AREERA PLAN OF WORK

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

Agricultural and Forestry Experiment Station
University of Alaska Fairbanks

Submitted to: United States Department of Agriculture Cooperative State Research, Extension, and Education Service

Certified by: _____

G. Allen Mitchell, Acting Director Date

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GOAL 1: An agricultural system that is highly competitive in the global economy.

Program 1. To produce new and value-added agricultural and forest products and commodities.

Overview: The University of Alaska Fairbanks School of Agriculture and Land Resources Management and Agricultural and Forestry Experiment Station (SALRM/AFES) generates and disseminates knowledge to stakeholders for the successful management and development of land resources in Alaska, the Western Region, and the nation. These efforts are jointly funded by federal formula funds, state matching funds, state and federal grants and private sector funds. The report that follows summarizes the accomplishments of SALRM/AFES in terms of outcomes and impacts to our stakeholders. The Experiment Station and Cooperative Extension are reporting separately; however, integrated activities are included in this report. Unlike many of the larger states, Alaska has very limited tracking of agricultural output. Neither the Agricultural and Forestry Experiment Station nor Cooperative Extension at the University of Alaska has an Agricultural Economist on staff. The primary source of economic impact information is Alaska Agricultural Statistics and information that researchers and agents glean from private sector producers.

Alaska's population of approximately 620,000 does not support a large agriculture production base. Currently, more than 93 % of food consumed in Alaska (excluding fish) is imported and there is no indication of significant changes in those statistics in the near future. Number of agricultural enterprises is stable and land in farms increased in 2000 from 910,000 to 920,000 acres. However, cash receipts for agriculture was down 6 percent and value of on-farm production was down 17 percent from the previous year. The reductions were across the board and weather was a primary contributing factor. Growers in the agricultural sector produce products primarily for in-state consumption including fresh market potatoes and vegetables, forages, grains, and other livestock feeds, greenhouse vegetables, flowers and ornamentals, and a variety of niche market crops. Animal enterprises include dairy, beef, reindeer, and alternative game animals muskox, elk, and bison. Alternative crops are being investigated through Hatch levered funding in New Crop Opportunities that include greenhouse produced raspberrys, medicinal components of Devil's Club (*Oplopanax horridus*), peonies and lingonberries for export markets, birch sap and bark products, and antioxidant products from Alaska berries. Export markets, which are relatively small at present, consist of reindeer meat and antler, grass seed, seed potatoes, and forest products, primarily raw logs.

Value-added processing of vegetables resulted in increased production of cabbage (+33%) and carrots (+71%) between 1998 and 2000. Research in support of the producers of vegetables, potatoes, and other field crops as well as home gardeners continues to focus primarily on variety selection, new crops, disease resistance, and

adaptability to northern environments. A five year Hatch project related to production practices and diseases of potatoes and vegetables terminated in 2001 with the production of 14 peer reviewed journal articles and 10 outreach bulletins for our stakeholder audience. A new Hatch project " Cultivar Selection, Production Methods, and Market Quality of Vegetables in Alaska" shows great promise for assisting producers with traditional problems in field vegetable production as well as new crop opportunities. This is an Integrated Activities project between AFES and CES and includes extensive on-farm research and demonstration as well as laboratory and field research with *Sclerotinia sclerotiorum*. The latter has infected leaf and head lettuce and resulted in producers plowing down entire plantings of lettuce in susceptible years.

Integrated Activities with Extension included an ongoing potato late blight monitoring and treatment project partially funded by Hatch, Extension Integrated Pest Management, and state matching funds. This was a very successful program that brought the potato producers from major damage and fungicide spraying costs in 1998, to only 25 % of the acreage sprayed in 1999, to complete control with no use of pesticides in 2000 and none in 2001.

Greenhouse and nursery production maintained its share of the cash value of Alaska agriculture in 2000. A Hatch project geared towards the interaction of environmental factors in the greenhouse and their effects on earlier flowering terminated in 2001 with 7 peer reviewed journal articles, 10 grower magazine articles, and a total of 35 publications. This researcher is a participant in the Northcentral Multistate Coordinating Committee NCR 101 "Controlled Environment Technology and Uses" and has levered Hatch funds to obtain funding from the Fund for Rural America With Cornell University and the University of Minnesota and New Crop Opportunities Special Grants to study off-season greenhouse raspberry production. Production requirements for field produced vegetables and nursery crops are evaluated and demonstrated through variety and other trials at the Georgeson Botanical Garden. A primary objective is adaptability of new crop varieties and continuing publication of variety trial results. All of these activities are carried out in cooperation with Cooperative Extension and provide alternative niche crops for in-state commercial greenhouse and nursery producers.

Much of the barley grown for livestock feed in Alaska is produced in the Interior where early frost or snow can devastate yields. In 2000, AFES scientists released a new feed barley variety, 'Finaska'. It is an early maturing, lodging resistant spring barley with excellent feed quality. Crosses made between Alaska and Nordic germplasm has resulted in several promising lines which are being evaluated and a new earlier variety should be released in 2002 or 2003.

Cash receipts from livestock products continued to decline in 2000. The domestic livestock activities of the animal scientist we share with Cooperative Extension centered on dairy outreach. Funding from a Special Grant provided travel and supplies for the dairy specialist to work one-on-one with dairy farmers in diverse regions of the state and to defray travel expenses associated with assisting dairy producers to attend the Western

Dairy Management Conference in 2001 and hear nationally recognized experts in all aspects of dairy management not available in Alaska.

Alaska contains 129 million acres of forests constituting 35 percent of the state's total land area. Forests contribute to Alaska's economy through commercial and subsistence harvest of timber and indirectly through contributions to socially and economically valuable activities including tourism and non-market activities that improve our citizen's quality of life. Forestry research quantifies timber productivity of the northern forest lands and provides resource managers with appropriate information for timber management decisions and stand prescriptions. Additional funding from Special Grants to investigate New Crop Opportunities resulted in new programs that address value-added marketing of such diverse products as birch sap drinks, bark baskets and art, ethanol production from black spruce biomass, and potential pharmaceuticals derived from tree bark.

Expenditures:

Hatch General:	$569,689
Hatch Multistate:	$ 21,225
McIntire-Stennis:	$ 58,033
State Match:	$960,691
Total FTE (SY):	6.0

PLANNED PROGRAMS

Key Theme: Greenhouse/Nursery Production

Environmental Plant Physiology of Greenhouse Produced Crops
Innovative Use of Natural and Supplemental Light for High Latitude Crop Production

Efficient use of greenhouse and controlled environment facilities requires definition of cultural techniques and recommendations. Discovery and manipulation of the effects of environmental conditions on plant growth is essential to produce plants for various targeted markets. A high latitude location provides unique opportunities to study seasonal and daily effects of natural light on plant growth and development in comparison to artificial light. Documenting the significance of the light type or quality, amount and daily duration on plant morphology is essential to improve controlled environments for efficient crop production ". End users of the information produced by these projects are more likely to be large greenhouse producers in the lower 48 states than smaller producers in Alaska. New crop opportunities for in-state greenhouse producers is

a high priority expressed by our stakeholders. In many cases, emerging markets are ahead of northern latitude production guidelines. This project leveraged Special Grant projects that included "Production and Handling of Forget-Me-Nots (*Myosotis*)" and "Greenhouse Raspberry and Small Fruit Production".

Accomplishments: (**ALK-95-05, ALK-00-09, NCR 101-01**) Light, daylength, and temperature interactions and their effects on improving the marketability of greenhouse grown flowers and food crops (specifically cyclamen, dwarf carnations, black-eyed Susan, forget-me-nots, and selected food crops such as raspberry) have been the objective of a five-year Hatch project. Outputs included 7 peer reviewed journal articles, 10 national grower articles, 10 abstracts at national meetings, and numerous articles and presentations for local producers. Examples of outcomes included production recommendations from grower-initiated studies for a white or pink flowered forget-me-not (state flower), earlier flowering dwarf carnations and flowering cyclamen, and reduced height for container-grown black-eyed Susan. Controlled environment research produced attractive, proportional, and quality cut flowers and resulted in sound recommendations for local growers and published for regional and national audiences. Studies evaluating light quality or spectral energy distribution (SED) for greenhouse floriculture demonstrated that manipulation of SED could significantly reduce time to flowering, increase branching (thus number of flowers), and shape of plants for a number of flower species and varieties. New research objectives on innovative use of natural and artificial light was initiated in 2001.

Impacts: Research carried out under this project provides information and hard recommendations for optimum environments for flower production to greenhouse producers not only in Alaska, but nationally through national grower publications, collaborations with other state land grant universities, and outside grower inquiries. Preliminary impacts of the New Crop Opportunities greenhouse studies have shown overwhelming consumer acceptance of locally produced Forget-me-nots in corsages and small floral designs. Currently, Forget-me-nots are marketed locally, regionally, or nationally without competition. Scarce availability and strong demand suggest consumers are willing to pay high prices for the Forget-me-nots. Research results are presented at Extension workshops, in bulletins and national lay publications as well as refereed journals. Greenhouse/nursery production in Alaska is relatively small compared to the larger markets of the lower 48 states.

Source of Federal Funds: Hatch General and Hatch Multistate
Fund for Rural America (through Cornell University)
CSREES Special Grant

Scope of Impact: Multistate

Horticultural Crop Production for Alaska

For the past 20 years, horticulture has been the largest agricultural industry in Alaska. Greenhouse bedding plant production especially annual flower sales, is currently the largest segment of the industry. However, landscaping with woody and herbaceous perennials is expanding and native species are becoming a major contributor. The conversion from annuals to perennials has been accompanied by a demand for cultural information particularly species, variety, and overwintering requirements. In addition to ornamental potential, several native plants have edible fruit (lingonberry, blueberry, etc.) which are processed into products such as jams, jelly, sauces and ice cream. Research and demonstration projects funded by Hatch, Smith-Lever, State, and grant funds continues at the Fairbanks campus and in commercial fields in Alaska.

