORIAL STAFF

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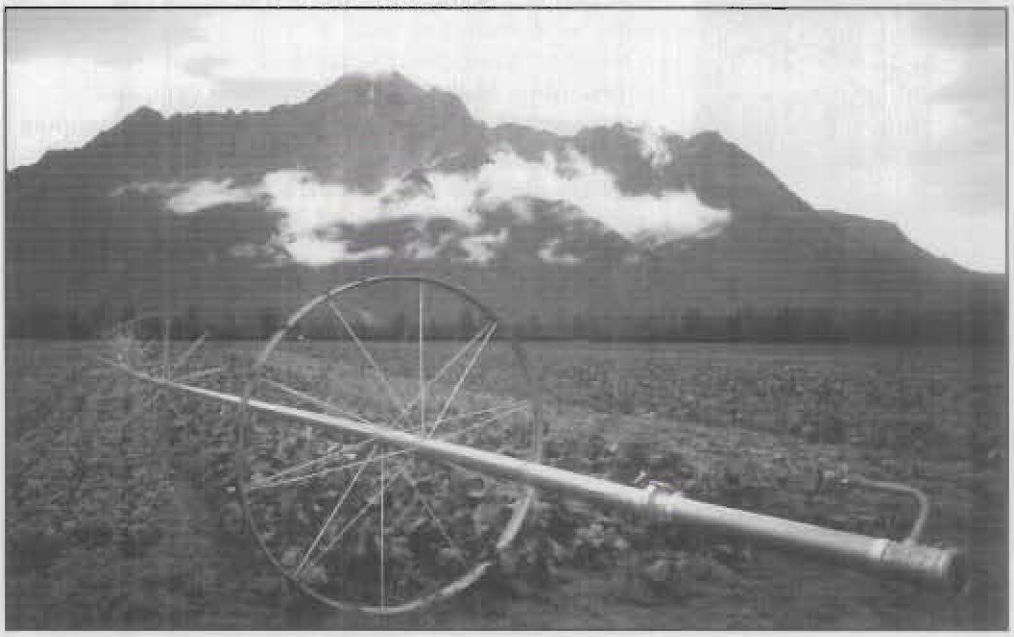


About the cover
This photo shows an Alaskan farm. AFES researchers work with various Alaska farmers through a variety of state and federal grants. Researchers also join private producers in developing research and demonstration projects with a component of the work done on private farms.

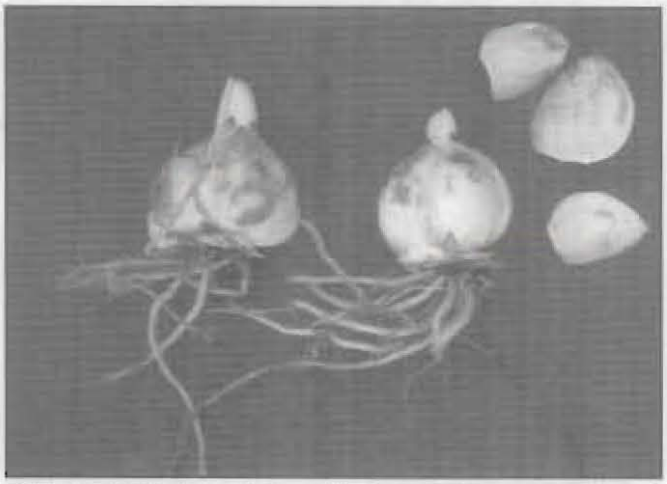
—Photo by Cal White—

Propagating Asiatic hybrid lilies

by: Dr. Patricia S. Holloway
Associate professor of horticulture

Many cultivars of Asiatic hybrid lilies have been tested over the years at the Georgeson Botanical Garden. This group of lilies is the most reliably hardy lily in Interior Alaska and provides brilliant color displays in late July and August. Homeowners and commercial growers can easily increase their quantity of lilies by vegetatively propagating the bulbs.

Dr. Pat Holloway demonstrates lily propagation techniques to a student from Weller Elementary School during an Earth Day program (AFES photo).



Asiatic hybrid lily scales and bulbs (AFES photo).

Asiatic hybrid lilies have scaly bulbs. These bulbs are not enclosed in a papery covering such as an onion or tulip. Instead, the bulbs are composed of a series of loose, fleshy scales. Anytime after flowering and throughout winter, these scales can be harvested and propagated to produce tiny bulblets that will flower in two or three years. The following method is an easy and quick way to get plenty of bulbs from one large bulb.

- Remove the parent bulb from its packing material (wood shavings, sawdust, etc.). Wash the bulb in clean water to remove this material. Peel off no more than 25 percent of the spoon-shaped, fleshy scales. Discard any that appear diseased or broken.
- Fill two-thirds of a new plastic bag (Ziploc® works well) with vermiculite that is available at garden centers and commercial greenhouses. Moisten the vermiculite until it is uniformly wet but with no standing water.
- Drop the scales into the bag and mix into the vermiculite. Make sure each scale is completely surrounded by moist vermiculite. A quart-sized bag can hold about a dozen scales. Some commercial growers dust the scales with a fungicide prior to inserting into the bag, but I have never found that necessary. Close the bag.
- Pot up the parent bulb. Place the container in a cool environment (38 to 45°F) until growth begins. When young shoots appear, bring the container into a warm room or greenhouse to bloom. With care, this parent bulb can be planted outdoors in spring. If flowering occurs indoors, keep growing the plant after flowering, and don't remove any foliage. Plant the bulb and attached stem in the garden in June.
- Set the bag full of scales and vermiculite in a warm room (approximately 70°F). Avoid cold windowsills or hot south-facing windows. Check the bag at least once a week to make sure vermiculite

Weller students fill plastic bags with scales for the third step of the propagating process under the watchful and helpful guidance of Pat Holloway. Students were able to take home their work (AFES photo).

stays moist. In about three weeks, begin checking for small bulblets forming at the base of each scale. Keep the scales in the vermiculite until you notice some roots and green shoots developing from the bulblets.

The Asiatic hybrid lily at six months (AFES photo).

❧ Carefully remove the bulblets from the scale, and plant them in flats or shallow containers using sterile potting mix. Water to keep the soil moist.

❧ After the bulblets form one, or rarely two, strap-shaped leaves, they go dormant. Place the containers or flats in a cool environment (root cellar, refrigerator, a non-freezing, approximately 40°F garage). Keep the flats moist, but avoid over watering to prevent fungal growth. They need about two months of cold temperatures to break dormancy.

❧ Depending on the time of year, the bulblets can be returned to the warm room or greenhouse in late spring to encourage new growth. The tiny bulblets can also be planted directly outdoors in a warm, sunny location. Some cultivars may bloom during the second summer, but the flower display is best beginning in the third summer.

Asiatic lily

drawing by Dr. Pat Holloway

Photo cutlines: Jennifer Pugin, a 1996 SALRM graduate with an M.S. degree, judges a science project at Immaculate Conception School and the Monroe Junior High School Science Fair. Charlie Knight and Bob Van Veldhuizen, background, look on. A science fair participant demonstrates a scientific principle for Stephen Sparrow.

Researchers judge science fairs

The School of Agriculture and Land Resources Management's faculty, staff and students worked in many capacities with various school science fairs during Spring 1996. Volunteers judged science projects or papers at Immaculate Conception School and Monroe Junior High School Science Fair (February 8-9), the Fairbanks District Science Fair (March 20-22) and the Alaska Statewide High School Science Symposium (March 23). The SALRM gave science awards for outstanding projects related to agriculture and natural resources at the Fairbanks District Science Fair and outstanding papers related to agriculture and natural resources at the Alaska Statewide High School Science Symposium.

—photos by Valerie Hendrickson—

Judges and other volunteers included: Christi Young, John Alden, Charlie Knight, Tom Malone, Stephen Sparrow, Tim Quintal, Jennifer Pugin, Steve Becker, Bob Van Veldhuizen, Darleen Masiak, Lola Oliver, Dave Maddux, Susan Todd, Meriam Karlsson, Elena Sparrow (ICS and Monroe Schools Science Fair Coordinator for four years), Sharon Schlentner, Stephanie Pike, Michele Hebert, Carolyn Pennington Chapin, Valerie Hendrickson and Fredric Husby.

Science awards were given to the following students.

Fairbanks District Science Fair

Isak Quakenbush, kindergarten, "How my house sank", Woodriver

Sara Lawhead, 1st, "Horse feeding," Pearl Creek

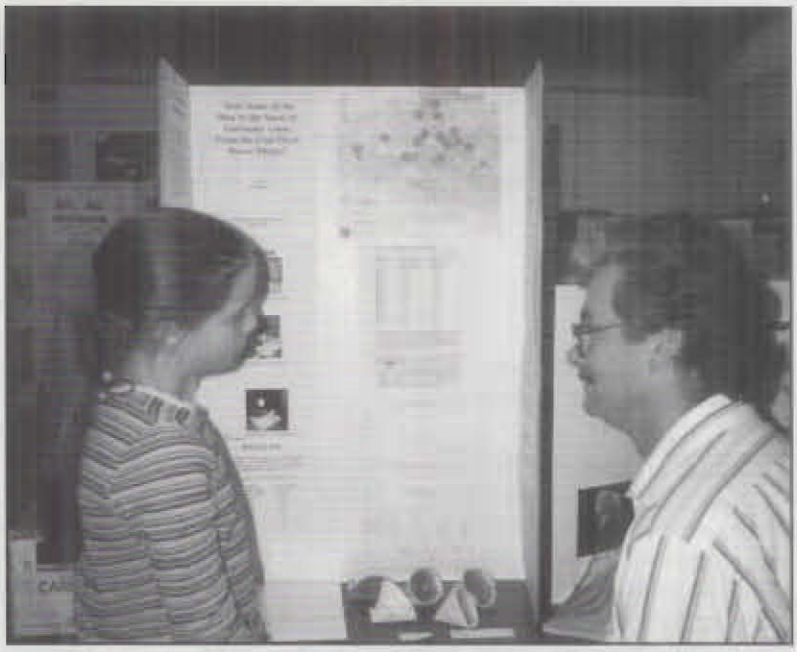
Andy Ferree, 2nd, "Do fertilizers work?" Nordale

Kari Martin, 3rd, "Spaced out carrots," Pearl Creek

Jamie High, 4th, "Plant growth," North Pole

Joan Mowrey, 5th, "Vegetables into paper," Denali

Lily Fitch, 6th, "DDT and the food chain," University Park



Emmalisa Sparrow, 7th, "Salmon oil weed whacker," Monroe

Patrick Juday, 7th, "Yeast growth in different temperatures," Monroe

Alaska Statewide H. S. Science Symposium, Outstanding Paper

Kelly Ross Doxey, "The microbes in utility water versus bottled water: an experiment in water sampling," Lathrop

Eric-Paul Sparrow, "Degradation of packing materials," Monroe

Charlie Knight (top photo) listens while a young scientist describes her project. Center photos feature three science displays. Dr. Fredric Husby, SALRM acting dean, and Elena Sparrow (left) recognize the winners of the Alaska Statewide High School Science Symposium and the Fairbanks District Science Fair.

Establishing Alaska wildflower meadow gardens

by: Ouina C. Rutledge
M. S., NRM
and
Dr. Patricia S. Holloway
Associate professor of horticulture

Alaska wildflower gardens have an appeal and beauty befitting our 49th state. To ensure your wildflower garden grows to its potential, please take the time to read the following information.

Soils: Till or break up the soil surface to at least two inches deep, although deeper is better. Wildflower seeds sown on untilled soil or sod will prevent or delay seed germination. If time permits till, allow weed seeds to germinate, then till again to eliminate as many weeds as possible. Repeated tillings for one season before sowing minimizes weeds, especially perennials that can out-compete the wildflowers.

Wildflowers: Use Alaska wildflowers, non-native flowers or a combination of both. Use caution when selecting a non-native wildflower. Avoid those that are considered noxious or invasive weeds. A noncompetitive bunch grass such as 'Tundra' glaucous bluegrass can be added for a true meadow look. Mixture should be 50-80 percent grass seed by weight and 20-50 percent wildflower seed.

Sowing: Sow up to five times the recommended sowing rate, especially if using Alaska wildflowers. Sow Alaska wildflowers in the fall (early-to-mid September), and non-native wildflowers in spring. Combine one part wildflower seeds with four parts fine, damp sand (i.e. builder's sand). Divide the sand/seed mixture in half and broadcast in two directions for more even coverage. Gently rake then tamp or roll the soil to get good soil to seed contact.

Maintenance: Irrigate, if possible, for about six weeks after sowing to effectively establish wildflowers and enhance flowering. You may need to periodically weed during the first season to maximize wildflowers. Following establishment, tree seedlings and perennial weeds may invade the meadow. Try to promptly removed them to maintain the integrity of the meadow.

Establishment: Non-native wildflower mixes provide the best color and show during the first three years, but gradually the annuals and non-hardy perennials die. For best results, re-sow every three years. It will take several years for a true Alaska wildflower meadow garden to establish and flower. Alaska wildflower seeds often have complex germination requirements, and the plants may appear one or more years after sowing. With patience, you can have a beautiful wildflower meadow and help conserve our Alaska native wildflowers for many years.

Researchers recommend seeds

Recommended Alaska wildflowers

Indian potato (*Hedysarum alpinum*)
Wild sweet pea (*Hedysarum Mackenzii*)
Tall Jacob's ladder (*Polemonium acutiflorum*)
Dwarf Jacob's ladder (*Polemonium pulcherrimum*)
Strawberry spinach (*Chenopodium capitatum*)
Yellow hawkweed (*Hieracium scabruisculum*)
Goldenrod (*Solidago multiradiata*)
Burnet (*Sanguisorba officinalis*)
Yarrow (*Achillea borealis*)
Siberian aster (*Aster sibiricus*)
Wild iris (*Iris setosa*)
Arctic lupine (*Lupinus arcticus*)
Arnica (*Arnica alpina*)

Recommended non-native wildflowers

Dame's rocket (*Hesperis matronalis*)
Shasta daisy (*Chrysanthemum maximum*)
Shirley poppy (*Papaver rhoeas*)
California poppy (*Eschscholzia californica*)
Yarrow (*Achillea millefolium*)
Rocky Mountain penstemon (*Penstemon strictus*)
Wild chamomile (*Tripleurospermum inodoratum*)

Research achievements

Plant, Animal and Soil Sciences

Managing Alaska beef for foraging

Objectives of a five year study were to: (1) maximize use of Alaska forage for beef, and (2) manage beef cattle on a fall calving scheme—August—to compare animal survival, health, and economic considerations of labor and feed to spring calving. From 1985 to 1990, Angus x Hereford cows in Palmer were managed to calve in February or March. Dr. Bruce did not report production data for that period. In 1990, the 35 cow herd was shifted to fall calving and the first crop was scheduled for Fall 1991. Within objective 1, results indicated that spring grazing of bromegrass should be postponed until mid-June to result in a 50% yield increase as pasture, hay or silage. Calf crops for 1991-1995 were 100, 80, 65, 20, and 80%, respectively. Dr. Bruce concluded that this system outperformed spring calving and that the system saves both grain and hay but that fall calving reduced the number of cows per acre because calves are grazed an extra summer. However, no data was available that was related to health or economics of spring vs. fall calving. Nor did the experimental design compare cows within the herd or the two calving schemes within a given year. Therefore, no statistical comparisons were valid nor made. The results reported by Dr. Bruce do not support a fall calving scheme conclusion.