Accomplishments: (**ALK-96-01,**) Over 2000 plant evaluations were done at the Georgeson Botanical Gardens (64^0 51' N) included woody perennials, herbaceous perennials, annual flowers, herbs, and vegetables. Annual Flower Evaluations along with botanical notes summarizing cultivar response and survival, cultural recommendations, and disease resistance were published and field days for local producers conducted. Over 100 community volunteers assisted in maintaining the test gardens. Additional research leveraged by Hatch funds included Special Grant projects on pollination biology of lingonberry and peony as a new cut flower.

Impact: The target audience for this research is both small business commercial producers of landscape and nursery supplies and homeowners and gardeners. SAES horticultural researchers and Extension agents maintain and publish an ongoing list of Alaska-adapted varieties of vegetables, flowers, and nursery plants identified by the research carried out by this project. The market for these adapted varieties and other research carried out under this project include eight flower seed companies, 12 grass seed and 13 seed potato producers, nine native plant outlets, and 58 nursery stock producers (an increase from 31 in 2000). In addition, 31 fresh fruit and berry producers are currently listed in the Division of Agriculture Food and Farm Products Directory. Outreach for this program includes SAES bulletins, circulars, the Georgeson Botanical Notes, garden tours, and field days. The botanical display garden and Annual Flower Evaluation circular (co-authored by stakeholder volunteers), represent the most popular community service program in the Agricultural and Forestry Experiment Station. In 2001, over 28,000 visitors toured the Georgeson Botanical Garden second only to the University of Alaska Fairbanks Museum.

Source of Federal Funding: Hatch General
CSREES Special Grant

Scope of Impact: Alaska Specific

Key Theme: Horticultural and Agronomic Crop Production

<u>Potato and Vegetable Crops</u>

Potato and vegetable growers have identified plant disease as the single most important deterrent to increasing profits in recent years. Identification of disease resistant varieties, pest monitoring, integrated pest management, and biological control methods are the primary avenues of investigation being pursued by Alaska horticulture and plant pathology researchers.

Accomplishments: **(ALK-95-07, ALK-01-09, ALK-01-02, NRSP-4)** Alaska Agricultural Experiment Station horticulturists and Extension horticulturist continued field and laboratory research on evaluation of commercial production practices, cultivars, and diseases of potato and vegetables. New Crop Opportunities Special Grant projects are evaluating Devil's Club (*Oplopanax horridus*) as a marketable medicinal plant potentially effective as an anti-fungal and anti-viral agent for human health. Increased yield and resistance to bacterial, fungal, and viral diseases in potatoes was addressed through comprehensive cultivar evaluations. Studies involving line selection and seed sources of Russet Norkotah demonstrated lines from Texas produced greatest yields (42.6 MT/Ha). Study of virulence and taxonomic relationships among types of the fungus *Rhizoctonia* in concert with cooperating labs in other states and countries has found that the category system provides a better indication of group relationships than the fusion frequency system. A combination Experiment Station/Cooperative Extension late blight treatment and monitoring project initiated in 1998 following an outbreak of the disease has successfully maintained a blight-free potato crop in 1999 and 2000. In view of the 31 % reduction in value of potato production in 2000, savings generated by less fungicide application resulted in a significantly higher "bottom line" for some producers. Research output for the terminated potato Hatch project for the five-year duration included 41 publications with 14 of those being peer reviewed journal articles.

Applied research and demonstration to enhance vegetable production included continuation of on-farm lettuce variety trials for head size, tip burn, and marketability. New varieties of iceberg head lettuce were added and compared in grower fields with currently grown varieties. Other variety evaluations were conducted at the Palmer Research and Extension Center (PREC) for cabbage, radiccio, and leafy greens. New Crop Opportunities studies investigated specialty greens for a heretofore untapped in-state retail and restaurant market. Increases in carrot and cabbage production (71 and 33 %, respectively) largely resulting from increased value-added marketing, offers optimism for similar marketability for specialty greens. Studies targeting *Sclerotinia* (white mold) in vegetables, particularly lettuce, continued at PREC and on-farm.

Impact: Results from applied studies are presented each year to the joint SAES/CES sponsored Potato and Vegetable Growers Conference. Attendance was down slightly in 2000 but still represented well over 50 % of commercial producers in attendance. These presentations over the past 10 years have established recommended varieties of potatoes and head lettuce grown by Alaska producers as well as providing production practices information. After a steady five-year increase in value of production of potatoes, 2000 production fell off but rebounded in 2001 to one of the highest statewide yields ever. The value of production 2001 was $4,853,000 compared to $2,760,000 in 2000. Potato

growers treated in excess of 40% of the total acres with multiple fungicide applications in response to an outbreak of late blight in 1998. On the positive side, quick action by SAES plant pathologists and extension pest scouts resulted in treatment being reduced to 25 % of the acreage in 1999 and no treatment required in 2000 or 2001 and no late blight was detected in either year. The late blight monitoring program will continue in 2002. Producers contributed matching funds for the P.I. to attend an international meeting in Scotland related to control of *Sclerotinia* in vegetables. One outcome of that trip, the use of the biocontrol agent *Coniothyrium minitans* to control *Sclerotinia,* was tested in an on-farm lettuce trial in 2001 and showed significant (30 %) but incomplete control. However, field plot and laboratory studies indicate excellent potential for *C. minitans* not only in lettuce but also carrots.

Source of Federal Funds: Hatch General
CSREES Special Grants

Scope of Impacts: Alaska Specific

Forage Crops for Northern Latitudes

Forage for hay, silage, and pasture make up over 65 % of the agricultural land in production. Perennial grasses are the principal forage crop grown and legumes particularly alfalfa have performed well in Alaska. However, shortage of high protein livestock feeds and high cost of imported supplements continues to place a premium on forages having high crude protein concentrations. Failures of dairy farms in the early 1990s in the state subsidized dairy project at Point MacKenzie can be directly linked to nonsustainable costs of imported feeds. Based on needs expressed by dairy and forage producers, trials involving grasses and legumes produced at similar latitudes, no-till establishment, and companion cropping systems have been conducted at multiple locations to evaluate cold-hardiness, forage quality, and sustainable production practices. Recent increases in dairy cow numbers by a second generation of farmers at Point MacKenzie has again identified the need for more locally produced quality feeds.

New Alaska guidelines for Confined Animal Feeding Operations (CAFO) are now in place. A key provision of those guidelines is management of amount, source, placement, form, and time of application of nutrients present in animal waste in a manner that will minimize agricultural nonpoint pollution of surface and ground water. A three-year field study on rates, sources, and methods and times of application of dairy waste on oats and smooth bromegrass was conducted at the Palmer Research Center to determine best management practices (BMP) for Alaska.

Accomplishments: (ALK-95-06, ALK-98-06, ALK-92-01) Forage research in interior and southcentral Alaska included perennial grasses and legumes and grass/legume mixes established both conventionally and no-till. Specific studies included evaluation of grass and legume varieties from the circumpolar north for yield and quality, no-till establishment of small seeded forage legumes, and determination of harvest timing for optimum yield and quality. A grass species trial initiated in 1993 and continued through 2000 concluded reed canarygrass, smooth brome, and timothy were the most winterhardy and produced consistently high yield and quality while other species and varieties commonly grown at lower latitudes were not sustainable. Five-year dry matter (DM) yields averaged 3.86 and 3.77 tons/A for reed canarygrass and smooth brome, respectively, while timothy was somewhat lower at 2.94 tons/A. No-till established perennial legume trials tested a range of clovers and alfalfa with red clover being the most winterhardy, acid soil tolerant, and producing highest yield (4.7 ton/A) and demonstrating highest quality. A three-year study with companion-seeded Vantage reed canarygrass and Altaswede red clover further demonstrated to dairy producers the hardiness and economic viability of these outstanding species. Non-irrigated forage yields tend to be greater in southcentral Alaska than in interior. No-till seeding resulted in poor germination and lower dry matter yield than did seeding into tilled ground in interior Alaska locations; whereas, no-till seeding resulted in good stands and yield in southcentral Alaska. A study of persistence of perennial legumes in Alaska was terminated in 2000 demonstrated that climatic conditions at Fairbanks and Delta Junction (interior) winterkilled all clovers but alfalfa persisted at modest yields. All legumes survived four years at Point McKenzie (southcentral).

Impacts: Bromegrass and timothy continue to account for the majority of hay and silage produced for dairy and beef cattle and hay for horses in Alaska. However, dairy producers are looking to research and demonstration work carried out by the Agricultural and Forestry Experiment Station and the Cooperative Extension Service to increase protein and energy content of feeds produced on-farm. The importation of protein and energy in the form of soybean meal, corn, and other high cost feeds from out-of-state seriously threatens the sustainability of the Alaska dairy industry.

Source of Federal Funds: Hatch General and SARE

Scope of Impact: Alaska Specific

Alternative Grain and Oilseed Crops

Small grains, principally barley and oats, along with forages, constitute a majority of the in-state feed base for domestic livestock in Alaska. Performance trials at Fairbanks, Delta Junction, and Palmer evaluated released varieties and new genetic materials from Canada, Sweden, Norway, and Finland. These include genetic materials from the recently terminated Alaska barley breeding program. Additionally, there is an increasing demand for native grasses, legumes, and wildflowers for use in revegetation and beautification projects.