·AFES faculty contribution

Monitoring for brucellosis

Researchers monitored brucellosis by taking blood samples from reindeer in each Seward Peninsula herd. These samples included a minimum of 20 samples from yearling reindeer; their infection rate can indicate the current rate of brucellosis transmission. Certain herds not previously sampled—the St. Lawrence Island, Pushruk, Olanna-Blodgett, and Stebbins herds—were sampled more intensively. Yearling infection rates ranged from 2 to 60%. Brucellosis testing results, compiled from the last five years, show relatively high infection rates in Seward Peninsula herds. This includes those herds that were previously vaccinated. Researchers and USDA brucellosis epidemiologists will assess the efficacy of the vaccine as applied under field conditions and will develop individual brucellosis control plans for each herd. Our group tested most of the reindeer handled at St. Lawrence Island in June 1995. All reindeer tested negative for brucellosis. We expect that within a few years, USDA will regulate all cervid species to control and eradicate brucellosis. Geographically isolated herds, such as the St. Lawrence Island herd, could be certified brucellosis-free based on a statistical sampling performed over a period of several years.

·Julia Bevins and Greg Finstad

Sampling for trace elements

Little is known about the trace elements that reindeer require. Consequently, research is currently establishing baseline data on trace element blood levels of western Alaska reindeer in conjunction with trace element levels in available forages. Baselines can identify, and perhaps remedy through supplements or changes to grazing practices, deficiencies in minerals such as zinc, phosphorus, iron, magnesium, copper, calcium and selenium. Low grade deficiencies in some minerals can result in lower growth rates and decreased productivity.

·Julia Bevins and Greg Finstad

Comparing potatoes

Average total yield of potato cultivars evaluated in Alaska's Matanuska Valley in 1995 was higher than the area's nonirrigated five-year average but lower than the irrigated trials, five-year average. The average yield in irrigated trials across the 45 varieties was 16.6 and 20.20 tons per acre for the US#1 and total categories respectively. The top yielding irrigated cultivar was Red Warba (28.6 tons per acre total yield) followed by Chieftain, Cherokee, Gold Coin and Atlantic. Average yields in the nonirrigated trials were 14.4 and 16.6 tons per acre for the US#1 and total categories respectively. The top yielding nonirrigated cultivar was Red Warba (22.3 tons per acre total yield) followed by IditaRed, Chieftain and Sangre.

·Donald E. Carling

Evaluating metam sodium

Thirty-day old greenhouse lettuce seedlings were transplanted into field plots treated the previous July with 0, 25, 50, or 100 gallons per acre of a 32.7% metam sodium solution. Plots were prepared and fertilized according to commercial production standards and watered as required throughout the

growing season. Tarping did not affect weed seedling populations. Total weed seedlings population were reduced by 51, 82, and 94% in the plots receiving 25, 50, and 100 gallons per acre of metam sodium respectively, compared to plots receiving no metam sodium. It cost from 34 to 65% less to remove weeds from plots treated with increasing rates of metam sodium. The metam sodium treatments did not affect head lettuce yields. These results illustrate the potential for commercial vegetable growers to use metam sodium as a herbicide in Alaska and other locations with similar growing conditions. Subsequent data collection will study if metam sodium provides multi-year control.

·Donald E. Carling

Developing simple inoculation method

Bacterial blight of rice, caused by *Xanthomonas oryzae* pathovar oryzae, is a major rice disease throughout Asia and much of the world, and is dreaded in U.S. rice growing regions. Pathogenicity test is essential in positively identifying *X. o.* pv. *oryzae*. Collaborating with the USDA-ARS, Foreign Disease, Weed Science Research Unit, we developed a simple inoculation method. We used a small, plastic syringe modified to infiltrate rice leaves to apply the bacteria into rice leaves which produced typical water-soaked lesions in five to seven days. Exudate was often evident after 8 to 10 days. We concluded that the current method of clipping induces a hypersensitive reaction in rice. The new improved infiltration methods induced true pathogenicity of rice *xanthomonads*.

·Ming Di and Jenifer H. McBeath

Studying barley breeding

In the 1995 barley breeding program, F2-F4 populations were advanced in bulk. Selection within these families will begin in the F6 generation. In addition, F1 plants from the covered x naked cross Jo1632/Thual were backcrossed to Jo1632 to incorporate the higher straw strength of that parent. Seeds from these crosses will he field planted in 1996 to generate F2 progenies.

A-32, a line with many kernels per head, was crossed to Uniculm Morex trying to obtain a uniculm line with a high yield per plant. F1 seed was grown in the field in 1995, and in 1996 F2 plants will be selected. Best limited tillering lines with the lnt gene were selected in 1995, however these lines were generally sterile in the upper florets.

·Stephen Dofing

Studying maturity, yield

It is necessary to understand developmental patterns that maximize grain yield while minimizing time to maturity. In one study, it was concluded that the yield to maturity ratio is optimized in varieties that take a long time to reach the heading stage and spend a short time in the heading-to-maturity period. Stated differently, the plant should spend as much time as possible in the pre-heading stage, but not take to long to mature. The pre-heading period should be followed by a short grain fill period. This indicates the importance of rapid grain fill rates in northern-adapted varieties.

·Stephen Dofing

Managing reindeer herds

Live body weights of adult and juvenile reindeer on the Seward Peninsula were recorded during the 1995 summer and winter handlings. Harvested antler weights were recorded during the summer handlings. Researchers and herders are using this information to evaluate harvest yields of meat and antler according to sex and age. Growth rates and reproductive success are being monitored in herds to evaluate range usage and the effectiveness of various husbandry techniques. Recently, a herder began using data collected by the Reindeer Research Program as castrating and culling criteria to select faster growing, large bodied, and antlered reindeer.

·Greg Finstad

Ranges, reindeer productivity

Velvet antlers and meat are commercial products of Alaska's reindeer industry. Variations in antler and body growth have been observed between animals of adjoining ranges. Range characteristics are believed to be responsible for the variations. Reindeer in Alaska forage year round over large ranges with minimal influence by herders. Spring and early summer forage—primarily sedges and willows—provides the essential protein and minerals needed for body and antler growth. Sedge and willow samples were collected from 12 sites during June and early July. Six sites were located along the Nome, Teller Road (Patrick Pushruk range) and six sites were located on the Kougarouk Road (Larry Davis range). The Plant and Soil Analysis Lab in Palmer analyzed all samples for percent crude protein, macro and trace minerals, neutral and acid digestible fibers. The data will be evaluated to determine nutrient flux and fiber levels for sedges and willows on the two adjoining ranges.

·Greg Finstad

Computerizing reindeer research

During the past year, reindeer researchers collected herd data for 18 herds, and shared this information with herders and other researchers. We shifted from a proprietary database management software to a commercially available and more user-friendly product. We also designed and are currently

implementing a World Wide Web page, and have begun creating a Geographic Information System (GIS) containing range and herd data. We plan on including vegetation, topography, hydrology, soil and climatic data, as well as reindeer herd records in the database.

• *Owen Guthrie and Greg Finstad*

Studying Usibelli vegetation

Usibelli Coal Mine funds vegetation inventory and revegetation studies in an effort to use the most recent knowledge and plant materials to continually improve their revegetation. This is the fifth year of a study that evaluates growth of grass species on different growth media on windy, south-facing slopes for cover, nutrient absorption, and decomposition. Plant cover and soil nutrient data were obtained and additional plots were added to assess the effects of fertilization for varying numbers of years.

Both Norcoast Bering hairgrass (*Deschampsia beringensis*), Nortran tufted hairgrass (Deschampsia beringensis), and Arctared red fescue (*Festuca rubra*)—all Agricultural and Forestry Experiment Station developed cultivars—have maintained their cover better than most other species on the plots fertilized only once. Cover of many other species has declined substantially on these plots. Native colonization was greatest on plots seeded with legumes and consisted mostly of herbaceous species that follow disturbances, such as fireweed (*Epilobium angustifolium*) and bluejoint reedgrass (*Calamagrostis canadensis*); although, there were also Bebb willow (*Salix bebbiana*) and paper birch (*Betula papyrifera*). Aspen (*Populus tremuloides*) sprouted from root fragments where an organic mat was used.

• *Dot Helm*

Studying Nolan revegetation

Seeded grasses frequently need to stabilize reclaimed mining sites in the first few years until native plant species can establish. Little data exist for revegetation recommendations using native cultivars for placer mines in the Upper Koyukuk region. Previous data focuses on introduced cultivars because they were the only readily available seeds at the time. Silverado Mines has started revegetation trials to assess plant species and fertilizers that are appropriate for the area. Naturally colonizing grasses are also being documented on reclaimed exploration trails and in the main mine area. More than 20 species of natural colonizers were found in one area during the first growing season following reclamation.

• *Dot Helm*

Managing, establishing woody plants

This study continues to evaluate longer-term (five to 10 years) effects of growth media or mycorrhizal inoculum on woody plant growth and natural colonization on three mined sites: a proposed coal mine near Palmer, an active coal mine near Healy, and an abandoned—but recently reclaimed—placer mine located 100 miles northeast of Fairbanks.

At the Palmer site, plant growth is substantially better on the three soil-material sites compared with the glacial till site. Height growth for many species has begun to slow on one growth medium. Large, broadleafed colonizers have outcompeted transplants on some growth media although transplants grew taller than the native colonizers on most plots. At the Healy site, a soil transfer introduced mycorrhizal inocula from two different forest types. These plants have been monitored for height and evaluated for mycorrhizal formation. Finally, at the placer mine, assessment continues to determine survival and growth for the trials of rooted and unrooted feltleaf willow (*Salix alaxensis*) cuttings that were planted at three heights above the water and three times during the growing season.

• *Dot Helm*

Evaluating mycorrhizal formation

This study seeks to document mycorrhizal types on key woody plant species across a primary successional chronosequence following glacial retreat. Samples included young seedlings as well as native trees. Greenhouse-grown plants were transplanted in the various stages to evaluate what mycorrhizae may form on uniform-aged plants. More than 20 ectomycorrhizal types were described from native plants in this area. Some types were found predominantly in the youngest stands while other mycorrhizal types were found only in the oldest stands. Significant differences across vegetation types did not occur for the other plant species but each plant species tended to have different ectomycorrhizal types. Fewer types formed on greenhouse-grown seedlings that were transplanted in successional stages from the barren outwash plain to the mature cottonwood forest than on the existing native plants in these stages. Seedlings planted next to nurse plants of the same species and inoculated with propagule-bearing soil formed more ectomycorrhizae than seedlings next to uninoculated nurse plants. Small nurse plants, typical of those found on the outwash plain, effectively provided inoculum to seedlings of the same species, but were not effective in ameliorating the environment or catching seeds.

• *Dot Helm*

Trellising and cucumber yield

At lower latitudes trellising increases cucumber

yield by allowing a vine to get more light, minimizing disease, and improving pollination. We grew 'Early Pride' slicing cucumbers outdoors in beds mulched with IRT-76 polyethylene. Half of the plants were trellised. Fruit was harvested beginning August 3. Trellised plants averaged 16.3 fruit per plant (3716.6 grams per plant) while untrellised plants averaged 18.9 fruit per plant (4405.1 grams per plant). This difference is not statistically significant. The very short harvest season (Aug 3 through Aug 25) probably negated any benefits from trellising. Although trellising did not improve yields, it may be useful in home gardens where space is limited.

• Pat Holloway and Pat Wagner

Grass clippings control weed

'Inca Yellow' marigolds were grown in unmulched plots or those that were mulched twice in June with three inches of fresh grass clippings. Soil temperatures were slightly lower in the mulched plots early in the season, but night temperatures throughout the season were warmer. The cumulative seasonal temperature effect of the mulch was slightly warmer soils than the control plots. Marigold growth and flowering did not differ among mulched and unmulched plots.

• Pat Holloway

AK's annual flower seed mixes

During the past four seasons, annual flower seed mixes have been grown at the Georgeson Botanical Garden. Mixes were grown successfully when direct-seeded and as five- or six-week-old transplants. Some problems with these mixes have included importing foreign weed seeds in some mixes and a serious problem with chickweed. The chickweed problem occurred on soils continuously planted with the annual flower mixes. In the fourth year, chickweed became so invasive that it crowded out the annual flowers. Considerable hand weeding or rotating the crop will be necessary to minimize the problem.

• Pat Holloway, Pat Wagner, and Hope Lockwood

Asparagus variety trials

Seven cultivars of asparagus were planted at the Georgeson Botanical Garden in 1991 and 1993. Plots were harvested for a one-month period beginning May 20, 1995. Highest yield for 1991 plants was Syn-4-56 (26.2 spears per plant, 326.3 grams per plant) followed by 'Jersey Giant' (15.4 spears per plant; 230.6 g per plant) and 'Jersey Prince' (12.1 spears per plant; 157.3 g per plant). The asparagus planted in 1993 averaged less than seven spears per plant for all cultivars.

• Pat Holloway

Enhancing plant resistance

The purpose of this project is to study the expression of cecropin gene (with antibacterial properties) in potatoes and tobacco. A chimeric gene fusion cassette was introduced into potatoes and tobacco. Transgenic and control plants reacted differently when inoculated with *Pseudomonas solanacearum and P. syringae pv tabaci* at cell concentrations of 102, 103,104, 105 and 106 colony forming unit per milliliter. With control plants, plant wiltings and a clear necrosis in leaf tissue were observed with all five bacterial inoculum levels. With MB39-transgenic plants, however, wilting and necrosis of leaf tissue were observed only at the two highest inoculum levels. Multiplying bacteria in leaves of MB 39-transgenic plants was suppressed more than 10-fold compared to the control plants, and absence of disease symptom development was associated with this growth suppression. The pathogen-induced promoter and the secretory sequence were competent elements for making a cecropin gene into an effective disease-control gene for plants.

• Yong Huang and Jenifer H. McBeath

Evaluating, improving barley

Canola has agronomic potential for Alaska but no oilseed crushers are operational within the state. Previous work at the station with whole (full-fat) seed in barley-based grower-finisher pig diets indicated that both the rate and efficiency of gains were significantly reduced at the 15% supplement level and that the maximum acceptable level of canola (TOBIN) should not exceed 10%. Constructing an oilseed crusher has been considered in Alaska. Therefore, two pilot studies were conducted to determine the effect of canola meal supplementation at 0, 5, 10, and 15% (w/w) replacement of soybean meal in barley-based 21-day early weaned pig diets and growing-finishing pig diets. Sixteen pigs were weaned at 21-days and allotted one of four diets formulated to contain 20% dried whey, 21% CP, 1.2% lysine and 4% corn oil with hulless barley the sole given. Preliminary results indicated no difference in feed intake nor rate and efficiency of gain. A second study with 24 pigs allotted to 8 diets in a 2 x 4 factorial arrangement with four diets each formulated with a covered (Datal) or hulless (Thual) barley and soybean meal replaced at 0, 5, 10, 15% with canola meal. No differences were present in rate or efficiency of gains. Results of these two pilot studies indicate that up to 15% of early-weaned and grower-finisher diets may include canola meal.

• Fredric M. Husby and Garrett Perney

Buttercup flowering

Buttercup (*Ranunculus asiaticus*) plants were

grown at 54, 60 or 68°F and 8, 12 or 16 hours day length. Plants grown at 60°F and 16 hours day length or 68°F and 12 hours day length flowered first. The plants flowering last required 27 weeks from seeding and were grown at 12 hours day length and 54°F or 8 hours day length and 60°F compared to 24 weeks for those plants flowering the fastest. Largest number of buds and flowers (15 per plant) developed on plants grown at 54° or 60°F and 12 hours day length.

• *Meriam Karlsson*

Primrose flowering

Two cultivars ('Dania Lemon Yellow' and 'Blue Danova') of primrose (*Primula vulgaris*) were compared at five day and night temperature combinations. The temperatures were selected to give differences between day and night temperatures of +16, +5, 0, -5 or -16°F. The day temperature was recorded during the 16 hours of light each day. The 24 hour average temperature was 61°F in all temperature combinations. It took approximately 100 days from seeding for Dania Lemon Yellow grown at any of the five temperature combinations to first flower. Blue Danova plants grown with a positive or zero difference between day and night (differences of +16, +5 or 0°F) required slightly more time (two days) to reach the stage of first open flower compared to plants grown with a higher night than day temperature (differences of -5 or -16°F). Flowering in Blue Danova was first observed 90 days from seeding. There were no differences in plant height or flower bud number at first open flower for plants in different treatments of either Dania Lemon Yellow or Blue Danova.

• *Meriam Karlsson*

Petunia, pansy flowering

Petunias of the cultivar 'Midnight Madness' and pansies of four cultivars ('Crystal Bowl Deep Blue', 'Majestic Giant Blue', 'Maxim Deep Blue' and 'Universal True Blue') were grown with 8 or 16 hours long days at two light levels. The light level during the 8 or 16 hours day length was adjusted to provide the same total amount of light each day. Plants grown at long days flowered faster than those exposed to 8 hours day length. Petunias grown at short days required 8 to 10 more days for flowering compared to plants grown at the same amount of light delivered during a 16 hours day length. Flowering was first observed 60 days from seeding for the plants at long days and high light. Plants grown at 8 hours day length and low light required 84 days from seeding to reach flowering. Fewer flowers developed on the petunias grown at the higher light independent of day length. At termination of the experiment, petunias grown at the lower light during either an 8 or 16 hours day length had on average 16 flowers. Pansies of Crystal Bowl, Majestic Giant, Maxim and Universal flowered fastest when grown at 16 hours day length and the higher light intensity. At the lower light, day length did not affect developing and flowering in any of the cultivars. Pansies of Crystal Bowl flowered first (74 days from seeding) and Majestic Giant flowered last (84 days from seeding) at growing conditions of high light and 16 hours day length.

• *Meriam Karlsson*

Canola production

I evaluated canola varieties at three locations in Interior Alaska. Argentine types of canola didn't fully mature at any location. Polish types reached maturity and contained less than 2% green seeds each year at all locations. Seed yields of Polish varieties averaged 0.97 tons per acre at Fairbanks, 0.78 tons per acre at North Pole, and 0.36 tons per acre at Delta Junction. Low yields at Delta Junction were apparently due to moisture stress. Supplemental irrigation may be cost effective for this crop.

A private party brought a used oilseed crusher to Alaska, and the Deltana Community Corporation is currently seeking funds to erect the crushing plant. Potential markets for the canola products include edible oil for human consumption, meal and oil for livestock rations, oil for dust control, and oil for fuel.

• *Charles Knight*

Fieldpea production

Since 1994 I participated in the Regional Fieldpea Varietal Performance Tests coordinated by the Alherta Special Crops and Horticultural Research Center. Selection criteria include early maturity, high seed yields, and standability. Most fieldpeas are grown for forage in Alaska, but seed is expensive to import due to its size and weight. High seed yields often correlate with high forage production since the peas and pods constitute a large portion of the forage. To produce seed in Alaska, the variety must fully ripen before autumn frost and must remain standing after frost for mechanical harvest. Dry pea yields as high as 3.5 tons per acre have been produced in the Eielson Agricultural Project near North Pole, Alaska, but yields vary greatly with precipitation. To date, highest yields were obtained with the variety 'Ascona' and the variety 'Carneval' has shown the best standability.

• *Charles Knight*

Small grain variety trials

Several varieties of spring cereal grains are evaluated in Interior Alaska each year. Varieties to be tested are selected mainly from Alaska, Canada, Norway, and Finland. Seed yield and early maturity

are the primary evaluation criteria. We began evaluating malting barley varieties. Among feed barley varieties, 'Otal' and 'Arra' have performed best. Among oat varieties, 'Cascade" has produced the highest yields, but 'Athabasca' is slightly earlier in maturity. Spring wheat is somewhat marginal in maturity for Interior Alaska, but highest yields have been obtained with the varieties 'Ingal' and 'Cutler.'

·Charles Knight

Disease control leads to a patent

Trichoderma atroviride is a fungus found in Alaska that can parasite a wide range of plant pathogenic fungi. Previously, *T. atroviride* was found to be equal or better than chemical fungicides in controlling potato black scurf disease caused by *Rhizoctonia solani*. This study evaluates the efficacy of four isolates of *T. atroviride* under conditions different from Alaska. In 1995, field trials were conducted under commercial field settings in Manhattan, Mont. Significantly larger numbers of black scurf were found on potato tubers produced from a blank control and carrier control treatments. Treatments of *T. atroviride* are comparably effective as Topsin M and binucleate *Rhizoctonia* treatments in controlling black scurf. Applying *T. atroviride* as in-furrow soil treatment is significantly better than seed dressing in reducing black scurf on progeny potato tubers.

The U. S Bureau of Patent granted a patent for *T. atroviride* in 1996.

·Jenifer H. McBeath

Evaluating lettuce varieties

Tip burn, a physiological disease caused by calcium deficiency, is detrimental to Alaska lettuce as it rapidly grows because of the extremely long day-length during the growing season. Basal rot, caused by *Sclerotinia sclerotiorum*, and grey mold, caused by *Botrytis cinerea*, can severely affect lettuce under certain environmental conditions. These diseases cause a decline in lettuce production and a parallel increase in economic loss to lettuce farmers each year. A lettuce variety trial was initiated in 1991. In 1995, 64 lettuce varieties and breeding lines were evaluated. Tip burn on lettuce was fairly severe; several head lettuce varieties markedly resisted this disease. *Botrytis cinerea* and *S. sclerotiorum* infested, rather severely, lettuce planted later in the season. Several varieties and breeding lines resisted, fairly well, these diseases.

·Jenifer H. McBeath

Developing seed potato exports

Geographic isolation and harsh winters provide Alaska distinct advantages in producing premium quality seed potatoes free from major viruses, bacterial ring rot, late blight (A1 and A2 strains) and golden nematodes. This project seeks to develop premium quality seed potatoes for export. It will benefit potato growers and help diversify the state's economy (and reduce trade deficits). During summer 1995, more than 1.5 million samples were collected from seed lots of nine farms and the Alaska Plant Materials Center. We found no presence of late blight and bacterial ring rot disease in any of the fields we tested. Indeed, some potato farms were completely free of virus disease, which supports the thesis that it is possible to produce virus-free potatoes in Alaska. We found no evidence of virus transmission by insect vectors. It seems that contaminated seed potatoes are the primary source of virus diseases in Alaska.

After an inspection visit by Dr. T.G. Chou, Taiwan's Bureau of Commodity Inspection and Quarantine, the Taiwan government lifted restrictions not only on Alaska seed potatoes but tablestock potatoes as well. In September 1995, a special permit was granted from the People's Republic of China for a trial shipload of premium Alaska seed potatoes to China the following spring.

·Jenifer H. McBeath and Yong Huang

Controlling petunia stem rot

Sclerotinia stem rot, caused by *S. sclerotiorum*, is one of the most serious diseases on many garden flowers in high latitude regions. This disease is especially devastating to petunia (*Petunia* spp.), one of Alaska's most popular garden flowers. The pathogen produces many large sclerotia on the surface and in the hollowed center of the stem. The sclerotia survive the harsh winters and stay viable in the soil for many years. Each spring, these sclerotia serve as the primary inoculum of the disease. In many cases, this disease is so severe that it makes cultivating petunias impossible. Controlling this disease is difficult and all popular cultivars are susceptible. Only systemic fungicides showed some effects. In 1995 field trial findings of *T. atroviride*, present inside the petunia stem tissues, indicated that *T. atroviride* can do more than topically protect against *S. sclerotiorum*. Results indicated that *T. atroviride* is comparable to systemic fungicides in controlling this disease.

·Jenifer H. McBeath and Grant Matheke

Vegetating gravel structures

Point sampling data were obtained in 1994 and 1995 for all plots except the 1993 seeding, which had not developed sufficiently. It is anticipated that all seedings will be sampled in 1996. Developing vegetation on gravel, thus far, showed that grasses were the most aggressive, occupying the plots in the first and second growing seasons at the expense of forbs.

Grasses began sexually reproducing after two growing seasons, but forbs required five seasons. After five growing seasons, grasses generated sufficient canopy to form measurable quantities of standing dead, a feature common to tundra vegetation. Three inches of topsoil, snowfencing, gravel thickness, and species composition and applied seed quantities affected the vegetation forming on gravel fill. Findings suggest that these cultural practices can accelerate vascular plant development on gravel fill in Alaska's arctic. The long-term effects from these practices are unknown. Based on revegetation research on mineral soil in this region, it appears that initial vegetation influences plant community development for a long time. This information should help design revegetation to achieve certain habitat objectives rather than simply producing vascular plants to cover bare ground.

• Jay McKendrick

Measuring cut forage moisture loss

Weather patterns vary considerably from year to year, but long term records indicate that the probability of rainfall increases steadily from May to early July in Southcentral and parts of Interior Alaska. The chance for increased rainfall makes it more difficult to successfully cure cut forage to produce a high quality product. Over the next several years, studies will measure the rate of moisture loss from cut grasses and legumes under our weather conditions. Factors that will be investigated include date of cutting, time of day at cutting, and physical treatments such as, conditioning and raking.

• Michael T. Panciera

Delaying hay harvest

Forage harvest is frequently delayed to obtain favorable drying conditions for curing forage. Such delays can impact quality and yield from subsequent cuttings. Strategies to minimize risks can only be developed if the economic consequences of yield and quality changes can be evaluated. Forage quality will be measured at cutting and during curing to identify the causes of quality losses.

• Michael T. Panciera

Minimum tillage technique study

Establishing conventional tillage of small-seeded forage crops in the spring can be difficult. Inconsistent spring rains and the drying effects of tillage to make a seedbed are major problems. Studies will evaluate usage of minimum tillage techniques to establish grasses and legumes in Alaska. Time of planting will also be studied to take advantage of increased rainfall probability later in the summer.

• Michael T. Panciera and Thomas R. Jahns

Studying alfalfa root reserves

Late summer to early autumn is a critical time for alfalfa winter survival. Cutting causes plants to deplete root reserves. If a killing frost occurs before restoring root reserves, the stand may suffer winterkill. Alfalfa stands were seeded at Point MacKenzie, Fairbanks, and Delta to determine the effects of clipping dates on survival of new seedings and established plants. Lowest levels of reserves were observed when the final cutting was in late August to early September. The impacts on plant survival and yield are not evident yet.

• Michael T. Panciera and Stephen D. Sparrow

Reindeer post-handling survival

Every summer, reindeer (*rangifer tarandus*) on the Seward Peninsula are handled to harvest antlers, mark calves, and vaccinate. Calves, due to their small size, are more susceptible to injuries than adults. Handling stress and injuries can lead to chronic infections in calves and may reduce survivability. Treating injured, stressed, or low weight calves with LA-200–a broad spectrum, long lasting antibiotic–may reduce post-handling infections and increase survivability. Previous work suggests that reducing calf mortality through improved handling produces a strong positive effect on reindeer populations. Calves were randomly treated with LA-200 during the 1995 handling season. Their survival rates will be determined by the number of calves returning as yearlings in 1996.

• Greg Pietsch and Greg Finstad

Classify, interpret permafrost soils

The cryogenic structures and morphological properties of permafrost soils were studied in the subarctic and arctic regions of Alaska, northeast Russia and northwest Canada. Soil horizons within the active layers generally contain sublimation, segregation, and injected ice. Fine and thin ice lenses are common, and massive ice occurs occasionally. Cryogenic structures of the permafrost layer usually differ from that of the active layer. Identifying the cryogenic structures can help establish the true active layer depth which is sensitive to climatic changes. The morphology of ice-cemented permafrost soils are usually characterized by ruptured organic horizons, distorted mineral horizons, and frost-churned humus into the mineral horizons with the exception of recently formed alluvial or tidal marsh soils. Granular structures are common in the A horizons, platy structures common in the B horizons, and massive and blocky structures are common in the BC horizons. The upper permafrost layers usually consist of ataxitic (ice-rich) horizons or massive ice.

• Chien-Lu Ping

Denali Park indepth study

The study: 1) establishes baseline data of the soils, vegetation, hydrology, and microclimates of different vegetation communities in the Rock Creek Watershed, 2) develops protocols for environmental monitoring to detect the effects of anthropogenic activities, and 3) determines the effects of soil water on the stream quality. The environmental monitoring is complete and the protocol will be transferred to the Denali Park Service in Summer 1996. The stream water quality study was set up in Summer 1995 and late summer water quality data indicated that calcium and magnesium are the major ionic species in the stream's soluble components. The presence of bicarbonates and nitrogen strongly reflect the vegetation communities and form.