Accomplishments: (**ALK-96-05**) The release of 'Finaska' variety barley in 2000 marked the first release in a number of years and reflected some nine years of breeding work by Dr. Stephen Dofing. Other cultivars showing even greater promise. In particular, experimental lines originating from crosses involving 'Otal', the earliest and most popular variety grown in Alaska and, in the 1980s one of the leading spring barleys in Canada, and 'Thual' an excellent Alaska hulless feed barley. Other evaluation trials, both irrigated and dry land, identified grains and oilseed crops with potential for meeting livestock energy and protein needs. Plantation of native plants included *Agropyron macrourum, Agropyron violaceum, Hedysaum mackenzii, Hedysaum alpinum, and Oxytropis campestris.*

Impact: New crops and improved varieties are important to Alaska producers. With limited exports, sustainable conventional agronomic crop (small grains, forages, etc.) production is limited. Alternative crops meet requirements of 'niche' market producers. Native seed producers are growing high cash-value crops for reclamation of areas disturbed by oil production, mining, and road construction. Recent energy shortfalls point to a natural gas pipeline that will increase demand for native plant materials including wildflowers.

Source of Federal Funds: Hatch General

Scope of Impact: Alaska Specific

Key Theme: Marketing of Alaska Grown Products

Work continued on marketing of Alaska agricultural and seafood products. The "Alaska Grown" program has gained consumer confidence and demand for these products at the retail level is great during season. Limited vegetable processing initiated in 1998 continues to progress with a new carrot processing plant opening in 2001 and export markets in the Asian far east continue to show promise.

Marketing Alaska's Agricultural and Processed Seafood Products

This project terminated in FY 2001 and the P.I. has taken an administrative position. However, the marketing issues are important to our producers and will continue to be addressed under state and other grant funding.

Federal-State Marketing Improvement Program: Marketing Alaska for Potato and Vegetable Producers

Over 90 percent of the food consumed by Alaska residents is imported. Cash receipts and market share from agricultural production has increased moderately over the years; however, marketing continues to be the limiting part of the economic equation. A remaining obstacle is the desire by large retail chains such as Safeway and Fred Myers to utilize their outside suppliers year around rather than breaking that supply chain for the relatively brief Alaska growing season (essentially July through September for most

vegetables currently being grown). Alternative new crops and more value-added processing is needed to help bridge the Alaska supply gap. This project has quantified the demand for Alaska grown fresh market and value-added potatoes and vegetables.

Accomplishments: A survey conducted last year found that perception among wholesalers and retailers in Alaska included the following: 1) Supply rather than demand is the limiting factor in purchasing, 2) Carton size should be standardized, 3) Individual farmer brands is secondary to the Alaska Grown logo, 4) Cooperatives are not the preferred vehicle for marketing Alaska products, and 5) The Alaska Division of Agriculture has gained the confidence of buyers in the area of quality control. Results of the survey were provided to the wholesalers/retailers and producers for their information and reactions. The primary outcome of this project was increased communication between the producers and the market resulting in a better understanding of the supply available and the potential market. Farmers were also surveyed to determine their concerns about market barriers and programs to assist them with marketing needs. Responses from the farmer survey included a spirited defense of their product as equal to or superior to outside products and for a competitive price (essentially Seattle plus freight). The primary role that government could play would be continued assistance in marketing and ensuring that state institutions utilize Alaska Grown products when price competitive.

Impact: There is a high regard for the Alaska Grown program by both buyers and growers. A significant problem identified by producers was funding for widespread advertising. A major outcome and impact of this project was the acquisition of $500,000 from the U.S. Department of Agriculture Federal-State Marketing Improvement Program for marketing/advertising of Alaska Grown. The funds will be funneled through the Alaska Division of Agriculture. Market share of Alaska grown products at both wholesale and retail outlets has increased and more stores are advertising Alaska Grown products.

Source of Federal Funds: General Hatch
USDA Federal-State Marketing Improvement Program

Scope of Impact: Alaska Specific

Key Theme: Traditional and Alternative Livestock Production

In the past ten years, cash receipts from livestock enterprises have been essentially flat. In 2000, dairy made up 40 percent and meat animals 27 percent of the total. The remainder was made up of minor species including reindeer, muskox, and elk. The objectives of this project are to determine means of improving reproductive management of domestic and alternative ruminant livestock on farms in Alaska. The Alaska Agricultural Experiment Station and Cooperative Extension Service are making good progress with the more traditional beef and dairy industries. While the Station no longer has a research dairy herd and only a small beef heard, studies were performed on three commercial dairy

farms and one purebred beef farm. Additionally, we are providing research and outreach service to the smaller but very vigorous alternative livestock industry which includes reindeer, elk, and muskox. The Experiment Station owns a small reindeer herd and has access to other reindeer and muskox at the Institute of Arctic Biology Large Animal Research Unit.

Reproductive Performance in Domestic Ruminants

Accomplishments: (**ALK-00-01, W-112**) Research during 2001 included projects involving dairy cattle, beef cattle, reindeer, and muskox. The accomplishments for this project are the results of collaborative efforts of multistate research (W-112), integrated activities with Cooperative Extension, and involvement of stakeholders from the Alaska animal industries. The latter involved on-farm research taking advantage of producer herds for improving reproductive management. Outcomes included the following:

- Different synchronization protocol was employed in private production settings to determine the effectiveness of estrous detection and timed artificial insemination (AI) in well managed herds. Results over the past two years showed silent ovulation does occur in postpartum dairy cows but at a lower rate than assumed and that knowledge of milk E2 (estradiol) is a useful tool in for dairy cow AI management.
- We investigated reindeer bull management and its effect on the onset of seasonal ovarian cyclicity and calving synchrony in reindeer cows. Reindeer cows were tested in two groups; early or late exposure to bulls to determine if early bull exposure hastened the onset of the breeding season and synchrony of parturition date among cows under different management schemes. Last year's results demonstrated that early weaning had no effect on the onset of breeding, but early bull exposure hastened the onset of seasonal ovarian cyclicity by two weeks. 2001 data confirmed that cows experiencing bull introduction just prior to the onset of seasonal ovarian cyclicity experienced parturition within a seven day period compared to 31 day period among cows that were cycling when bull introduction occurred.
- An investigation of different means of estrous synchronization in dairy and beef cattle using privately owned cattle on three dairy farms (80 cows) and one purebred beef herd (70 cows) and effectiveness of early pregnancy testing on three farms were initiated in 2000. Data collection on this project is complete and will be analyzed after cattle have undergone parturition.
- The use of radiotelemetric estrous detection in order to quantify breeding behavior between muskox cows and bull. Each cow harem was held by a single bull and housed separately to minimize bull aggression. Breeding activity data was collected in 2001 and is currently being analyzed and will be compared to reproductive hormone data to verify coincident estrous and breeding activity.
- In cooperation with the Alaska Cooperative Extension helped sponsor the Alternative Livestock Producers Conference attended by 96 registrants including 90 percent of all Alaska game farmers. One important outcome of this conference was the establishment of the Alaska Diversified Livestock Association.

Impacts: Outcomes from this research demonstrate the effectiveness of reproductive management technologies and techniques that will be used to improve reproductive efficiency on traditional dairy/beef and alternative livestock farms, ranches, and open range. At present, reindeer and muskox herds represent primarily Alaska Native enterprises and offer economic opportunities in extremely rural settings. For reindeer and muskox herders, bull management effects timing of breeding and thus improve reproductive success. Research efforts for the project will increasingly involve additional species including elk and bison. Both dairy production and beef and reindeer numbers are down significantly and applied research and outreach activities closely tied to farm operations is critical. The Alaska Diversified Livestock Association has approached the Experiment Station with a request for research that specifically addresses their needs and have approached the state legislature for funding support.

Source of Federal Funds: Hatch General and Hatch Multistate

Scope of Impact: Multistate

Feasibility of Intensively Raised Reindeer Utilizing Grazed Forages and Alaskan Produced Feed Ingredients

Among the livestock currently raised in Alaska, reindeer have a long history of domestication. Historically raised in extensive, free-ranging systems, their tractable nature enhanced and expanded their use by many native cultures. With the ability to produce meat, antler by-products, and recently, agrotourism, reindeer are an increasingly attractive species for northern agriculture. Herd size has fluctuated due to predator, disease, and environmental impacts. Since 1997 the herd numbers have decreased from approximately 29,000 to less than 20,000 due primarily to reindeer being incorporated into migrating caribou herds and other range habitat changes. For that same period, reindeer meat production was cut in half. Some type of confined animal feeding operation (CAFO) may be required either as a temporary holding action or perhaps a longer term solution to prevent further lose of animals. Also there are, though relatively small, confined operations in the so-called railbelt. In either case, research to establish baseline nutritional information for CAFOs needs to continue. Reindeer typically show a strong seasonal variation in body weight where intake rates and body weight drop from a maximum in September to a low in March prior to calving. A strong relationship exists between calf birth rate and growth rates with mother body weight prior to calving. By formulating diet based on the most palatable and digestible Alaska-grown barley we hope to reduce weight loss by females prior to calving. The only commercial diet available to reindeer producers contains 66% imported feed ingredients and is prohibitively expensive. The objective of this project is to evaluate Alaska produced feed ingredients and determine which can be used in reindeer diets in a nutritious and economically sustainable manner.

Accomplishments: (**ALK-98-07**) Outcomes are judged in terms of both reproductive success and calf weight gain. In 2000, utilizing 80 % dry-rolled barley and 20% brome

hay, all females in the feeding trials dropped viable calves. Calves were placed in feed trials in 2001 and showed weight gains similar to free-ranging deer. When females were fed diets containing Alaska grown varieties Thual (hulless) or the recently released Finaska (91.8 and 88.1 *in vitro* digestible and 12.3 and 15.2 % NDF, respectively). The Finaska group lost less weight prior to calving (1.4 kg) than the Thual group (6.9 kg).