• Chien-Lu Ping

Tundra soil organic matter

Carbon dioxide and methane flux by ecosystem type and long-term feedback relationships with the atmosphere. This study assesses the carbon stores in soils of the NSF-LAII-Flux study sites, and seeks to determine the relationships between the quality and quantity of soil organic matter and gas fluxes in the arctic ecosystem. Twenty-five soil profiles, representing the flux monitoring sites and major landforms of the study area, were excavated one meter deep. Their morphological properties were studied in detail, and soil samples were taken for analyzing characteristics and assessing carbon storage. Soil carbon stores range from 1 to 6 pounds of carbon per cubic foot. Coastal plain and foothill tundra soils average 4 and 3 pounds of carbon per cubic foot, respectively. Nearly 50% of the total carbon is stored in the upper permafrost layer due to cryoturbation. The permafrost table fluctuates with climate change either sequestering or releasing the frost-churned carbon. The carbon stores estimated for the tundra soils in this study are more than double previous estimates which only measured carbon stores in the surface soils. The extractability of organic carbon increases with depth, indicating an increased humification of soil organic matter. The CO_2– and methane–producing capacity decrease with depth. This indicates the less decomposed organic matter fraction being the sources of CO_2 and methane gases.

• Chien-Lu Ping and Gary Michaelson

Monitoring wet soils

The project objectives are to: 1) study the redoximorphic features of seasonal frozen soils in Alaska, 2) evaluate the relationships between those features and reduced conditions, and 3) define hydric soil criteria of these soils. Mark Clark completed his master thesis on monitoring the seasonal frozen soils in Southcentral Alaska. In Summer 1995, a wet soils monitoring network—established with two other agencies—began along a catena on Douglas Island, Southeast Alaska. This project will also study the hydrology and oxyhydric nature of these soils.

• Chien-Lu Ping, Mark Clark, and Dave D'Amore

Mica weathering in ryegrass

The rhizosphere is the soil adjacent to, and influenced by, the presence of live plant roots. It is characterized by higher biological activity and higher microbial populations than that of the bulk soil. Microorganisms, as well as roots themselves, produce substances which may enhance the weathering of soil minerals. This in turn can result in release of plant available nutrients from these minerals. Many soils in Alaska and the neighboring Yukon Territory and northern British Columbia are high in a mica which contains potassium. Weathering of mica in rhizospheres could be one way that plants obtain potassium in soils high in mica. The objective of this study is to determine the effects of soil temperature on the weathering of mica and release of potassium in the rhizosphere of ryegrass roots, both in the absence and presence of microorganisms. Preliminary work is currently in progress; no results are available yet.

• Stephen D. Sparrow and Joselito Arocena

Perennial legumes

Information on long-term persistence, yield, and effects on soil properties of perennial forage legumes is lacking for Alaska. This experiment was begun in 1992 to determine potential forage yields, dinitrogen fixation, and changes in soil biological, chemical, and physical properties under perennial forage legumes, perennial grasses, annual small grains, and fallow. Plots were established at Delta Junction and Fairbanks in Interior Alaska and at Pt. MacKenzie in Southcentral Alaska. Forage yields, root yields, and N yields were measured for each plant species. Soil properties measured included organic carbon, total nitrogen, pH, wet aggregate stability, and microbial biomass carbon. Survival of all forage legume species was poor at Delta Junction. After the first winter only Peace alfalfa remained, and in 1995 only a few alfalfa plants remained. Survival of forage legumes was quite good at the other two sites, with good stands and good forage yields obtained in 1995. By 1995, differences among treatments for the various soil properties were small and usually not significant. However, some definite trends were evident. For example, wet aggregate stability was highest for soils under perennial legume crops and lowest under fallow. Soil biomass carbon was highest under perennial legumes and grasses and lowest under continuous barley. It usually takes several years for a given crop and soil management system before

large changes in soil properties occur under climates typical of subarctic Alaska.

• Stephen D. Sparrow and Michael T. Panciera

Nitrogen-fixing plants

The Delta Junction Bison Range (DJBR) provides summer and autumn forage for the Delta bison herd and discourages the bison from entering farmers' fields and damaging crops before harvest. The range has been only partially successful. Maintaining high quality forage has been difficult, partly because there is insufficient funds to fertilize properly and manage cutting. Nitrogen-fixing plants, which do not require nitrogen fertilizer, produce high quality, palatable forage. Also, some forage legumes remain green late into autumn. Therefore, if nitrogen fixing-plants could be worked into the management regime for the DJBR, fertilizer costs might decline and forage quality increase. To test the feasibility of using forage legumes on the DJBR, several species of legumes were planted at several locations on the range in 1992 and 1993. Survival of all forage legumes was poor in open range areas, which are subject to winter winds. In areas protected from winter winds, survival was quite good and the areas consistently obtain good yields for red clover and alfalfa. Therefore, using forage legumes appears to be feasible in protected areas. Unfortunately, these areas represent only a small proportion of the DJBR, and thus forage legumes will have limited use.

• Stephen D. Sparrow and Michael T. Panciera

Managing bluejoint

Bluejoint (*Calamagrostis canadensis*), a native Alaska grass, is a serious weed on range land in Alaska, such as the Delta Junction Bison Range, because it outcompetes the introduced forage grasses. Bluejoint produces fairly good quality forage early in the growing season but the quality decreases rapidly as the season progresses. Often, using herbicides is not an option for controlling bluejoint. Therefore, there is interest in controlling bluejoint through mechanical means—mowing or improving bluejoint forage quality making it a useful forage grass throughout the growing season. We experimented on native bluejoint stands to determine if various mowing treatments, combined with various nitrogen fertilizer treatments, would improve bluejoint forage quality or control its growth and allow more desirable species to grow. Fertilizer treatments include no nitrogen fertilizer, N fertilizer applied once at the beginning of the growing season, or split applications where fertilizer was applied once in early season and a later date. Mowing treatments include none, single, or triple cuttings done at different times during the growing season. Plant materials are harvested from each plot periodically throughout the growing season. In 1995, addition of N fertilizer caused substantial growth; grass yields for single and double N applications were similar. Regrowth increased after early season cuttings; little regrowth followed double or triple mowings. Samples are being analyzed for forage quality. Plots will be observed in 1996 to determine survival and growth following the various treatments. The treatments will be established on a different bluejoint stand in 1996 and the study will continue through 1997.

• Stephen D. Sparrow and Michael T. Panciera

Evaluating potato fertilizer rates

Nitrogen was applied to potato plots at 0, 60, 120, 180, or 240 pounds of nitrogen per acre. Tuber numbers and mass, and above-ground mass were measured weekly throughout the growing season. Data indicate substantial differences between the two varieties tested, Green Mountain and Russet Burbank. Yield of marketable tubers produced by Russet Burbank increased as nitrogen was added up to the highest level, whereas higher rates of nitrogen increased unmarketable, oversized Green Mountain tubers, but not marketable production. Tuber initiation and development were not delayed by the use of high rates of nitrogen in either variety.

• James Walworth

Controlling weeds

Metam sodium and dazomet were surface-applied and irrigated into soil at rates of 0 to 320 pounds active ingredient per acre in late summer. Five weeks after application, weeds were absent where the highest rate of dazomet was used; the equivalent rate of metam sodium reduced weed levels by 79%. The following summer corresponding weed reductions were 84% and 54% for dazomet and metam sodium, respectively. Potato yields from treated soils indicate that using metam sodium or dazomet did not adversely affect crop yields. Weed populations and lettuce production were measured for the third year on plots that received metam sodium in 1992. Good weed control is still observed on plots that received 160 or 320 pounds active ingredient per acre.

• James Walworth

Evaluating lettuce varieties

Twenty-seven head lettuce varieties were transplanted into field plots at three planting dates and evaluated for tip-burn, head size and mass, marketability, and flavor. Among the top named Varieties were Premier, Tiber, and Pybas 142.

• James Walworth

Fish by-products, bioremediation

Fish processing by-products are being evaluated as nutrient sources for bioremediation. Laboratory incubation studies have been conducted to measure effects of soil pH and temperature on nitrogen and phosphorous release rates from dry or hydrolyzed white cod bonemeal. At 10°C 100% of organic nitrogen from white cod bonemeal is mineralized in 10 weeks, whereas complete mineralization occurs in eight weeks in 200 incubations. Bioavailability of phosphorus added as bonemeal materials was greatest when applied, and declined for several weeks following application. In laboratory studies with petroleum contaminated soils, white cod bonemeal resulted in more rapid biological oxidation of petroleum than equivalent levels of nitrogen and phosphorus added as inorganic fertilizer (diammonium phosphate). These studies are being duplicated in a field-scale bioremediation cell.

•James Walworth

Bioremediation, water potential

The interaction between soil moisture levels and soil nitrogen concentrations is being studied in a series of laboratory experiments. Preliminary data suggest that the microbes responsible for bioremediation may be sensitive to excess nitrogen in dry soil, but not in wetter soils. Total water potential (osmotic plus matric potential) apparently controls biological activity in this situation.

•James Walworth

Nitrogen source study

Nitrous oxide is being tested as a vapor phase nitrogen source for bioremediation. There is a need for vapor phase nitrogen in in-situ bioremediation where adding water is not desirable. Initial laboratory data indicate that petroleum-degrading bacterial may be able to use nitrogen contained in nitrous oxide.

•James Walworth

Forest Sciences

Assessing environmental damage

We are using satellite imagery to comprehensively assess damage in Bosnia. The goals of this project are to provide the United Nations with information necessary for economic reconstruction and environmental reclamation of the country. Andrews and Bader used Global Positioning Satellite receivers to document the locations of specific vegetation and damage types in Bosnia. We then acquired satellite imagery taken during July 1987 (prewar) and July 1994 (postwar) for computer analysis. We are currently correcting the satellite data for geometric warping, and will then subtract prewar image data from postwar image data for damage assessments.

•Jonathan Andrews, Harry Bader, Dara Fell, and Dave Verbyla

Comparing wetlands mapping

We compared ERS-1 synthic apeture radar with Landsat Thematic Mapper optical data for mapping wetland types within the Tanana Flats area southwest of Fairbanks. Radar's advantages over optical data include its ability to penetrate through clouds and to strongly respond to inundation conditions. However, single-band radar data was not as accurate as multi-band Thematic Mapper data. Combining radar and optical data yield the best accuracy. We believe that the two sensor types respond to different physical properties. Radar is sensitive to plant canopy architecture and water conditions, optical remote sensing is sensitive to plant pigments and plant surface conditions.

•Andrew Balser and Dave Verbyla

Modeling landscape level management

A computer program is being written to simulate the interactions of environmental variables and forest management decisions on forest floor surface temperatures. Understanding these interactions will help determine how forest harvest impacts soil freezing and thawing. Simulation runs of a watershed model exploring the effect of timber harvest on stream flow and soil freezing and thawing indicate high sensitivity to initial soil moisture conditions and the possibility of as much as a five-year delay in effects of timber harvest on runoff. Researchers are testing this model with historical data sets from Alaska and other northern states. We plan to link this watershed model to a Geographic Information System to display the spatial patterns of key variables such as frost depth, thaw depth, and soil moisture at various times throughout the year.

•John D. Fox Jr.

Digital classification optimistic bias

We used satellite imagery of Bonanza Creek Long Term Ecological Research Site to demonstrate that misleading estimates of vegetation mapping accu-

racy is likely under certain conditions. These conditions include: using training data to assess accuracy; restricting reference data sampling to homogeneous areas, and sampling reference data not independent of training data. The magnitude and direction of bias in classification accuracy estimates depends on the methods used to classify and reference data sampling. Therefore, vegetation mappers should always report their methods in sufficient detail to enable readers to assess the potential for bias in classification accuracy estimates.

• Tim Hammond and Dave Verbyla

Studying white spruce—post fire

Survival and height growth of all white spruce seedlings in a one hectare (2.47 acre) plot within the 1983 Rosie Creek Burn have been measured since 1989 as part of the Bonanza Creek Long-Term Ecological Research (LTER) program. Researchers have mapped and measured 1,678 spruce seedlings, including 1,459 alive in spring 1995 (86.9%) and 219 (13.1%) that died during the period. All seedlings in the plot germinated from 1983, 1987, or 1991 seed crops and most were discovered three to five years after the seed crop. As a result white spruce regeneration surveys are not likely to be accurate before the fifth year. In Spring 1995 we discovered 148 new seedlings and only 16 dead seedlings. Falling snags of mature trees killed in the 1983 fire pose the greatest threat to spruce seedlings. Animal browsing and falling dead trees caused about 300 (~20%) seedlings alive in 1995 to loose their terminal buds or leaders. The average height growth of 1983 seed-crop seedlings in 1994 (measured in 1995) was 4.7 inches (11.9 cm), a standard deviation of 7.3, which is equal to or below 1991 through 1993 height growth. This reduced growth is correlated with high drought stress levels. This study developed a comprehensive picture of establishing and early growth of upland white spruce.

• Glenn Juday

White spruce climatic growth

The radial growth history of white spruce in the Reserve West (RW) and Timber Bench (TB) reference plots in and near Bonanza Creek LTER was measured from a balanced sample of 68 and 25 basal tree disks respectively. Radial growth at both stands is positively correlated with mean annual and summer precipitation at the University Experiment Station (UES) with lagging of one to three years. Radial growth in both is inversely correlated with the available record (1906+) of mean annual temperature at UES. This means that the trees grew best following the coldest years and grew the least following the warmest years. This unexpected relationship of temperature and growth appears to be caused by the high drought stress associated with hot years. The radial growth and development of the RW stand was reshaped by a 1878-79 trauma, producing three subpopulations of trees: winners, normal, and losers. In winner trees, the ratio of cross-sectional bole area in 1883 compared to 1982 is greater than two, in normal trees the ratio is between one and two, and in loser trees the ratio is less than one. Winner trees experienced most of the significant stand-wide growth reduction in 1958 and 59 following the severe 1957 and 58 summer droughts; looser trees were not greatly affected.

• Glenn Juday

Forest products marketing

An 18-member team reviewed Alaska's forest products sector as part of the state's "Marketing Alaska" initiative. The team recommended 14 initiatives grouped under: (1) enhancing value-added instate processing of forest products, (2) state forest policy, and (3) communications and information networks. We recommended changes to state timber sales policy to promote regional value-added processing and expanding existing Alaska businesses, forming an Alaska Timber Grading program, developing log export policy, more effectively implementing the Forest Practices Act, and stabilizing funds for state renewable resources research. The state administration and interim committees of the Alaska Legislature incorporated several of our recommendations in forestry legislation and they were signed into law by the governor.

• Glenn Juday

Clear AFS biodiversity

Clear Air Station (CAS) is a 10,800 acre U.S. Air Force base located along the Parks Highway and the Alaska Railroad 80 miles southwest of Fairbanks. We completed a biodiversity survey to advise the Department of Defense of environmentally sensitive features requiring special management. Vegetation covering CAS was mapped and sites with important biodiversity vales were identified. Most of the station is covered with a unique forest that alternates between aspen following fire and black spruce that gradually replaces aspen and causes permafrost to develop. When the black spruce burns then the soils thaw again and the forest cycles back to aspen. Base commanders need to plan for the high natural fire frequency in this forest type. A special lichen-moss-dwarf woodland plant community called gravel barrens is found at CAS. Gravel barrens are found on pure coarse gravels lacking a fine soil cap that were put in place by glacial meltwater at the end of the Ice Age about 12,000 years ago. Some relatively uncommon species occur in gravel barrens, and the mats of lichens and mosses can be destroyed when

crushed by repeated foot or vehicle traffic. The floodplain of the Nenana River is a wildlife-rich corridor and old island cores, modern terraces, and active floodplain surfaces that support unusually high tree species diversity.

·Glenn Juday and Robert Ott

Disturbing Tongass National Forest

Results from a study of natural small-scale forest canopy gap disturbance in the coastal forest of Southeast Alaska were formulated into decision rules for the Tongass National Forest Land Management Plan Revision. Timber harvest rules were developed for areas needing a substantial remaining canopy (uneven aged forest management systems), especially the extended beach fringe zone. In the beach fringe zone, openings produced by forest harvest must be less than 2.0 acres and must include a well distributed set of openings that range from 0.1 to 2.0 acres. Total harvest disturbance is limited to no more than 10% of a contiguous 100 acre analysis area every five decades. Total forest area removed for necessary roads or catastrophic salvages count toward the 10% maximum disturbance standard.

·Bob Ott and Glenn Juday

Disturbance, responding understory

Data were analyzed from 20 forest canopy gaps at each of three sites and from five reference plots in northern Southeast Alaska. Responses were measured under intact forest canopy, in openings caused by the death of one to 10 overstory trees (canopy gaps), and in the transition between the two. Light readings were measured as a percent of full sunlight at both the top of the shrub layer and at the herb layer. Preliminary results reveal the expected gradient in overall light levels from lowest values under forest canopy, to intermediate in transition gaps, to highest in canopy gaps. Height of tallest woody species follows the same gradient. However high light levels in canopy gaps at the shrub layer promotes vigorous shrub growth, often resulting in more light interception (less light) at the herb layer in canopy gaps than under intact forest canopy. The observed light patterns are expected to cause fewer plant species at the herb layer in canopy openings than under intact forest canopy. Trees reproducing in gaps are important replacement trees that maintain forest cover, but in this study understory tree density in gaps was not correlated with gap size. Tree seedling density in canopy gaps is also influenced by illumination from surrounding canopy gaps.

·Bob Ott and Glenn Juday

Individual tree volume tables

Sampling of spruce continued and will be completed during 1996. A final set of statewide, cubic-foot volume tables (inside and outside bark) will be completed in 1997. Sampling of tree and bark measurements for other species is ongoing.

·Edmond C. Packee

Forest products future

Export markets (British Columbia, Washington, Oregon, and Asia) for Alaska round logs greatly decreased in the latter half of 1995 and are expected to be depressed into 1997. More efficient harvesting that cleaned up existing "Lower 48" timber sale contracts, the available additional fiber from salvage and stand management activities in the "Lower 48", and normal market cycles for forest products contributed to the decline. Pulp inventories were high in the latter half of 1995; inventory corrections (reduced inventory building and reducing stock) should be complete by mid-1996. Logs from the Kenai Peninsula were shipped to Southeast Alaska in 1995. The demand for value-added products also dropped; thereby shifting logs from Pacific Northwest mills to export markets. Canadian export to the United States will decrease in 1996 and increase to the Pacific Rim. Various Alaska organizations are seriously investigating value-added processing, such as paper birch for veneer.

·Edmond C. Packee

Silvicultural systems

A major concern in a silvicultural system is adequately regenerating the right species. In Fall 1995 survival and height growth of the Tok Levels-of-Growing-Stock (LOGS) was assessed. The LOGS plantations were established in August 1992; this assessment provides the common, standard third growing season results. Survival for the four species (white and black spruce, tamarack, and lodgepole pine) continues to exceed 90%. Data analysis has begun. The LOGS study at Bonanza Creek, although not formally assessed, indicates heavy insect infestation. Aphids continue to attack tamarack while spruce gall aphids attack the white spruce, varying intensity for each tree. The spruce gall aphid is also present on the three-year old seedlings at Tok. The 10-year measurement, scheduled for Fall 1996, will include insect information at both sites.

·Edmond C. Packee

Managing forests for biodiversity

Efforts to explore the relationship between forest management and biodiversity continued in the Tanana Valley and have been expanded to include Southcentral Alaska. Emphasis continues to concentrate on the Townsend warbler (*Dendroica townsendi*). The literature search confirms that the species uses both conifers and mixed conifer forests in Alaska. The warbler nests in spruce, true-fir, and

Douglas-fir and gleans conifer foliage for insects. However, after hatching eggs, it forages in hardwoods. This is probably associated with shifting food sources; since the early-season defoliators of conifers are gone but hardwood defoliators are abundant. Stand density or tree size appears to be related to nesting site selection. Low initial conifer stocking or pre-commercial thinning may adversely impact the birds. It is unclear whether tree size is relative to the rest of the trees in the stand or is absolute (big trees being preferred). The Townsend warbler undoubtedly will be displaced from beetle-killed, fire-killed, or harvested white spruce stands due to loss of required nesting habitat and spring foraging habitat.

• Edmond C. Packee

Summarizing Alaska forest inventories

The effort to summarize Alaska's forest inventories continued.

• Edmond C. Packee

Reforestation stocking standards

After reviewing the survival statistics for white spruce at various operational plantations, less than 60 to more than 90 percent of the spruce survived into the third year. The Tok Levels-of-Growing-Stock study revealed that more than 95% of white spruce survived into the third year. This high rate is attributed, in part, to care in handling seedlings from the nursery through planting. At Tok, mortality continued through the third year. When the state set minimum spruce stocking goals of only 450 surviving seedlings per acre two years after planting, they underestimated subsequent mortality. Based on Canadian data, this will ensure unoptimal productivity on sites where trees are grown to less than 75 feet high. Regeneration planning must address: sustained yield and the number of seedlings to obtain that goal, the concept of free-to-grow so that mortality is no longer a serious problem, and target heights of seedlings at the next harvest.

• Edmond C. Packee

Forest health

Northern forest conditions exist that can only be described as serious forest health problems: continual and expanding insect epidemics, fuel buildups that increase the severity of wildfire, and losses of desirable habitat. Loss of spruce will detrimentally impact certain wildlife species. Observations suggest that it also increases the abundance of *Calamagrostis canadensis* grass which has limited forage value. Fuel types change following the loss of live spruce from the stands: the grass creates an early spring fuel that readily ignites and carries surface fires to heavier fuels. Research on Kenai Peninsula Lowlands suggests that the spruce beetle kills 95% or more immature and mature spruce over six inches in diameter.

• Edmond C. Packee

Kenai lowlands forest stand

Analyses of age data indicate that forests on the Kenai lowland commonly consist of single cohort and multi-cohort stands. One stand approaches an all-age structure. Often times the largest diameter trees were not of the oldest (cohort) age class. Typically, beetles attacked larger diameter trees first and hardest.

• Edmond C. Packee

Permanent sample plots

More than 50 sample plots were established during 1995, increasing total plots to more than 60 in more than 20 sites throughout the Tanana Valley. Emphasis was on mixed hardwood-white spruce stands. One-half of previously selected potential sites did not meet the required standards. Of the remaining potential sites, a large number are on private lands. Negotiations are in process with Native organizations to access their lands and set aside areas for long-term plots. One-half of collected data was entered into plot spreadsheets, while age determination for most plots is complete. Number of stems in several stands exceed 1,500 per acre. Breast height age of one upland spruce dated back to the middle of the 18th century. A list of potential plant species was prepared.

• Edmond C. Packee

Logging vs. natural fires

Before we can develop appropriate forest management policies, we must understand contrasting effects on biodiversity of fire and logging—the major disturbances in upland boreal forests of Alaska. Data in this study were collected in Summer 1995 from the Tanana and Yukon River drainages in south-facing upland white spruce forests representing four stand development stages. The combined burned sites and successional stages support more species overall (158) than logged sites (111), and burned sites supported more species at each stand development stage. Species richness on burned sites consistently increased linearly in the first three stages; species richness on logged sites remained relatively flat across the stages. Species turnover was greater between stages on burned sites than between stages on logged sites. Species that dominate burned sites in early succession virtually disappeared in the last two stages, while early successional dominant species on logged sites steadily increased across all four stages. Surface organic layer was twice as deep on logged sites in each stand development stage

compared to burned sites. This suggest that available nutrient elements may be lower on logged sites. Logged sites appear to initiate succession with substantial patches of the original older forest understory and its complement of species intact, and appear not to support a set of specialist fire-dependent species. Burned sites appear to be more uniformly disturbed, to support several fire-dependent species, and to experience more species turnover through time.

·Dan Rees and Glenn Juday

Integrating a forest ecosystem model

Computer modeling of forest ecosystems biology has been devoted to combining theoretical and empirical approaches representing the function of a forest ecosystem generally within an undefined spatial context. Moving to a large spatial context, like the state of Alaska, will require theoretically representing critical biological processes found in the ecosystem that can be represented on an individual cell basis. It should then be possible to vary the size of the smallest cell from 10.8 square feet to 250 acres (1 m^2 to 100 ha). A forest ecosystem dynamics model is being developed that is based on the nitrogen productivity concept for forest growth; litterfall quality and microbial efficiency for forest floor decomposition, and forest regeneration based on a tree's sprouting or seed production capability. Climate and ecosystem level disturbances will be handled as random processes restricted to the ranges found in various regions of Alaska. The model has been programed as a geographic information system module. This computer programing has resulted in an ARC/INFO AML within the GRID package. The current version of the model has been verified as functional from an individual tree basis in a number of forest types found in Interior Alaska. Verifying a landscape scale is difficult because of a lack of detailed data that can be used from a landscape perspective. However work is progressing on moving to a landscape representation of the model.

·John Yarie

Balancing carbon, boreal forest

Determining the carbon balance in a broad forest region like the Alaskan boreal forest requires developing a number of important environmental (state factors) classes to allow for carbon balance estimates. We have used the following factors to develop a regional classification of the state.

1. Average monthly temperature from May through September—representing the state's approximate growing season,
2. Average total precipitation from May through September,
3. The domain, division and province levels of the ecoregions classification of Alaska—a published classification of various vegetation, and climatic regions found in the state

Additionally, the following classifications that further subdivide and describe Alaska's boreal forest regions are being developed:

4. Seasonal land cover
5. Age structure of the vegetation in the forest areas

A forest dynamics model for the Alaskan boreal forest will be run to determine the effects of anticipated global change on the carbon dynamics within the regions of the biogeoclimatic classification. This approach should accurately represent the carbon dynamics of the forest within an area of land the size of Alaska.

·John Yarie and Tim Hammond

Resources Management

Rural economic models

We developed a community and economic profile for four villages along the lower Yukon River, examining the cash economy of the four villages and comparing it to the Yukon-Koyukuk Census Region, the Denali Borough, Alaska, and the United States economies. The U.S. Department of Commerce Bureau of Economic Analysis database and the 1990 Census provided the basic data. We examined the subsistence economy using information from a report published by the Tanana Chiefs Conference, Inc. and the U.S. Fish and Wildlife Service. While this was to be an intermediate product in our ongoing rural regional economic modelling effort, resources did not allow us to pursue a full modelling effort in these villages.

·Joshua Greenberg, Carol Lewis, and Hans Geier

Marketing cooperatives in Alaska

The objective of this project was to educate and develop services for producers interested in forming marketing cooperatives. Work began with Delta Junction dairy farmers interested in marketing raw milk, and producers interested in marketing oilseed products. There is a need to expand market opportunities for Interior Alaska dairy farmers. With the potential availability of an oilseed crushing plant,

there is also a need to investigate markets for edible oils, oilseed meal for animal feed, and markets for industrial oils. Industrial uses include biodiesel fuel, crop oil, and dust control for gravel roads. We are looking at other cooperative ventures including a boat haulout in Wrangell, a processing and freezing plant in Shaktoolik, and vegetable marketing.

·Hans Geier, Carol Lewis, and Ed Arobio

Studying recreational territories

Field data on recreational territories were collected on the Gulkana River between June 15 and July 10. Fishers typically set up territories around the primary fishing holes, marking it by spreading out their equipment and defending it by actively fishing. This maintains exclusivity of the hole for a specific time. After analyzing the preliminary results, the information was given to the Bureau of Land Management and the Alaska Department of Fish and Game. A new pattern of fishing is emerging where many holes are fished as the people float the river, spending a half to an hour at each one. They simply camp wherever they are at the end of the day. Thus, there is less emphasis on establishing a territory and defending it. Plus, these people appear to be more successful in catching fish. The patterns, if they hold over the next two seasons, are considerably different than the historical recreational territories. This change appears to have been instigated by sport fishing guides on the river as a more efficient way to allocate scarce fish resources among sport fishers.

·Alan Jubenville

Supervising graduate research

I supervised four graduate research projects: Dalton Highway visitor survey; impact of recreation use on the Taiga biosystem; analysis of BLM's planning process; and wilderness classification system.

·Alan Jubenville

A lesson in ag production

Research, service, and instruction are combined in the classroom in NRM 310: Agricultural Concepts to show consumer marketing as part of the agricultural industry. Producers are involved and represent their business and products to the class. The class participates in sensory panels, prepares marketing strategies, and creates logos (some of which have been used by businesses) for a predetermined products. Alaska honey, carrots, barley pancake mix, salsa, and tomatoes have been used in past years. The project has expanded to include processed seafood products. Pollock fillets enhanced with a whey product only and a combination of a whey and sodium injection are being prepared for evaluation.