- Impact: Female reindeer in the study fed a less fibrous, more digestible diet lost more weight than those on the more fibrous less digestible diet regardless of intake rate. Results indicate that reindeer will consume, gain weight and be reproductively successful on a predominately barley-based diet. Utilization of barley grown in interior Alaska can make feeding of reindeer economically feasible in Alaska Native herds on the Seward Peninsula where the high cost of feed shipped from out-of-state has historically been prohibitive. This research provides the only support for what, in past years, was an economically sustainable agricultural industry wholly owned and operated by Alaska Natives. Loss of range reindeer to migrating caribou herds has significantly impacted the industry particularly on the Seward Peninsula. Annual value of meat, antler, and by-product sales in 2000 was down 38 percent from the previous year. This is a major economic factor in the economy of the rural villages of the region. SAES researchers are working collaboratively with USDA-NRCS, Alaska Fish and Game, and the Alaska Reindeer Herders Association to monitor movement of reindeer commingling with the large Western Arctic Caribou Herd utilizing satellite monitored collars. Native reindeer herders can monitor their animals for unexpected movements and make adjustments to herd location to avoid migratory caribou. Using this methodology, herders have reduced the rate at which the reindeer were disappearing as well as mapping range utilization to prevent overgrazing.

Educational Outreach. To increase the awareness of students K-12 of the Alaska Native reindeer industry, researchers have taken slide shows to schools in the Fairbanks area as well to village schools on the Seward Peninsula and offered hands-on opportunities to students.

Source of Federal Funding: Hatch General

Scope of Impact: Alaska Specific

Key Theme: Forest Products

Tree Species Growth & Yield and Site Productivity for the Alaskan Northern Forest

Value-Added Forest Products

The objectives of these projects are split between AREERA Goals 1 and 4. Under Goal 1 the project quantifies timber productivity of Alaskan Northern Forest lands and provides resource managers with appropriate information for timber management decisions and

stand prescriptions. It also identifies, documents, and reviews available timber inventories for the Northern Forest in Alaska. Additionally, funds from New Crop Opportunities Special Grants leveraged by McIntire-Stennis and state funding, is addressing black spruce for ethanol production and a combination of species for production of phytochemicals. Much of the northern forest consist of unmarketable fiber for traditional forest products as well as byproduct waste from marketable trees. This study is investigating fiber need and black spruce availability for a 350 ton per day ethanol plant and to identify fiber sources. An additional objective included evaluation of byproduct waste as a source of high-value foods, chemicals, and pharmaceuticals (i.e. birch syrup, paper birch compound as herpes remedy, aspen as a source of aspirin, and antioxidants from spruce bark)

Accomplishments: (**ALK-97-01**) Forest Productivity: Drafts of polymorphic aspen site index curves was completed along with good progress in expanding the network of permanent sample plots with a total of 406 sites in this continuous inventory of fiber production potential. These efforts are establishing Northern Forest productivity, growth and yield models, and individual tree volume equations. While these studies are, by their very nature, a work in progress, the models and data are now available to assist public and private land managers in determining stand management prescriptions, biomass production, wildlife habitat maintenance, and carbon sequestration for credits and energy. Ethanol and Phytochemical Production: A review and analysis of all existing published forest fiber inventories for the upper Tanana Valley and estimates of fiber quantities was completed in 2001. Field reconnaissance in the summer of 2001 narrowed the target species to black spruce. Inventory data was completed on a 750 harvested tree sample and identified at least 25 individual stands appropriate for the project. Researchers found black spruce ranging up to 14 inches in diameter, age of 106 years, and heights to 70 feet. A spinoff from the ethanol project identified other non-timber forest products (NTFP) from foliage, bark, wood, and sap with chemical, pharmaceutical, and food product potential as well as niche market possibilities for Alaska Natives. The latter include birch bark baskets and art. Graduate and senior thesis students finished literature reviews on bark characteristics, chemistry and use; work was initiated on bark sample collection, and native elders were contacted for information on traditional basket making. Other outcomes were related to birch syrup and included data from three sites in 2001 that included 1. tree characteristics, sap flow, and sugar content, 2. birch syrup survey on sap collection methods, syrup production in Alaska, and industry needs. Over 80 % of the commercial producers completed the survey.

Impacts: Forest growth and yield data collection in Alaska is far from complete. However, outcomes from this project continue to build on a database that will include permanent sample plot, levels of growing stock, tree volume equations, early height growth of trees, and the forest vegetation simulator model. This new data will assist managers in making preharvest silvicultural prescriptions and economic decisions. Based on progress to date, Alaska Forest Refinery, Inc. is preparing to open an ethanol facility near Tok. However, recent reductions in energy prices has delayed these plans at least temporarily. The new federal energy policy currently in congress will impact forest-related ethanol production.

Birch syrup has been consumed by northern indigenous peoples for centuries. Efforts with this project included collaboration with the Alaska Birch Syrup Association and the Alaska Boreal Forest Council. In addition to traditional syrup, prototype sap drinks were developed in 2001 by boiling sap with wild berries and other ingredients. Calypso Farm and Ecology Center will serve as a study site and market for birch sap products in 2002. USDA-NRCS has initiated birch tapping classes and is disseminating information to potential commercial tappers. A website will facilitate communication exchange between sap harvesters.

Source of Federal Funding: McIntire-Stennis and USDA Special Grant funds

Scope of Impact: Alaska Specific

GOAL 4: Greater harmony between agriculture and the environment.

Program 2. To increase the research and knowledge base for environmental sciences, agriculture, and forestry including conserving and protecting ecosystem integrity and biodiversity.

Overview: Alaska has a wide expanse of state, federal, and private forest and rangelands. It possesses an area as large as 42 Rhode Islands that is, by far, the least developed in the U.S. It has a wilderness that is larger than all wilderness found in CA, WA, and OR combined. Less than 1 percent (excluding Native lands) has undergone significant commodity production and very little land-use change. However, the state is faced with economic need to develop its renewable and non-renewable resources to contribute to the well being of its citizens. At the same time, it must also contribute to the ecological integrity and biodiversity of its landscape. A significant portion of SALRM/AFES research and education efforts are directed toward environmental issues raised by conflicts among multiple users, nonrenewable resource development, renewable resource production, and economic and environmental sustainability. Currently the majority of these issues center around energy and mineral resource development, forest sustainability, impacts of global climate change, wetlands, non-market impacts, and agricultural production impacts on soil resources.

AFES has been involved in reclamation and revegetation research related to the development of the Prudhoe Bay oil fields and the Trans-Alaska Pipeline (TAP) since 1972. The recently terminated (1998) long-term evaluation of disturbed arctic tundra and colonization has continued to reap benefits to private sector resources development and mineral extraction companies, regulatory agencies with the environmental compliance mandate, and the citizens of Alaska. Dr. Jay McKendrick, Professor Emeritus recently surveyed and sampled soils and vegetation along the TAP route from Prudhoe Bay to

Valdez [1]. The purpose was to evaluate the environmental impact after 25 years of pipeline service. This program will take on renewed importance with new energy development projects proposed such as the gas pipeline and potential drilling in the Alaska National Wildlife Refuge. Other revegetation research has addressed landscape disturbances both natural and anthropological in nature with focus on plant species, growth media, and management strategies that will assist mining companies and resource managers in meeting regulatory requirements for erosion control, reinstating wildlife habitat, and plant diversity.

Global climate change effects on soil conditions in the arctic and subarctic have potential to impact permafrost soils with resulting impacts on the soils moisture regimes and carbon flux and stores. Research related to wet soils monitoring has determined the current definition of biological zero at 5 ^{o} C is incorrect for arctic environments. Normalized difference vegetation index (NDVI) and phenological evidence in the Arctic and some portions of the subarctic, the vegetation initiated spring growth while temperatures were still below zero C. This discrepancy will result in misclassification of wetland soils in a large area of arctic. Companion research on carbon flux and soil organic matter funded by NSF and Hatch general funds provided field soil data as a basis for models of winter carbon flux to the atmosphere for the arctic system. We found that appreciable amounts of CO_2 evolved from the snow-covered arctic tundra when there was no photosynthetic source of CO_2. Ultimately, the arctic model will be an essential part of an improved global climate model for predicting the impacts of climate change. This latter work is in cooperation with scientists from other states and nations although not a formal multistate effort.

Other soil related research focused on long-term effects of crop tillage methods on soil quality in Alaska's interior. Barley acreage in Delta Junction was up 30 % over 2000. Aided by research and outreach from university researchers and extension personnel, the value of production of barley was almost double the 2000 value. Perhaps more importantly, utilization of information on optimum tillage practices that reduce soil loss to wind erosion, improve soil structure and increase moisture-holding capacity by farmers has paid dividends. These practices in concert with federal soil conservation efforts by local conservation districts and USDA- NRCS ensure farm productivity and wildlife habitat consistent with the stated desires of our stakeholders.

An alternative treatment for the control of economically destructive plant diseases, which is both safe and environmentally benign, is Plant Helper, a commercial product containing *Trichoderma atroviride* spore suspension. This product developed by AFES plant pathologists has been found to be effective in the control of damping-off of cotton, rusty root of ginseng, snow mold in turfgrasses, and other plant diseases important to the states of the Western Region.
Forests are one of the major renewable resources of Alaska. Alaska forests provide habitat for wildlife, forest products and opportunities to expand forest products

[1] McKendrick, J. D. 2002. Soils and Vegetation of the Trans Alaska Pipeline Route: A 1999 Survey, Univ. of Alaska Fbks, Agric. and Forestry. Exp. Sta. Bulletin 109, 121 p.

production, and the scenic backdrop for much of Alaska's tourism industry. Ecological processes in high latitude forests are a significant feedback to the world carbon cycle and major potential source of greenhouse gases.