·Carol Lewis, Joshua Greenberg, and John French

Alaska's agricultural industry

Alaska's agricultural industry is integral to industry in the circumpolar north. We previously developed three models for Alaska's industry which are based in the percentage of federal, state, and private investment in a developing industry. In 1992, we compared the models to past and present agricultural development in eastern Canada, the Yukon, and Siberia. Using the core-periphery theory as a basis, we found that northern agricultural development is dominated by national policy which does not favor expansion. Thus, agriculture remains regional in its production and product distribution. In 1995, we updated our models to determine predictive accuracy. The model based in rapid development using only state funding, in the form of loans and direct payments, to develop infrastructure was the least successful. This model is influenced by the political process. The most successful model—"hands off"—mixed federal, state, and private funding with little or no restrictions or compliances on farmers. Development under this scenario, however, will progress slowly and most likely will not go beyond regional production and distribution. The implication is that Alaska must penetrate national and international niche markets. Entering the commodity markets is unlikely.

·Carol E. Lewis and Roger W. Pearson

Advancing extreme life systems

The problems of obtaining adequate pure drinking water and disposing of liquid and solid waste in the U.S. Arctic have led to unsanitary and socially unacceptable conditions. Past solutions— honey buckets and open lagoons—damage human health and the environment. Historically, high technology systems are not a viable solution because residents in remote communities are not trained to operate and maintain them.

Advanced life systems for extreme environments (ALSEE) provide a solution by applying NASA-developed technologies. ALSEE is a holistic approach to the water and sanitation problems in the circumpolar north. A project goal is to educate and train people in water and waste water technology. The technology incorporates hydroponics and aquaculture into the waste and water treatment system which provides high quality products for consumption and sale. The atmosphere necessary for hydroponics and aquaculture can offer respite from severe arctic winter conditions and may alleviate stress associated with these extremes. Researchers and educators involved in the project will also offer

secondary and post-secondary education in science, business and management. Finally, spin-off technologies and food product sales offer business opportunities that would not have existed in the far north.

• Carol E. Lewis and John J. Kelley

Alaska agricultural tours

We are preparing brochures tailored for residents and tourists who would like the opportunity to see Alaska's agriculture in self-guided tours in the Delta Junction and the Mat-Su areas. The Delta Junction tours will highlight one of the two state supported agricultural projects in Alaska and a modern homestead. The Mat-Su brochure will feature the federal resettlement program area.

• Carol Lewis, Roger Pearson, and Hans Geier

DR. JAMES WALWORTH, associate professor of soil fertility and horticulture, explains tuber formation to Stephen Lay, communications manager. Potatoes form tubers throughout the growing season, however, not all tubers develop into potatoes. The plant may reabsorb some of its tubers. In the second photo Walworth is pointing out a newly formed tuber. The small potato to the right of his finger is about the diameter of a dime. You can read more about Walworth's research beginning on page 17.

—photos by Cal White—

Faculty Publications

January 1995—December 1995

Journal Articles

Title	Author(s)	Where Published
Patterns and regulation of mycorrhizal plant and fungal diversity	E. B. Allen, M. F. Allen, D. J. Helm, J. M. Trappe, R. Molina, E. Rincon	*Plant and Soil*. 170:47-62
First report of *Rhizoctonia solani* AG-7 in Indiana	R. E. Baird, D. E. Carling	*Plant Disease*. 79:321
Botanical and other characteristics in arctic salt-affected coastal areas used by migratory geese and caribou	L. B. Bruce, M. T. Panciera, R. G. Gavlak, B. A. Tillman, J. M. Cadle	*Journal of Range Management*. 48:206-210
Phenological development-yield relationships in spring barley in a subarctic environment	S. M. Doffing	*Canadian Journal of Plant Science*. 75:93-97
Involvement of thaxtomins in pathogenicity of *Streptomyces scabies* on seedlings	B. A. Fry, R. H. Leiner, D. E. Carling, R. Loria	*Phytopathology*. 85:1121
Native grass cultivars for multiple revegetation goals on a proposed mine site in southcentral Alaska	D. J. Helm	*Restoration Ecology*. 3:111-122
Vegetation chronosequence near Exit Glacier, Kenai Fjords National Park, Alaska, U.S.A.	D. J. Helm, E. B. Allen	*Arctic and Alpine Research*. 27:246-257
Rhizome production in lingonberry, *Vaccinium vitis-idaea*	P. S. Holloway	*Plant Propagator*. 7(2):21-23
Expression of a bacterial avirulence gene in transgenic tobacco induced the hypersensitive cell death	J. Huang, J. McBeath	*Phytopathology*. 85:1161
Putting wild back into wilderness	A. Jubenville	*International Journal of Wilderness*. 1(1): 47

Title	Author(s)	Where Published
Trail and site management are the key to untrammeled wilderness	A. Jubenville	*International Journal of Wilderness.* 1(2): 23-25
Characterization of anastomosis group-10 (AG-10) of *Rhizoctonia solani*	G. C. MacNish, D. E. Carling, M. W. Sweetingham, A. Ogoshi, K. A. Brainard	*Australasian Journal of Plant Pathology.* 25:252-260
Use of vegetatively compatible populations (VCP) to determine field distribution of *R. Solani* AG-8	G. C. MacNish, D.E. Carling	*Phytopathology.* 85:1040
Evaluation of *Trichoderma atroviride* in controlling *Rhizoctonia solani* of potato under potato field conditions in Montana	J. H. McBeath, E. Carpenter, M. Sun	*Phytopathology.* 85:1153
Reclaiming an abandoned placer mine in Alaska	M. G. Nelson, E. C. Packee Jr., D. J. Helm	*Mining Engineering.* 47:240-242
Addition of livestock performance and economic factors to yield and quality analysis of forage management experiments	M. T. Panciera, L. B. Bruce, R. G. Gavlak, B. A Tillman	*Journal of Production Agriculture.* 8:101-106
Effects of nitrogen fertilizer on dry matter and nitrogen yields of herbaceous legumes in interior Alaska	M. T. Panciera, S.D. Sparrow	*Canadian Journal of Plant Science.* 75:129-134
Improvements in the definition of cryic and pergelic soil temperature regimes in Soil Taxonomy using daylength/solar radiation	S. E. Samson-Leibig, J. M. Kimble, C. L. Ping	*Soil Survey Horizon.* 36:20-25
A description and classification of soils and landscapes of the lower Kolyma River, northerneastern Russia	C. A. S. Smith, D. K. Swanson, J. P. Moore, R. J. Ahrens, J. G. Bockheim, J. M. Kimble, G. G. Mazhitova, C. L. Ping, C. Tarnocai	*Polar Geography and Geology.* 19:107-126
Dinitrogen fixation by seven legume crops in Alaska	S. D. Sparrow, V. L. Cochran, E. B. Sparrow	*Agronomy Journal.* 87:34-41
Residual effects of harvested and green-manured legumes on a subsequent barley crop in a subarctic environment	S. D. Sparrow, V. L. Cochran, E. B. Sparrow	*Canadian Journal of Plant Science.* 75:453-456.
Registration of 'Otal' barley	R. L. Taylor, R. I. Wolfe, S. M. Dofing, D. G. Faris	*Crop Science.* 35:1711
Remediation of a petroleum contaminated cryic soil: Effects of phosphorus, nitrogen, and temperature	J.L. Walworth, C.M. Reynolds	*Journal of Soil Contamination.* 4:299-310
The arctic flux study: A regional view of trace gas release	G. Weller, F. S. Chapin, K. R. Everett, J. E. Hobbie, D. Kane, W. C. Oechel, C. L. Ping, W. S. Reeburg, D. Walker, J. Walsh	*Journal of Biogeography.* 22:365-374
AC Albright barley	R. I. Wolfe, S. M. Dofing, J. G. N. Davidson, P. J. Clarke	*Canadian Journal of Plant Science.* 75:457-459

Title	Author(s)	Where Published
Conservative bias in classification accuracy due to pixel-by-pixel comparison of classified images with reference grids	D. L. Verbyla, T. O. Hammond	*International Journal of Remote Sensing*. 16(3):581-587
Carbon and nutrient availability effect on plant nutrient supply for upland forest sites in Interior Alaska (1994)	J. Yarie, B. Pulliam, K. Van Cleve, R. Schlentner	*New Zealand Journal of Forestry Science*. 24:234-252

Book or Chapter in Book

Book/Chapter	Author(s)	Title, Editor & Publisher
Temporal and spatial variability as neglected ecosystem properties: lessons learned from 12 North American ecosystems	T. K. Kratz, J. J. Magnuson, P. Bayley, B. J. Benson, C. W. Berish, C. Bledsoe, E. R. Blood, C. J. Bowser, S. R. Carpenter, G. L. Cunningham, R. Dahlgren, T. M. Frost, J. Halfpenny, J. Hansen, D. Heisey, R. Inouye, D. Kaufman, A. McKee, J. Yarie	Evaluating and Monitoring the Health of Large-Scale Ecosystems. NewYork, NY
Geographic Information Systems	D. L. Verbyla	*Introduction to Forest and Renewable Resources*. G. W. Sharpe, C. W. Hendee, W. F. Sharpe and J. C. Hendee (eds.) McGraw Hill, Inc. NY
Satellite remote sensing of natural resources	D. L. Verbyla	Lewis Publishers, CRC Press. FL

AFES Circulars

Title	Author(s)	AFES Publication No.
Use of Alaska -grown whole seed canola in dairy cattle diets—year 2	K. Randall, S. Dofing, D. J. Brainard	Cir. 101
Annual flower & perennial landscape plant evaluations 1994	P. J. Wagner, P. S. Holloway, G. E. M. Matheke, S. Berry, E. Barbour	Cir. 102
Potato variety performance, Alaska 1994	D. E. Carling, P. C. Kroenung	Cir. 103
Identifying alkaloids in Alaska Lupinus *spp. with reference to crooked calf disease*	R. Grover, L. A. Renecker, K. E. Panter, K. Van Cleve	Cir. 104

AFES Miscellaneous Publications

Title	Author(s)	AFES Publication No.
Larch in North America	E. C. Packee	Misc. Publ. 95-1
Northern forest silviculture and management	E. C. Packee (ed.)	Misc. Publ. 95-1
Developing site specific forest renewal prescriptions and the biology of lodgepole pine towards its northern limit	E. C. Packee (ed.)	Misc. Publ. 95-2

Title	Author(s)	AFES Publication No
AFES research: Alaska grown		Misc. Publ. 95-3

Research Progress Reports

Title	Author(s)	AFES Publication No.
Metam sodium and dazomet as herbicides for use by vegetable growers in Alaska	D. E. Carling, J. L. Walworth, J. S. Conn	RPR 34

Proceedings

Title	Author(s)	Published In:
Grouping strains of *Rhizoctonia solani* by hyphal anastomosis	D. E. Carling	Proceedings of the International Symposium on *Rhizoctonia*. Noordwijkerhout, The Netherlands. p. 20
Controlling weeds in field-grown vegetables with metam sodium and dazomet	D. E. Carling, J. L. Walworth, J. S. Conn	Proceedings of the 2nd Circumpolar Agricultural Conference, Tromso, Norway. pp. 2-27
Characterization and pathogenicity of isolates of *Rhizoctonia solani* that cause web blight on common dry beans in Central America and the Caribbean	G. Godoy-Lutz, J. Arias, F. Saladin, J. R. Steadman, D. E. Carling	Proceedings of the International Symposium on *Rhizoctonia*. Noordwijkerhout, The Netherlands. p. 57
Plant studies in Norway	M. G. Karlsson	14th Alaska Greenhouse and Nursery Conference. Fairbanks, AK. pp. 29-34
Nitrogen cycling in Interior Alaska agricultural soils	C. W. Knight, S. D. Sparrow	Proceedings and workshop: nitrogen supply and nitrogen fixation of crops for cool and wet climates. Tromso, Norway.
The ecology of the northern forest	E. C. Packee	Yukon Forests: A sustainable resource symposium. Whitehorse, Yukon Territory, Canada
Factors affecting coldhardiness development	M. T. Panciera	14th Alaska Greenhouse and Nursery Conference. Fairbanks, AK
Rhizosphere enhanced bioremediation for cold regions: Contaminant effects on root distribution	C. M. Reynolds, C. A. Beyrouty, D. C. Wolf, and J. L. Walworth	Proceedings of Joint US/Canada Military and Civilian Workshop, Technologies and techniques for hydrocarbon remediation in cold and arctic climates. Kingston, Ontario
How to lie with an error matrix	D. L. Verbyla, T. O. Hammond	Proceedings 1995 Alaska Surveying and Mapping Conference, Anchorage, AK
Utilizing fish processing by-products in production systems	J. L. Walworth	14th Alaska Greenhouse and Plant Nursery Conference. Fairbanks, AK
Incorporating stand-level models into landscape-scale management in Interior Alaska	J. Yarie, K. Winterberger	Proceedings of the 1994 SAF National Convention, Anchorage, AK

Contract Reports

Title	Author(s)	Contracting Agency:
Vegetation-soils report, Knob Creek, abandoned mined lands	D. J. Helm	Alaska Dept. of Natural Resources, Division of Mining
Final report 1994 revegetation studies on Two Bull Ridge (draft)	D. J. Helm	Usibelli Coal Mine, Inc.
Revegetation evaluation Poker Flats-Gold Run Pass 1994	D. J. Helm	Usibelli Coal Mine, Inc.
Nolan Creek vegetation-soils report	D. J. Helm	Tri-Con Mining, Inc.
Abandoned placer mined land reclamation Birch Creek-Mile 101 Steese Highway, vegetation-soils progress report 1994 (Year 2)	D. J. Helm	Alaska Dept. of Environmental Conservation
Marketing Alaska forest products sector report	Marketing Alaska Forest Products Sector Team (G. Juday)	Alaska Dept. of Commerce & Economic Development
Report of biodiversity research at Bonanza Creek/Caribou-Poker Creeks LTER	G. P. Juday, L. A. Viereck, M. A. Oswood, P. A. Adams, J. Bryant	National LTER Coordinating Committee. St. Paul and Cedar Creek, MN
Biodiversity survey of Clear Air Station, Alaska	K. LaGory, G. P. Juday, P. W. C. Paton, R. A. Ott, A. M. Wildman, J. K. Sarles	Environmental Assessment Div., Argonne National Library
1994 progress report Surfcote landfill site revegetation project Prudhoe Bay, Alaska	J. D. McKendrick	ARCO Alaska Inc. Field Environmental Compliance Eastern Operating Area Prudhoe Bay Unit
Vegetation recovery after 12 years at three test pits on the Diamond Alaska Coal Company lease southcentral, Alaska	J. D. McKendrick	Riverside Technology, Fort Collins, CO
Long-term gravel vegetation project quarterly report for October, November, December, 1994	J. D. McKendrick	BP Exploration (Alaska), Inc. Anchorage, AK
Long-term gravel vegetation project quarterly report for January, February, and March, 1995	J. D. McKendrick	BP Exploration (Alaska), Inc., Anchorage, AK
Long-term gravel vegetation project quarterly report for April, May, and June 1995	J. D. McKendrick	BP Exploration (Alaska), Inc., Anchorage, AK
Long-term gravel vegetation project quarterly report for July, August, and September 1995	J. D. McKendrick	BP Exploration (Alaska), Inc., Anchorage, AK
Contaminated soil remediation, Palmer Research Center	J. L. Walworth	University of Alaska, Planning and Project Services