Forest science research makes up a significant percentage of federal formula funds coming to SALRM/AFES. While not specifically required by AREERA we have included research summaries and impacts for McIntire-Stennis funded projects. In many cases this research supports and augments some Hatch funded research. For example, the carbon flux and global climate modeling discussed above, is augmented with research on forest floor organic matter decomposition pathways and nutrient cycling. Results of this work contributes to our understanding of the impacts of boreal forests as a sink or source of carbon dioxide to the atmosphere and to soil respiration responses to disturbance. Other forestry research related to forest ecosystems and biodiversity contrasts forest growth with major climate features. This research develops basic information related to natural regeneration and seedling growth and the impact of climate and climate change on northern forest development. While some models of global carbon balance assume that the boreal forest would store a major share of carbon dioxide added to the atmosphere by human activity through increased tree growth in response to climate warming, our data suggests that warming-induced drought may represent an important limit to carbon storage.

Expenditures:

Hatch General:	$211,462
Hatch Multistate:	$120,368
McIntire-Stennis:	$385,709
State Matching:	$736,288
Total FTE (SY)	8.5

PLANNED PROGRAMS

Key Theme: Plant Disease Control/Biocontrol

Managing Plant-Microbe Interactions in Soil to Promote Sustainable Agriculture

Snow mold of turfgrasses (caused by a complex of *Myriosclerotinia borealis, Microdochium nivali,* and *Coprinus psychromobidus*), pink root of potato, damping-off of cotton and early season disease (both caused by *Pythium* spp) and rusty root of ginseng

and potato late blight (caused by *Phytophthora infestans*) are all economically destructive diseases affecting a variety of crops in all regions of the U.S. Traditional fungicide use is less acceptable because of fungicide resistant pathogens and potential residues in the food chain. Among the new biological control agents available that offer varying degrees of control of these diseases is *Trichoderma* atroviride, a versatile mycoparasitic organism found in Alaska. This research was carried out under the aegis of the Western Multistate Research Technical Committee W-147.

Accomplishments: (**ALK-94-01, W-147**) Alaska Agricultural Experiment Station scientists and W-147 participants continue research related to the use of the mycoparasite *Trichoderma atroviride* for potential biological control. *T. atroviride* is capable of infecting a wide range of pathogenic organisms including those listed above. Unlike most commercial *Tricoderma* products that require elevated temperatures to be active as a biological control agent, *T. atroviride* has an effective temperature range of 4 to 33 C and its proclivity for high humidity ensures its efficacy under environmental conditions at which the target pathogens flourish. This gives Alaskan *Tricoderma* strains a distinct advantage by allowing spore germination to occur earlier in the growing season and to allow biocontrol establishment in the soil prior to pathogen establishment. Trials in commercial cotton fields and ginseng gardens demonstrated that *T. atroviride* significantly reduced damping-off, rusty root, and early season disease incidence. Results of experiments conducted under laboratory, greenhouse, and field conditions showed that *T. atroviride* could provide good control of late blight in potato seed pieces. Research under this multistate Hatch project demonstrated for the first time that *T. atroviride* was as effective as conventional fungicides for the control of seed-borne late blight. Production of the enzyme chitinase apparently plays a role in hyperparasitism involved in the suppression of disease. Research under this project published in 2001 provided important evidence that *T. atroviride* penetrated and lysed the mycelia of disease organisms and, in turn, supports the important role of chitinase.

Impact: Damping-off, gray mold, rusty root, early disease, and late blight together deal destructive and economically devastating effects on high cash crops in many states. In Alaska, a single outbreak of late blight in potatoes in 1999 infected over 50 % of commercial potato fields. Nationwide, it is estimated that the monetary loss to soil borne disease in all crops is in excess of $4.0 billion/year. Plant Helper, a commercial product containing *T. atroviride* spore suspension was found to be effective in partially controlling these diseases in cotton (damping-off), ginseng (rusty root and early disease), and snow mold in turfgrasses. The economic impact in multiple states on a number of commercial crops could prove to be in the millions of dollars. However, it must be understood that at this point in time, few of these biocontrol agents have proved successful in large-scale commercial fields. They are not yet candidates for complete replacement of chemical control and other disease reducing production practices.

Source of Federal Funding: Hatch Multistate

Scope of Impact: Multistate

Key Theme: Reclamation and revegetation of disturbed lands

Range Management and Long-Term Evaluation of Tundra Colonization on Disturbed Sites in Alaska's Arctic Oil Fields

[This project terminated with the retirement of the P.I. The position has been recruited and a new project may be in place by the beginning in FY02. Historically this position produced 26 years of research on reclamation of North Slope oil field disturbances and pipeline route through subarctic regions of the state. This program will take on renewed importance with new energy development that is part of a state and national policy shift.]

Soils and Vegetation of the Trans-Alaska Pipeline Route

When the Trans-Alaska Pipeline System (TAPS) was initially proposed, concerns related to impacts on wildlife habitat in the arctic temporarily blocked construction. Twenty six years of research has documented successful rehabilitation and reclamation of disturbed lands in the arctic. **A capstone report in an Experiment Station Bulletin just published (2002) summarizes revegetation efforts and existing vegetation within the TAPS right-of-way and outside the ROW at 52 sites along the 800-mile pipeline.** It points out the successes and the failures of reclamation methodologies used in that project, many of which were the results of Hatch, state, and private funded research carried out by the Agricultural Experiment Station.

Impact: Over 10 billion barrels of oil have traveled through the TAPS over the past 25 years. Currently, the pipeline output makes up approximately 25 percent of total U.S. oil production and has transported over $250 billion worth of oil in its lifetime. Royalty taxes going to the state of Alaska have been deposited in a Permanent Fund that is now valued at over $30 billion and proceeds account for 80 percent of the Alaska state operating budget. Hatch funded research over the past 26 years (last project terminated in 1998) has supported research that enabled environmentally sound development and provided regulatory agencies and the oil companies with scientifically sound reclamation and revegetation information and recommendations.

Source of Federal Funds: Hatch General

Scope of Impact: Alaska Specific

Ectomycorrhizae on Disturbed Lands in Southcentral and Interior Alaska: A comparison of Regional Similarities and Differences

A previous McIntire-Stennis project that terminated in 4/2000 had objectives that addressed disturbed mineland ecology. These studies assist mining companies and resources managers in decisions relative to what plant species, growth media, and management strategies will meet regulatory requirements for erosion control, reinstating wildlife habitat, and plant diversity. A summary of accomplishments for that project was summarized in 2000. In terms of the bottom line for the mining companies, it allows

them to continue extraction of renewable resources by providing them with information on plant species and soil conditions that allows them to meet regulatory compliance.

Accomplishments: (**ALK-00-02, WCC-021**) Accomplishments for the recently initiated project to study ectomycorrhzae (EM) centered around sample collection of roots and soil at various sites around the state where natural colonization has occurred following natural (glacier activity and floodplain) and anthropogenically (mining, road construction, etc.) disturbances for evaluation of EM and to determine if sufficient commonalities exist for development of a common revegetation inoculum. Study sites ranged from glacial outwash plains to prescribed burns and mined lands. EM had already formed on paper birch by August of the first year but not on balsam poplar. This observation and preliminary data from different latitudes of origin will determine if a common EM inoculum is possible or if latitude of origin needs to be considered much in the same way as with seed.

Impacts: The terminated project assisted coal and gold mining companies in interior Alaska. The research evaluated and identified Alaskan plant species for new mining sites. Additionally, we found that sandstone overburden was a better growth media the first two years following mining; however, after four years, topsoil performed better and allowed a quicker return to pre-mine vegetative conditions and allowed companies to recover reclamation bonds. In relation to the new project, development of a common EM inoculum could provide a low-cost and environmentally friendlier substitute for use of chemical fertilizers to supply certain required nutrients, particularly phosphorus and micronutrients in the reclamation of disturbed lands.

Source of Federal Funds: McIntire-Stennis and Hatch Multistate funds

Scope of Impact: Multistate

Key Theme: Soil Carbon Flux, Permafrost Characteristics, and Nutrient Cycling

Hydric Soil Properties of Permafrost-Affected Soils in the Boreal Forest Zone

To establish a relationship between reducing conditions, soil temperature, and morphological properties and identify hydric soil indicators in interior and arctic Alaska.

Accomplishments: (**ALK-97-05, WCC-093**) Growing season based on 5^{o} C is currently used as a criterion for hydric soils and hydrology components in wetland delineation. However, soil and phenological research in the Alaska arctic over the duration of this project has shown this is invalid. A combination of phenological evidence and normalized difference vegetation index (NDVI), soil temperature, soil morphology (redoximorphic features), and biological evidence clearly show that biological and chemical activity well below freezing. Despite the fact that these soils have soil temperatures during the growing season barely above freezing, they are technically

hydric soils and should delineate wetlands. Scientists are gathering baseline data for the North Slope that provide useful information in the event of oil drilling activities in the Naval Petroleum Reserve and ANWR. Other accomplishments included:

- Provide data to the National Technical Committee on Hydric Soils regarding growing season and biological zero in arctic and subarctic regions.

- The permafrost-affected soils database is being further used to develop the Alaska soil carbon map by NSSC and to develop the model for the circumpolar active layer depth by the National Snow and Ice Data Center in Boulder, CO.

- Total of 4 journal articles, 2 book chapters, and numerous symposium presentations and contract reports.

Impacts: Makes the connection between actual observed conditions in northern regions and soil properties biological conditions used to identify hydric soils and wetlands. The current use of 5^{o} C as biological zero lacks scientific credibility and is not valid in the arctic and subarctic environment. If this definition is not corrected, the areas covering this region of Alaska, which is the size of California, cannot be classified as wetlands. This data base information is needed by native corporations, oil and gas interests, mining industry, and government agencies for environmental compliance and permit processing. This project ties in with Alaska Native interest lands and provides cooperative working relationships with the native villages, BLM, and private industry.