Title	Author(s)	Published In:
The use of Alaskan fish meal as a nutrient source for bioremediation	C. R. Woolard, J. L. Walworth, K. Harris	Alaska Science and Technology Foundation, Project No. 95-2-069S

Theses/Student Professional Papers

Title	Author
Hydrology, morphology and redox potentials in four soils of Southcentral Alaska	Marcus H. Clark
Mediation of resource management conflicts: Two case studies of the relationship between team design and effectiveness	Michael Paul Conner
Environmental racism in the landscape: a paradigmatic survey and mapping of environment burdens	Amy Prosser
The effect of migratory Canada geese on nitrogen yield in subarctic agricultural soils	Jennifer A. Pugin
Applied forestry principles at the exotic tree plantation portion of the UAF Boreal Arboretum	Mark J. Tacheny

AFES Newsletters, Notes & Magazines

Title	Author(s)	Publication
Improving Alaska's northern forests	J. Alden	*Forest Science Notes* # 3
GBG receives MAPCO educational grant	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(1):1
Research projects abound in the garden	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(2):1
Nitrogen fertilizer from plants	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(2):2
Early-season color in the flower garden	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(2):3
Alaska-grown asparagus	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(2):7
Garden wins honors	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(3):1
The not-so-pretty side of annual flower seed mixes	P. S. Holloway	*The Georgeson Botanical Garden Review* 4(3):4-5
Propagating Asiatic hybrid lilies by scaling	P. S. Holloway	*Georgeson Botanical Notes* No. 22 (rev.)
Cucumbers-does trellising improve yield?	P. S. Holloway, P. Wagner	*The Georgeson Botanical Garden Review* 4(1):4-5

Title	Author(s)	Where Published
Resources Management Dept. Newsletter	A. Jubenville (ed.)	*The Natural Resources News*
Agronomic crops for Alaska	C. W. Knight, R. M. Van Veldhuizen	*Georgeson Botanical Notes*, No. 24
Annual flower seed mixes: transplanted or direct seeded?	H. Lockwood, P. S. Holloway, Collins, P. Wagner	*The Georgeson Botanical Garden Review* 4(2):4-5
Who wants to weed anyway?	G. E. M. Matheke	*The Georgeson Botanical Garden Review* 4(3):3
Satellite images: better than maps?	D. L. Verbyla, T. O. Hammond	*Forest Science Notes # 4*
Commercial seed and plant sources	P. Wagner	*Georgeson Botanical Notes* No. 4 (rev.)
Annual flowers 1995	P. Wagner, P. S. Holloway, G. E. M. Matheke	*Georgeson Botanical Notes* No. 14 (rev.)
Vegetables and herbs 1995	P. Wagner, G. E. M. Matheke, P. S. Holloway	*Georgeson Botanical Notes* No. 15 (rev.)

Miscellaneous Publications

Title	Authors	Where Published
Affidavit to Superior Court for the State of Alaska Third Judicial District Civil Case No. 94-8606 CTV, Alaska Sportfishing Association et al. vs. Tomas H. Boutin, Harry Noah, and State of Alaska Dept. of Natural Resources re: timber sale on Kalgin Island	E. C. Packee	
Factors affecting coldhardiness development	M. T. Panciera	Alaska Cooperative Extension, Pub. no. 100G-00143
Tutorial: If & then—maybe, maybe not	D. L. Verbyla	*Point, Line, Poly (Host).* 4(2):3-4
Slide shows in Arc/Info	D. L. Verbyla	*Point, Line, Poly (Host).* 4(3):5-6

Abstracts

Title	Author(s)	Where Published
Revegetated coal surface mines in Alaska —Do they meet the forage needs of native big game?	C. L. Elliott, J. D. McKendrick	Issues and technology management of impacted wildlife. Proceedings of Sixth Symposium. Boulder, CO. pp. 85-92
Diversity of mycorrhizae across a glacial chronosequence, Kenai Fjords National Park U.S.A.	D. J. Helm, E. B. Allen	46th Arctic Division Science Conference, Fairbanks, AK p. 69
Long term arctic wetland rehabilitation research	C. J. Herlugson, J. D. McKendrick, L. H. Fanter	National Interagency Workshop Wetlands. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. pp. 337-340

Title	Authors	Where Published
The Late-Pleistocene environment of the Bering Land Bridge: Buried soils from Seward Peninsula, NW Alaska	C. Hoefle, M. E. Edwards, C. L. Ping, D. H. Mann, D. M. Hopkins	The 25th Arctic Workshop, Universite Laval, Quebec, Canada. pp. 78-80
Covered and hulless barley in beef cattle and swine diets	F. M. Husby	2nd Circumpolar Agricultural Conference. Agricultural Forum North, Tromso, Norway. p. 3.16
Barley and herring meal in sled dog diets	F. M. Husby	2nd Circumpolar Agricultural Conference. Agricultural Forum North, Tromso, Norway. p. 3.2
Lessons from forest biodiversity studies for boreal forest management in Alaska	G. P. Juday	46th Arctic Division Science Conference, AAAS. Fairbanks, AK. p. 220
Forest landscape diversity at Clear Air Station	G. P. Juday	46th Arctic Division Science Conference, AAAS. Fairbanks, AK. p. 175
Radial growth response of white spruce to climate at Bonanza Creek LTER	G. P. Juday	46th Arctic Division Science Conference, AAAS. Fairbanks, AK. p. 175
Light quality initiating or ending the day affects internode length in petunia	M. G. Karlsson, J. Nilsen	*HortScience*. 30(4):861
The significance of irradiance, photoperiod and temperature for the flower formation process in primula	M. G. Karlsson	2nd Circumpolar Agricultural Conference. Tromso, Norway. p. 2.14
Grain and oilseed crops and cultural practices for interior Alaska	C. W. Knight	2nd Circumpolar Agricultural Conference, Tromso, Norway
Morphogenesis of the upper Yedoma deposit of Northern Yakutia, NE Russia	C. L. Ping, Y. L. Shur, J. M. Kimble, S. Gubin, E. M. Pfeiffer, W. R. Eisner, L. Zhao	The 25th Arctic Workshop, Universite Laval, Quebec, Canada. pp. 155-156
Long-term observations of tundra recovery in northern Alaska	J. McKendrick	Disturbance and recovery of arctic terrestrial ecosystems. University of Lapland, Finland
Comparison of natural and anthropogenic disturbance regimes in temperate rain-forests of southeast Alaska: considerations for ecosystems management	R. A. Ott, T. Garvey, J. Fincher, G. P. Juday	46th Arctic Division Science Conference, AAAS. Fairbanks, AK. p. 183
Some responses of grass pastures to initial clipping date and clipping frequency in Alaska	M. T. Panciera, L. B. Bruce	*Agronomy Abstracts*. 1995:162
Evaluation of liquid calcium (LCA-II) in reducing salinity for arctic tundra rehabilitation	B. A. Reiley, J. D. McKendrick, S. C. Lombard	National Interagency Workshop on Wetlands. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. pp. 331-334
Rational nutrient amendment rates for Effective Soil Bioremediation	J. L. Walworth, C. M. Reynolds, P. Bhunia	*Agronomy Abstracts*. 1995:341

FY 96 research funding

Grants and Special Funds; July 1, 1995– June 30, 1996

National Science Foundation

Dot Helm ..... Patch formation, mycorrhizal colonization during succession on glacial till
John Yarie ..... LTER: successional processes in taiga forests of Interior Alaska
Chien-Lu Ping ..... LAII flux study
Don Carling ..... Australia cooperative research

National Oceanic and Atmospheric Administration

Joshua Greenberg ..... Crab management policies
Harry Bader ..... Legal analysis of allocation of fish

National Biological Survey

Chien-Lu Ping ..... Rock Creek watershed
Chien-Lu Ping ..... Rock Creek water quality

United States Department of Agriculture

Donald Carling ..... Evaluation of metam sodium for weed control in Alaska vegetable production
Jenifer McBeath ..... Cooperative agriculture pest survey
Chien-Lu Ping ..... Wet soils monitoring studies in Alaska; *(SCS funding also)*
John Yarie ..... Carbon balance of the Alaska boreal forest
Carol Lewis ..... An inclusive regional economic model for rural Alaska
Stephen Dofing ..... Agronomic value of two genes conferring limited tillering in barley
Jeff Conn ..... Goose population dynamics
Carol Lewis ..... Alaska marketing co-ops
James Drew ..... Alaska's forest trees
Tricia Wurtz ..... Spruce and alder interactions

Oregon State University

Jeff Conn ..... Leaf cellulose

Bureau of Land Management

Dave Verbyla ..... GIS support
Alan Jubenville ..... BLM cooperative agreement—Dalton Highway

Alaska Department of Natural Resources

Anthony Gasbarro ..... Forestry students

Alaska Department of Administration

G. Allen Mitchell ..... Senior community service employment program

Alaska Science and Technology Foundation

Charles Knight ..... Development of rotational crops and markets
Stephen Sparrow ..... Use of N-fixing plants to improve forage quality of Delta Bison Range
Patricia Holloway ..... Evaluation of wildflower seed mixes for Interior Alaska
Jenifer McBeath ..... Seed potato

Usibelli Coal Mine, Inc.

Dot Helm ..... Usibelli vegetation studies
Dot Helm ..... Revegetation studies on Two Bull Ridge

BP Exploration (Alaska), Inc.

Jay McKendrick ..... Gravel vegetation studies

Research funding...con't

Weston & Sampson Engineers

James Walworth ..... Bioremediation

Frito-Lay

Donald Carling ..... Potato tests for Frito-Lay

Silverado Mines Inc.

Dot Helm ..... Nolan Creek revegetation

Alaska Department of Fish and Game

Joshua Greenberg ..... BSAI crab fisheries

U. S. Army Corps of Engineers

Tobi Campanella ..... Chena Lakes project

Department of Transportation

Alan Jubenville ..... DOT cooperative agreement—Dalton Highway

University Corporation for Atmospheric Research

John Yarie ..... Climatological analyses

University of Alaska Natural Resources Fund

Stephen Dofing ..... Continuation of a program in plant breeding and genetics
Harry Bader ..... Determination of recreational impacts to subarctic xeric alpine tundra resources
Jenifer McBeath ..... Support of potato industry in AK
D. Verbyla, A. Balser ..... Monitoring boreal wetlands
Dave Verbyla ..... Development of an Alaskan wildfire detection and mapping system
J. McBeath, M. Karlsson ..... Cultivation of ginseng in AK
S. Sparrow, S. Becker ..... Mycorrhizal inoculation techniques
Stephen Sparrow ..... Agronomic and economic evaluation of forage crops for AK
Jay McKendrick ..... Recording tundra recovery on AK's oil exploration sites NPR-A

MAPCO Alaska Petroleum Inc

Pat Holloway ..... Multimedia showcase
Dave Verbyla ..... GIS teaching lab
Edmond Packee ..... GPS for Educators
Dave Verbyla ..... Enhancement of GIS Lab

Department of Environmental Conservation

Dot Helm ..... Abandoned placer mined land reclamation

University of Alaska Foundation

Patricia Holloway ..... Georgeson Botanical Garden
Greg Finstad ..... Reindeer research

UAF & University of Northern British Columbia

Stephen Sparrow ..... Weathering of mica

Fairbanks Private Industry Council

Pat Holloway ..... Summer youth employment

Golden Valley Electric Association

Edmond Packee ..... Vegetation management options

Fred Gloeckner Foundation, Inc.

Meriam Karlsson ..... Growth and development of cyclamen

Research funding...con't

Formula Funds; July 1, 1995—June 30, 1996

Hatch General; USDA

Donald Carling	Potato variety comparisons and evaluations of rhizoctonia disease on potato
Fredric Husby	Management of Alaska beef cattle to maximize forage use
Harry Bader	Comparative legal analysis of private property use and regulation in the rural U.S.
Michael Panciera	Maximizing forage quality at northern latitudes
Patricia Holloway	Propagation and cultivation of Alaska native plants
Meriam Karlsson	Effects of irradiance, temperature of growth and development of greenhouse produced plants
Jay McKendrick	Vegetating man-made gravel structures within arctic wetland plant communities
Chien-Lu Ping	Classification and interpretation of permafrost soils in Alaska
James Walworth	Improving soil fertility for potatoes and lettuce in Alaska
Stephen Sparrow	Nitrogen fixation, herbage yield and persistence of perennial legumes in Interior Alaska
Carol Lewis	Alaska's agricultural industry: a microsystem of the circumpolar north
G. Allen Mitchell	Palmer administration
Meriam Karlsson	Environmental plant physiology of greenhouse produced crops
Don Carling	Evaluation of production practices, cultivars, and some diseases of potato and vegetables
Pat Holloway	Horticulture crop production for AK
Joshua Greenberg	Regional economic modeling for rural AK
Jay McKendrick	Long-term responses to tundra revegetation experiments, Arctic, AK

Hatch Regional; USDA

Fredric Husby	Characteristics and feed value of barley and western protein supplements for swine
G. Allen Mitchell	Regional research planning and coordination, western region
Jenifer McBeath	Biological suppression of soil-borne plant pathogens

McIntire-Stennis; USDA

John D. Fox, Jr.	Simulating the effects of forest harvest on soil freezing and thawing
John Yarie	Forest floor organic matter chemistry as a control of plant element supply in Interior AK forests
John Yarie	Prediction of landscape level effects of global change on the Alaskan boreal forest
Edmond Packee	Determination of the growth and yield potential of northern forest species in Alaska
Alan Jubenville	Territoriality in forest recreational settings in Alaska
Dot Helm	Ecosystem for establishment of wood plants on disturbed lands
Dave Verbyla	Development of an Alaskan AVHRR wildland fire detection and mapping system
Glenn Juday	Forest biodiversity resources in AK: identification, monitoring, strategies for management
John Yarie	Mechanisms of change in forest floor decomposition, element supply in successional forests of AK

Financial Statement

Expenditures — July 1994 through June 1995

The following is a statement of expenditures of federal and state funds for the fiscal year beginning July 1, 1994 and ending June 30, 1995 (FY 95). NOTE: This is not an accounting document.

		(percent of total)
Federal		
Hatch General Formula Funds	$ 777,392	10.8
Hatch Regional Formula Funds	87,393	1.2
McIntire–Stennis Formula Funds	409,855	5.7
USDA–Agricultural Research Service	56,573	0.8
Other Grants and Contracts	1,304,333	18.2
State Appropriation/Program Receipts	4,539,175	63.3
Total	$7,174,721	100.0 percent

Professional staff profile

HARRY R. BADER, Associate Professor of Natural Resources Law; Washington State University '84, B.A.; Harvard Law School '88, J.D.

LARRY BURKE, Farm Superintendent; University of Idaho '66, B.S.

TOBI CAMPANELLA, Acting Fiscal Officer; University of Alaska '93, A.A.

RUDY CANDLER, Laboratory Supervisor; Colorado State University '67, B.S.; University of Alaska '74, M.S.; '87, Ph.D.

DONALD E. CARLING, Professor of Horticulture; St. Cloud State University, Minnesota '67, B.A.; University of Missouri-Columbia '69, M.S., '75, Ph.D.

STEPHEN M. DOFING, Associate Professor of Agronomy; Kansas State University '78, B.S.; University of Nebraska '80, M.S., '83, Ph.D.

JOHN D. FOX, JR., Associate Professor of Land Resources; Trinity College '68, B.S.; University of Washington '70, M.S., '76, Ph.D.

DONNA GINDLE, Publications Supervisor; University of Alaska Fairbanks '89, B.A.

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DOROTHY J. HELM, Research Associate Professor of Vegetation Ecology; University of Delaware '69, B.S.; University of Michigan '70, M.S.; Colorado State University '77, M.S., '81, Ph.D.

PATRICIA S. HOLLOWAY, Associate Professor of Horticulture; Millersville University of Pennsylvania '73, B.A.; Washington State University '76, M.S.; University of Minnesota '82, Ph.D.

YONG HUANG, Research Associate; University of Wisconsin, Madison, Ph.D.

FREDRIC M. HUSBY, Professor of Animal Science and Acting Dean, School of Agriculture and Land Resources Management; Washington State University '66, B.S., '69, M.S., '74, Ph.D.

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CHARLES W. KNIGHT, Associate Professor of Agronomy; Kansas State University '70, B.S., '71, M.S.; University of Alaska Fairbanks '88, Ph.D.

J. STEPHEN LAY, Communications and Information Technology Manager, Trinity University, '69, B.A.; Ohio State University, '88, M.A.

JAMES LEVISON, Acting Business Manager; University of Alaska Fairbanks '79, B.S.

CAROL E. LEWIS, Professor of Resources Management; University of Florida '62, B.S.; '64, M.S.; Georgetown University '70, Ph.D.; University of Alaska Fairbanks '76, M.B.A.

JENIFER H. MCBEATH, Professor of Plant Pathology; National Taiwan University, '65, B.S.; University of California, Davis '70, M.S.; Rutgers University '74, Ph.D.

JAY D. MCKENDRICK, Professor of Agronomy; University of Idaho '63, B.S., '66, M.S.; Kansas State University '71, Ph.D.

GARY J. MICHAELSON, Research Associate; University of Arizona '74, B.S.; Iowa State University '81, M.S.

G. ALLEN MITCHELL, Acting Director-AFES, and Associate Professor of Agronomy; University of California, Riverside '71, B.S., '73, M.S., '77, Ph.D.

EDMOND C. PACKEE, Associate Professor of Forest Management; University of Montana '62, B.S.; Yale University '63, M.F.; University of Minnesota '76, Ph.D.

MICHAEL T. PANCIERA, Associate Professor of Agronomy; University of Guelph '77, B.S., '79, M.S.; Pennsylvania State University '82, Ph.D.

GARRETT W. PERNEY, Herder; Cal Poly San Luis Obispo '90, B.S.

BARBARA J. PIERSON, Student Affairs Coordinator; Montana State University '77, B.S., '85, M.S.

CHIEN-LU PING, Professor of Agronomy, Soil Scientist; Chung-Hsin University, Taiwan '65, B.S.; Washington State University '73, M.S., '76, Ph.D.

PETER C. SCORUP, Research Associate; Colorado State University '66, B.S.

ELENA B. SPARROW, Affiliate Associate Professor of Soil Microbiology; University of the Philippines '62, B.S.; Cornell University '66, M.S.; Colorado State University '73, Ph.D.

STEPHEN D. SPARROW, JR., Professor of Agronomy; North Carolina State University '69, B.S.; Colo-

rado State University '73, M.S.; University of Minnesota '81, Ph.D.

SUSAN TODD, Assistant Professor of Regional and Land Use Planning; Bryn Mawr '75, B.A.; University of Michigan '79, M.R.P.; University of Michigan '95, Ph.D.

GWENDO-LYN TURNER, Research Associate; Humboldt State College '70, B.A.; University of California '75, M.S.

DAVID L. VERBYLA, Associate Professor of Geographic Information Systems; Rutgers University '79, B.S.; Michigan State University '82, M.S.; Utah State University '88, Ph.D.

JAMES L. WALWORTH, Associate Professor of Soil Fertility/Horticulture; University of Wisconsin '76, B.S., '80, M.S.; University of Georgia '85, Ph.D.

JOHN A. YARIE, Associate Professor of Silviculture; West Virginia University '71, B.S.; University of Maine '74, M.S.; University of British Columbia '78, Ph.D.

Emeriti

ARTHUR L. BRUNDAGE, Professor of Animal Science

ROBERT A. DIETERICH, Professor of Veterinary Science

DON H. DINKEL, Professor of Plant Physiology

JAMES V. DREW, Dean of SALRM, Director of AFES, and Professor of Agronomy

ANTHONY F. GASBARRO, Associate Professor of Forestry Extension

ALAN C. EPPS, Professor of Natural Resources

LESLIE J. KLEBESADEL, Professor of Agronomy

CHARLES E. LOGSDON, Professor of Plant Pathology

WILLIAM W. MITCHELL, Professor of Agronomy

BONITA J. NEILAND, Professor of Land Resources and Botany

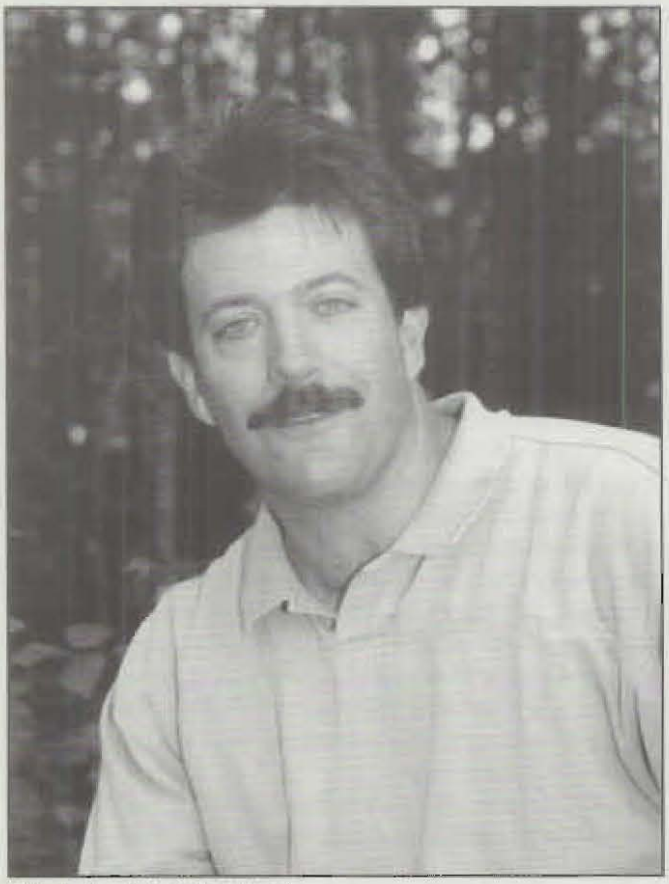
SIGMUND H. RESTAD, Assistant Director, Alaska AFES

WAYNE C. THOMAS, Professor of Economics

KEITH VAN CLEVE, Professor of Forestry (Soils)

ROBERT B. WEEDEN, Professor of Resources Management

Valentine joins forest sciences



(Photo by J. Stephen Lay)

DR. DAVID W. VALENTINE is scheduled to join the forest sciences department as an assistant professor of forest soils in September. Valentine was formerly an affiliate assistant professor at Colorado State University.

He earned a bachelor of art in biology in 1981 from the Wittenberg University, a master of science in forest ecology in 1984 from Duke University and a doctorate in biogeochemistry in 1990 also from Duke. Valentine says his research interests are in "ecosystem ecology, with a particular emphasis on trace gas biogeochemistry, within the context of ecosystem structure and function, biosphere-atmosphere interactions, and global climate change."

From 1991 through 1993, Valentine was the recipient of the Distinguished Postdoctoral Fellowship in Global Change from Oak Ridge Associated Universities, and from 1993-1994, he was a participant in the National Academy of Science Young Investigator Program in Arctic Ecology in the Russian Federation. He is a member of the American Association for the Advancement of Science; American Geophysical Union; American Institute of Biological Sciences; Ecological Society of America; Sigma Xi; The Scientific Research Society; Soil Science Society of America; Union of Concerned Scientists; and WorldWatch Institute.

Welcome Dr. Valentine!

(Photo by J. Stephen Lay)

Young masters two programs

by: Donna Gindle
Editor

Whether she is recruiting students for the School of Agriculture and Land Resources Management, discussing her double major graduate degrees, or developing a consulting business with three other graduate students, Christina Young is the type of person who projects intelligence and inspires confidence.

Barbara Pierson, student affairs coordinator, said Christi is also highly motivated, enthusiastic, and innovative when it comes to enhancing the school's recruitment program.

The 29-year-old native of south California's Trabuco Canyon moved to Fairbanks in December 1994. "I had been thinking about coming to Alaska for a few years when I was forced to decide between taking over an appraisal business or doing something new. I decided if I was accepted to graduate school in time to attend the spring semester (1995) I would move. If not, then I would stay in California.

"Well, here I am and I haven't regretted one minute of the adventure."

Young earned an MBA in May 1996 and will complete an M.S. in natural resources management by December. For her thesis, she developed a feasibility and business plan for the city of Wrangell for a mobile boat hoist business. She recently completed a business plan for the City of Shaktoolik which is looking at developing a fish processing plant.

She and three other people—all who have also earned graduate degrees from SALRM—are currently establishing their own business. "We plan to offer consulting and research services for natural resources based businesses," explained Young. "Between us we offer experience in forestry, Geographic Information Systems (GIS), wildlife biology, environmental interpretation and education, and economic development using natural resources."

Although it might seem that free time is a scarcity in Young's life, she places a high priority on exercising, staying in shape, and doing just about anything outdoors. She runs, hikes, swims, kayaks, scuba dives and loves horseback riding.

One of Young's best childhood memories is riding her horse to school, riding the school horses and taking care of the other farm animals at the school. "Not many people at my age can say they've had such an experience," she said. However, her little hometown has grown immensely and the small school house is now a five room school.

"After high school I was a bit unclear what direction to take," Young said. "I had been working as a riding instructor and decided to ride professionally. I had my own business for about five years and went from owning two horses to managing 25."

After a while, though, Young became burned out with the business and decided to focus on college. Originally she was in the pre-veterinarian program but switched to agricultural business management when she realized that "My interest was in equines, not a very profitable field for specialization." She earned a bachelor of science degree from Cal Poly, Pomona and also began working as a real estate appraiser for her dad.

In December 1991 she first visited Alaska. "I fell in love with the state and made two more trips to be certain." The rest, as they say, is history. Or in Young's case, business and resources management.

Achievements, activities, news

1996 Graduates

Congratulations to the 1996 graduates of the School of Agriculture and Land Resources Management:

Master of Science: Marcus Hugh Clark, Michael Paul Conner, Amy Marie Prosser, Jennifer Adrienne Pugin, Mark Joseph Tacheny

Bachelor of Science: Scott Adams, Elizabeth Bilyeu, Deborah Broneske, Toby Burke, Gary Fischer, Diane Hunt, Kristine Kern, Michael Knabe, Jeanne Pigors, Thomas Roser, Robert Russo, Jennifer Sampson, Franz Schoening, Gideon Schreiber

Recognizing service

The following people were recognized for their years of service to UAF.

25 years: Lola Oliver
20 years: Tony Gasbarro, Fredric Husby, John Muth
15 years: Donald Brainard, Jan Hanscom, Dot Helm, Gary Michaelson
10 years: Barbara Pierson, Mary Peters
5 years: Harry Bader, Keith Barton, Darrell Blodgett, Martin Gibson, Joshua Greenberg, Yong Huang, Becky Knight, Garrett Perney, Julie Shalvoy, Todd Sherman, Alan Springer, Susan Todd

Corporate gift

British Petroleum donated two gas chromatographs to Alaska's Agricultural and Forestry Experiment Station Laboratory located in Palmer. A gaschromatograph separates various components in a mixture and can be used to analyze a variety of items including pesticide and oil-contaminated soil. Two new instruments would cost between $60,000 and $100,000. The gift was timely because a few days after taking getting the equipment, the laboratory's GC broke as technicians were in the midst of doing analyses for statewide risk management. Dr. Rudy Candler, laboratory supervisor for the AFES in Palmer, "Needless to say, we were grateful we had BP's donation." Rather than getting backlogged with assignments, researchers kept right on working.

National coverage

Harry Bader, associate professor of natural resources law, and **Jonathan Andrews**, graduate student, were highlighted in a June 1996 *National Geographic* article on the war in Bosnia. The two men spent two months in Bosnia in 1995 preparing damage assessments of the war-torn country for the United Nations.

Rotary Scholarship

Steven Becker, a resources management graduate student, recently was awarded the ambassadorial scholarship from Rotary District 5010 (Alaska, Canada, eastern Russia) for $22,500. The annual award highlights outstanding academic and community service excellence. Becker will study soils at Aberdeen, Scotland.

Web Site

Visit our world wide web site for links to information about SALRM and AFES, to our undergraduate and graduate programs, and to our research. Our address is:

http://www.lter.alaska.edu/salrm/salrm.html

41 year memories

Pete and Carol Dow *from Lake Powell, Ariz. at the Georgeson Botanical Garden. They visited the Agricultural and Forestry Experiment Station's farm in July fulfilling Pete's 41-year-old dream of returning. Pete worked as a farm hand after the Korean War and he was released from the U. S. Marine Corps in 1955. He and several other buddies came to Alaska looking for summer work before going to college in the fall. "We worked our tails off at the farm, but we sure ate well also," Pete said. The Dows, now retired, drove up from Arizona and spent about six weeks touring the state (photo by Donna Gindle).*

Harvesting the Hay...

Alan Tonne, agricultural assistant, and Steve Bethane, student assistant, harvest the first batch of hay at the Agricultural and Forestry Experiment Station (Photo by Cal White).