Source of Federal Funds: Hatch General, USDA-NRCS, and NSF

Scope of Impact: Multistate

Winter Carbon Flux and Soil Organic Matter

Accomplishments: AFES researchers in collaboration with scientists from other states and agencies are characterizing the soils of arctic ecosystems and relating soil organic matter quality. They found that soil microbes shift to more water-soluble substrates to support respiration as temperatures drop below freezing. Soils from field sites in six arctic ecosystems were studied for correlation between soluble organic carbon (OC) and respiration and a good correlation was found. However, water-soluble carbon did not correlate with total OC. Surprisingly, soils in the permafrost layers had increased water-soluble OC substrate levels and higher respiration. Other somewhat unexpected findings indicate that near 0 C, the activity of soil organic matter is greatest and nearly equal for both the highly organic surface soil layers and for the deeper, minimal carbon mineral layers. These soils with significant stores of carbon in this profile position hold high potential for release of carbon dioxide during the cold season.

Impact: Our results provides insight into controls on gas fluxes from soils of the arctic system for the cold season when up to 60 % of carbon emissions can occur and about which little is known. We provide real soils data as a basis for models describing winter

flux of carbon to the atmosphere. Ultimately, the arctic model will be an essential part of an improved global climate model for predicting the impacts of climate change.

Source of Federal Funds: NSF and Hatch General

Scope of Impact: Multistate

Mechanisms of Change in Forest Floor Decomposition and Element Supply in Successional Forests of Alaska

This project terminated 1/29/01 and was replaced by:

Soil Carbon Balance and Nitrogen Dynamics Following Disturbance by Wildfire and Logging in Interior Alaskan Forests

and

Long-term Forest Ecosystem Monitoring and GIS Modeling of Taiga Forest Dynamics

This year's report addresses all three projects.

Studies of disturbance impacts on boreal forests can be justified along two lines. First, increasing management activities requires a better understanding of forest responses to disturbance in order for management objectives to be reached. Second, disturbance in boreal forests is a potentially dominant wildcard of global atmospheric carbon balance. Carbon stored in boreal forest vegetation and soils is second only to tropical forests in size and constitutes roughly one-sixth of total terrestrial carbon stores. Clearly, changes in the magnitude of the boreal forest carbon balance will likely dominate future atmospheric C balance.

A primary means of summarizing and utilizing forest ecosystem data for management purposes is through development and application computer models. Understanding the effects of forest management and climate change on Alaskan taiga forest function and structure will require knowledge of biology of the forest and its environmental interactions. This new project will develop a version of the Spatial Alaskan Forest Ecosystem Dynamics (SAFED) model with subroutines of fire disturbance, insect mortality, natural regeneration, and site preparation after clearcutting followed by estimates of change in landscape level carbon capture resulting from climate change, fire frequency, and management intensity.

Accomplishments: (**ALK-95-04**) AFES Scientists and graduate students in cooperation with researchers from the Institute of Arctic Biology and the Forest Service Cooperative Forestry Unit have pursued multiple objectives related to forest floor organic matter decomposition pathways, nutrient cycling dynamics and responses to disturbances such as fire and logging. Recent findings include:

- Net Nitrogen Mineralization. One mechanism by which plants may influence N dynamics is through release of soluble carbon compounds, such as phenolics from foliage and decomposing litter. *Ledum palustre* (labrador tea) is found extensively in northern forests and contain relatively high concentrations FO phenolic compounds. Results showed that phenolic compounds not only stimulated gross and net immobilization when microbes used them as carbon source, but also accelerated gross N mineralization rates. Studies utilizing 15N pool dilution techniques and mass spectroscopy confirmed that these differences were primarily the result of increased gross immobilization (i.e. stimulation of microbial activity) rather than decreased gross mineralization. These studies indicate that leachates from throughfall under dense *Ledum* canopies would limit N availability to other species including aspen and birch trees in the overstory.

- We examined soil respiration in a variety of situations in order to identify the responses of respiration to fire in black spruce and hardwood ecosystems. A second objective was to evaluate the relative contribution of roots and microbes to soil carbon efflux in black spruce forests. Soil respiration declined markedly following fire and did not recover within two years. Early results from the microbial/root separations shows trees from colder soils contribute proportionally less to carbon flux than those from warmer sites.

- We completed the 5-year study of log decomposition and added two new sites that resulted from a fire adjacent to the Bonanza Creek Experimental Forest. SAFED model calibration and verification used a 34-year forest monitoring data set of tree growth, temperature and moisture variables.

Impacts: The expanding role of forestry in Alaska and in the circumpolar north requires a clearer understanding of the soil respiration response of boreal forest floor microbial dynamics to natural and man-made disturbances. The boreal forests of the circumpolar north contain an amount of carbon equivalent to the earth's atmosphere. This research is quantifying carbon flux pathways of plant production and biomass loss through decomposition, combustion (fire), and removal (logging). Should global temperatures increase as predicted, indicators point to northern forests as a net carbon source not a carbon sink. To follow that train of thought, we could conclude further elevation of atmospheric CO_2 levels, increased organic matter decomposition, and reduced soil carbon storage.

Source of Federal Funds: McIntire-Stennis and NSF funds.

Scope of Impact: Alaska Specific

Key Theme: Soil Health and Sustainable Agriculture

Tillage and Crop Residue Management Effects on Properties of a Subarctic Soil

Other soil related research focused on long-term effects of crop tillage methods on soil quality in Alaska's interior. Barley acreage in Delta Junction was up 30 % over 2000. Aided by research and outreach from university researchers and extension personnel, the value of production of barley was almost double the 2000 value. Perhaps more importantly, utilization of information on optimum tillage practices that reduce soil loss to wind erosion, improve soil structure and increase moisture-holding capacity by farmers has paid dividends. These practices in concert with federal soil conservation efforts by local conservation districts and USDA- NRCS ensure farm productivity and wildlife habitat consistent with the stated desires of our stakeholders.

Accomplishments: (**ALK-98-06**) Initial evaluations found tillage treatments and residue management had no effect on total soil carbon or total soil nitrogen. However, soil biomass carbon, biomass nitrogen and mineralizable carbon and nitrogen in the surface 4 inches (indicators of organic matter turnover) were significantly higher in the no-till compared to conventional and minimum till practices. Bulk density was lowest and aggregate stability highest in the no-till plots when compared to the minimum and conventional tillage treatments indicating preferential soil physical conditions resulted from less disturbance of the soil. There were essentially no effects of tillage on soil health and quality beyond 4 inches. These findings confirm surface soil health and quality in terms of biomass carbon and nitrogen and structural stability are significantly better with less tillage disturbance. Additional studies in a SARE funded project to study no-till forage establishment for renovation of degraded pasture and hay lands. This research was located on six private sector farms in interior and southcentral Alaska. Degree of establishment varied by forage species, cropping system, and location. No-till seeding generally was more successful in southcentral Alaska, presence of a companion crop reduced bromegrass and timothy yields, and nurse crop yields were lower in no-till versus tilled situations. Overall, no-till established forages did not fare as well as those seeded into tilled soils.

Impact: Wind and water erosion can significantly impact soil conditions in the Delta Junction agricultural region and has resulted in over 25,000 acres of farmland being qualified for the federal Conservation Reserve Program. Our results would support minimum or no-till land preparation for small grain production to minimize soil loss and improve moisture holding capacity in this drought prone area. Similarly, no-till establishment of perennial forages is clearly a superior conservation practice, but at a significant cost in production in interior Alaska and less so in southcentral.

Source of Federal Funds: Hatch General funds

Scope of Impact: Alaska Specific

Dairy Waste Management at Northern Latitudes

Anticipated regulatory guidelines for Confined Animal Feeding Operations (CAPO) and land application of dairy wastes has prompted field trials to assist in development of best management practice for optimizing waste nutrient utilization by dairy feed crops while

protecting surface and ground waters. Liquid manure application rates, methods, and time of application to oats and bromegrass were compared with conventional application of chemical fertilizers.

Accomplishments: We demonstrated that application rates as high as 20,000 gal/A of liquid manure (200 lb N/A) could be sustained on grassland without significant nitrate movement beyond six inches soil depth. However, nitrate leaching beyond 6 inches was detected under conventionally cropped oats. Runoff and potential down slope movement was noted with broadcast applications under both cropping systems. This was manageable by reducing application rate and by injection application. Spring broadcast application yielded slightly more DM yield of bromegrass than injected while fall injected significantly outyielded fall broadcast application. Overall, spring application produced the highest DM yield and the greatest N recovery efficiency.

Impacts: Results from this project will directly impact the dairy industry by establishing local guidelines for CAFO through collaboration with USDA-NRCS and CES. Sustainability of the dairy industry in Alaska will depend in some part on waste management practices that protect surface and ground water supplies and recycle nutrients to produce quality feeds on-farm. This research demonstrates optimum application rates and methods for sustainable use of dairy waste. Outreach efforts supported by this project have provided producers with dairy herd management expertise from outside the state and an opportunity for the formation of the Alaska Dairy Association.

Source of Federal Funds: USDA-CSREES Special Grants

Scope of Impact: Alaska Specific

Key Theme: Forest Protection

Over the past 12 years, SALRM/AFES has seen faculty numbers erode from 32 in 1990 to 22 in 2001. This was precipitated by state budget reductions some years and flat budget the other years. In 2001, through a competitive initiative process within the university SALRM/AFES acquired three new faculty positions in Forest Science (Forest Health and Protection and Forest Measurements) and Outdoor Recreation. These projects will be reported on more fully next year.

Satellite Change Detection Techniques for Mapping Spruce Bark Beetle Infestation in Alaska

Optical remote sensing of insect damage at high latitudes suffers from three problems: 1) Cloud cover due to long daily periods of evapotranspiration, 2) cloud shadow due to relatively low solar radiation, and 3) Variable dust and smoke due to glacial and wildfire disturbances. Radar remote sensing does not utilize solar radiation, therefore does not suffer from these problems. In theory, short band may be useful to detect changes in

canopy structure resulting from defoliation and changes in water status due to bark beetle infestation.

Accomplishments: (**ALK-99-02**) To test the potential of radar remote sensing, AFES researchers acquired RADARSAT and ERS-1 images for the periods of pre- and post-spring leaf flush. Despite its theoretical advantages, there was no consistent trend in backscatter in any radar sensor or forest type (spruce or broadleaf forest). Potential confounding factors that may influence backscatter include freeze/thaw conditions and standing water/ice within stands. We concluded that ERS-1 and RADARSAT satellite data are not useful in monitoring insect infestation within the boreal forest.

Impact: While short-band radar remote sensing from aircraft may be useful for mapping and monitoring spruce bark beetle infestations in the boreal forest, current space-borne satellites will not improve the interpretation.

Source of Federal Funds: McIntire-Stennis formula funds

Scope of Impact: Alaska Specific

Key Theme: Forest Ecosystems and Biological Conservation and Diversity

Forest Biodiversity Resources in Alaska: Identification, Monitoring, and Strategies for Management. (ALK-95-03) Terminated April 19, 2001.

The Response of Forest Ecology and Growth to Climate Variability in Alaska: Patterns, Controls, and Strategies for Management Initiated April 20, 2001

Forest managers need specific and reliable information about the following aspects of actual or potential responses of forests to climate variability and climate change. These are: the risks to particular forest systems, the vulnerabilities of forest systems and forest management practices, opportunities to obtain market values for carbon uptake and sequestration, opportunities to promote resilience in forest stands through management practices. The overall purpose of the new project is to broaden the range of species and regions investigated for forest response to climate variation and trend, and to apply results into the context of forest management.

Accomplishments: (**ALK-01-08**) Forest researchers have been evaluating a reference stand of white spruce seedlings in the 1983 Rosie Creek burn area since 1989. In 2000, a late spring and cool wet summer contributed to the best growth in two decades. Continued excellent growth in 2001 due to lack of extreme heat and well timed rains during the summer. This further supports the conclusion that that moisture stress is the limiting factor in the establishment and early growth of white spruce seedlings. Strong summer warming in the last two decades with no concurrent increase in precipitation has disproportionately reduced the growth of the trees that sustained the highest growth rate.

We have found that even the largely suppressed 2nd and 3rd seed crops after a fire will retain the potential to become a pert of the emerging canopy. One outcome from the recently terminated 5-year McIntire-Stennis project was a mathematical model developed from over 50 years of continuous ring-width measurements. This model explained over one-third of the variability in an experimental black spruce stand. Some models of global carbon balance assume that the boreal forest would store a major share of carbon dioxide added to the atmosphere by human activity through increased tree growth in response to climate warming. Our results suggest that drought may represent an important limit to carbon storage.

Impact: Alaska is the ideal place to understand the effects of global climate change on forest productivity. Alaska has warmed substantially during the 20th century, especially so in the last three decades. This project has demonstrated that a substantial portion of the year-to-year variation in tree growth can be explained by Alaska's highly variable climate. The models we have developed has enabled us to make approximations of overall forest growth cheaply and easily from annual climate data. Using these models, we will assess carbon storage by northern forests in past, present and future scenarios and substantiate carbon credits for international exchange or sale.

Source of Federal Funds: McIntire-Stennis and NSF Funds

Scope of Impact: Alaska Specific

Key Theme: Forest Management and Harvest

Stream Temperature Response to Timber Harvest Activities in Interior Alaska

One argument that surfaces in all discussions related to the advisability of timber harvest in Alaska forests is impact of these activities on streams and the biology of the streams inhabitants. AFES researchers are investigating both direct and indirect effects of timber harvest on stream temperature regime. In particular, do ice bridges constructed for timber harvest increase ice thickness to the point of negatively affecting fish or fish habitat? An additional concern is how downstream summer water temperatures vary with distance and local buffering by riparian vegetation.

Accomplishments: (**ALK-99-06**) We have completed a review of historic ice-thickness measurements for Alaska streams and rivers. A layered model to account for ice thickness changes associated with either buildup of ice bridge surfaces with the removal or compaction of snow was completed in 2001. We found that ice thickness is enhanced by ice bridge construction which is one objective of such construction. Our results indicate that effects of stream-side timber harvest on stream temperature is limited in interior Alaska by low sun angles, cold water temperatures and mixing effects downstream from areas affected by timber harvest. These results also indicate that areas of upwelling along salmon spawning streams are not good sites for bridge construction. Portions of our results have been published *In:* Martha Welbourn (ed.). 2000. Region III

Forest Resources & Practices Riparian Management Annotated Bibliography. A Report to the Alaska Board of Forestry. AK DNR Div of Forestry pp.103-126.

Impact: Results from this project has been reported to local land and forest managers through the Science and Technology Review Committee appointed to help review riparian standards under the Alaska Forest Practices Act. This research has resulted in proposed changes in the Forest Practice guidelines that will continue to allow sound timber harvests in winter and protect valuable salmon stream habitat.

Moisture Dynamics in Forest Organic Mat

In the Alaska Interior ground fuels, primarily feathermosses, are a predominant fire carrier. The moisture content of ground fuels determine the ignition probability and depth of burn and is well correlated with the fire danger rating. We are We are evaluating and testing new field moisture probes and correlating physical characteristics of the mat layer such as bulk density and water holding capacity to establish drying rates for calibration of the probes for local use and incorporate local data into the Canadian Fire Weather Index (FWI) which is currently used in Alaska. The current FWI tends to underestimate fire behavior and fire severity often with serious consequences. The Alaska Fire Service is continuing to monitor and test the moisture probes within their current network of remote automated weather stations. With calibration data provided by our work we will hopefully result in an automated system for measuring fuel moisture and fire danger index throughout the state.

Impact: Results of this ongoing research has been communicated to the U.S Forest Service and Alaska Division of Forestry and is being incorporated into refining the Alaska FWI. This will assist in predicting potential severity of prescribed burns as well as natural fires in remote areas.

Source of Federal Funds: McIntire-Stennis Funds

Scope of Impact: Alaska Specific

Key Theme: Multi-Resources Planning and Policy

Rural Communities and Public Lands in the West: Impacts and Alternatives

Alaska participated in writing the renewal proposal for the above titled multistate project (W-192). The current participant is on leave without pay with the Alaska Department of Natural Resources.

Assessing the Resource Planning Process in Alaska

Over 90 percent of Alaska's land is in public ownership and most is subject to planning projects related to conservation, preservation, and resource development. It is important to know who is doing the planning, to communicate the planning process, and to mediate

disputes related to plans involving multiple use of these public resources. This project addressed three primary objectives in 2001. These included: 1) Evaluation of means for forming a successful negotiating team, 2) Determining the effectiveness of utilizing the internet in resource management planning process and its effect on public participation, and 3) The degree to which the use of maps and other visuals are effective in the dispute mediation process.

Accomplishments: (**ALK-98-05**) A literature review of criteria for effectiveness in resources planning and environmental dispute resolution was completed in 2000. In 2001 we published a manuscript that described essential factors necessary in forming an effective negotiating team as well as a hard copy and web version of the Alaska Planning Directory. We also applied internet tools to actual planning cases to evaluate effects on citizen participation. One important finding was that interactive websites are much more effective than passive ones.

Source of Federal Funds: Hatch Funds

Scope of Impact: Alaska Specific

GOAL 5: Enhance Economic Opportunity and Quality of Life for Americans

Program 3. Pursuit of economic opportunities for citizens and communities in diverse geographic locations.

Overview:

Alaska residents live in such diverse communities as urban Anchorage, suburban residential towns, and rural communities and villages. The latter are often outside the road/rail system and are dependent to some extent on resource use for subsistence and resource development for economic opportunity. Alaskans need assistance in removing barriers that limit their success and enhance their economic wellbeing. Research, extension, and education opportunities provided by the School of Agriculture and Land Resources Management, the Agricultural and Forestry Experiment Station, and the Cooperative Extension Service play an important role in consideration of specific economic development project and marketing strategies.

Specialized economic models such as IMPLAN and others were adapted to Alaskan cultural environments. These models are useful in generating economic profiles that enable community leaders to assess the direction they want to pursue in terms of resource development.

With the termination of the Hatch project, “Regional Economic Modelling for Rural Alaska”, AFES resource economists have completed four major regional economic models. 1) Net benefits from the Kenai Peninsula ocean sport fishing industry and

effects of changing economic profile from commercial fishing to tourism, 2) The Katchemak Bay watershed economic model points to the evolution from a resource production base to a service based economy, 3) Seward Peninsula reindeer production and effects of out-migration of deer on the local economy, and 4) regional economic model of the Norton Sound commercial red king crab industry.

Another industry involving primarily Alaska Natives is knitted products using qiviut, a muskox hair product. AFES scientists in cooperation with biologists from the Institute of Arctic Biology are investigating reasons and solutions for the lack of growth for the industry despite increased demands for qiviut products as well as muskox meat.

Two additional regional non-cash economic models on four villages in the Lower Yukon-Koyukuk district and subsistence Bowhead whaling in the North Slope Borough were initiated but not completed due to withdrawal of participation by the communities targeted. While unfortunate, the completion of the successful projects continue to address economic efficiency within the confines of cultural and community integrity, sustaining traditional uses and practices, fairness to user groups, and community growth.

Expenditures:

29

Hatch Multistate: None

McIntire-Stennis: None

57

.9

PLANNED PROGRAMS

Key Theme: Development of Regional Economic Models for Rural Alaska

Regional Economic Modeling for Rural Alaska Terminated 9/30/01
Impact Analysis for Alaska Natural Resources Beginning Dec 11, 2001

This Hatch project was conceived as an effort to examine how this critical information could be provided in an Alaskan setting. Furthermore, the project scope widened over its research life as the complexities and subtleties of Alaska natural resources allocation

issues became evident. Accomplishments for the recently terminated project are listed below.

Accomplishments: (**ALK-96-03, WCC 109**) We examined the theoretical framework for modeling the regional economies of four villages in the Lower Yukon-Koyukuk Census District of Alaska. We determined that, at this time, we could not get sufficient information to develop a regional model that incorporated both the cash and non-cash (subsistence) sectors. Community profiles; however, were developed. This outcome, the inability to obtain necessary data for development of a regional model that included a non-cash sector, also occurred on a second project, a Regional Economic Impact Analysis of Subsistence Bowhead Whaling. As with the Lower Yukon-Koyukuk study, the intent was to develop a model that integrated the cash and non-cash sectors. However, despite initial assurances of cooperation by key stakeholders, we discovered that there would be considerable community opposition to study participation. However, as part of this project, three regional economic models for rural Alaska were successfully completed. A regional economic of the Norton Sound commercial red king crab industry was developed. A second regional model was constructed for the eastern Cook Inlet area communities of Kenai, Soldotna, Ninilchik, Anchor Point and Homer. The ocean sport fishing industries (halibut and king salmon) were modeled and included as separate sectors in the model. Finally, a regional economic model of the Kachemak Bay watershed was completed. A study of proposed more restrictive pot limit regulations in the Bristol Bay red king crab fishery focused on the potential effect of regulatory changes to the various resource user groups. Of particular interest and impact was the differential impacts of the more capitalized segment of the industry, principally comprised of vessels from outside Alaska, versus the less capitalized fleet segment located in rural Alaska. Other outputs and outcomes include:

- FES economists are constructing a regional economic model for the Alaska reindeer industry on the Seward Peninsula to evaluate the impact of recent reindeer-caribou interaction and out-migration of reindeer on the Seward Peninsula economy. They are using the IMPLAN based model, using meat and antlers for product, and are estimating the economic loss to the reindeer industry of out-migration and deleterious effects on range conditions. This model is not complete at this time.

- Publication of journal articles (2), contract reports (2), annual reports to the Coastal Marine Institute (3), and Experiment Station Bulletin (1)

Impact: Natural resources use and allocation are central to virtually every sphere of Alaska life: social, political, cultural and economic. Natural resource managers operate within a setting where there are multiple and conflicting demands for resources. Alaska has a number of rural economies tied to natural resources in their specific regions. The use of input-output analysis and the IMPLAN model along with information/data collection, surveys, and collaboration with community and industry leaders (Reindeer Herders Association, Kenai Borough, North Slope Borough, etc.) provides the rural

leaders with economic estimates to assist them in their decision-making. It is unfortunate that two regional models had to be dropped from the overall study due to withdrawal of participation of some groups; however, with this information, natural resources managers, as well as the general public, may achieve a better understanding of the complex interactions between natural ecosystems and socio-economic institutions.

Source of Federal Funds: Hatch General, Hatch Multistate, and NOAA

Scope of Impact: Multistate and Alaska Specific

Total Expenditures (All Goals)

Hatch General:	$806,180
Hatch Multistate:	$141,593
McIntire-Stennis:	$443,742
State Matching:	$1,767,936
FTE (SY):	15.4

Stakeholder Input Process

The following actions were taken to seek stakeholder input and participation in the research planning process for projects funded by Hatch, Hatch Multistate, and McIntire-Stennis federal formula funds.

- In 2000, the SALRM/AFES Board of Advisor with the cooperation of SALRM/AFES faculty and students developed and made available on the SALRM/AFES web site, a strategic planning survey to solicit stakeholder input from all Alaska citizens including traditional stakeholders and underserved populations. The results of that survey were published as an Experiment Station Bulletin.

- An abbreviated version of the input survey was made available in hard copy at various stakeholder-attended meetings around the state in 2000 and 2001. These meetings were attended by the Director of the Agricultural and Forestry Experiment Station and other representatives of AFES to answer questions as well as to collect written comments and recommendations. These included:

  1) Farm Bureau Annual Meeting November 16, 2000 (Attendance ~ 55)
  2) The Agricultural Symposium November 17-18, 2000 (Attendance ~140)
  [These were advertised in the Anchorage Daily News on 11/5/00 and 11/11/00 inviting all citizens to participate at the meetings or to utilize

the survey on the SALRM/AFES web page. These advertisements are on file]

3) Greenhouse and Nursery Conference February 22-23, 2001 (Attendance ~85)

4) Potato and Vegetable Growers Conference March 7-8, 2001 (Attendance ~ 90)

- In 2001, results of the surveys are presented to the SALRM/AFES Board of Advisors for use in their program assessment and recommendation process. Board of Advisors meetings were held March 29-30, 2001 and October 25-26, 2001. The participation of the B of A in the stakeholder input process included gaining input from stakeholders that individual B of A members represented.

- To assist us in developing a new strategic plan for SALRM/AFES, we hosted the Expert Advisors Meeting for Strategic Plan Development in March 2001 at the Captain Cook Hotel in Anchorage, Alaska (minutes of meeting and participants are on file). Leaders from private industry, environmental organizations, and state and federal government agencies were invited and attended. The input solicited was in four basic areas:

    1. Trends: What are the major social, economic, educational, and intellectual trends that you see in your particular area that should incorporated into an academic program such as our?
    2. Skills: What skills are needed by a person performing professional work in the natural resources field?
    3. Priorities: What research priorities would you recommend for the Agricultural and Forestry Experiment Station?
    4. Alaska Application: How do overall trends, issues, and needs apply in an Alaska context.

This input was presented to our Board of Advisors at their March 30, 2001 meeting and a summary provided to the participants of the planning group.

The University of Alaska Fairbanks and SALRM/AFES underwent successful accreditation review by the Northwest Association of Schools and Colleges Commission on Colleges in 2001. Information provided by the stakeholder input process served as a primary source of information for our accreditation document.

Results of stakeholder input processes are presented to SALRM/AFES faculty annually. The outcome of the Expert Advisory session and a summary of AREERA requirements were presented at a faculty retreat in February 2002 for the purpose of developing a new Strategic Plan for the School. The outcome of this process will be reported in next years report.

Program Review Process

All new and revised Hatch General and McIntire-Stennis project proposals within the Agricultural and Forestry Experiment Station undergo scientific peer review using Hatch and McIntire-Stennis Administrative Manual's Appendix F "Essentials of a Project Proposal". All proposals are submitted to the Director of the Agricultural and Forestry Experiment Station. The peer review panel will be composed of a minimum of three members and are appointed by the Director. The panel consists of competent authorities in the discipline of the proposal or related disciplines and will include at least one authority from a supporting discipline. Each reviewer completes a Peer Review Form consisting of specific criteria, provides other comments and suggestions, and makes a recommendation to the Director. Reviews are returned to the Director for transmittal to the author(s) of the proposal. The author(s) review all comments and recommendations of the reviewers and make adjustments or explanations. The Director reviews all comments and recommendations from the reviewers as well as the revised proposal. The signature of the Director on Form AD 416 submitted to USDA-CSREES will indicate approval of the project by the Director and will certify that the proposal has been recommended by a majority of the Peer Review Panel.

Scientific peer review of multistate projects are carried out for individual projects under the aegis of the Western Association of Agricultural Experiment Station Directors' and the Western Cooperative Extension's Regional Coordinating and Implementation Committee (RCIC). The specific review process can be found under Appendix C of the Supplementary Guidelines for Western Multistate Research and Integrated Research/Extension/Teaching " Peer Review Guidelines: Performance Standards and Operational Guidelines for State Agricultural Experiment Stations". This can be found on-line at http://www.colostate.edu/Orgs/WAAESD. Additional access to the multistate review process is available on the NIMSS website (http://www.lgu.umd.edu) established by SAES Directors.

Evaluation of the Success of Multi and Joint Activities

Alaska participates in the following multistate research and coordinating committees:

W-147: Managing Plant-Microbe Interactions in Soil to Promote Sustainable Agriculture
W-112: Reproductive Performance in Domestic Ruminants
4-NRSP/IR4: A National Agricultural Program to Clear Pest Control Agents for Minor Uses.
NCR –101: Controlled Environment Technology and Uses
WCC-021: Revegetation and Stabilization of Deteriorated and Altered Lands
WCC-093: Western Region Soil Survey and Inventory
WCC-103: Soil, Water, and Plant Analysis for Improved Nutrient Management and Water Quality
WCC-109: Seafood Marketing and the Management of Marine and Aquacultural Resources

Stakeholder inputs have questioned the importance of multistate research to Alaska's needs. Specifically they point out the relative development of Alaska agriculture compared to most western states. Unlike other small population states in the west such as Wyoming, we have no nearby markets in other more populated states. This coupled with extreme differences in environmental and economic climate found in other states has been a factor in Alaska's limited participation in multistate research. Many of the multistate technical committees do not address the range of research our faculty is pursuing. Exceptions include W-112 and W-147. However, the relative isolation of our faculty would argue for more collaboration with scientists from other regions. A clear example is our controlled environment horticulturist. Through involvement in NCR-101, she has developed collaborative projects with Cornell University and University of Minnesota which has led to funding opportunities that were not previously available to her. We will encourage our scientists, particularly young faculty to pursue these opportunities.

Our efforts to encourage multistate involvement, we hosted two multistate technical committee annual meetings in Alaska in 2001. They included:

W-112 "Reproductive Performance in Domestic Ruminants" June 7-8, 2001 in Fairbanks, AK.

W-147 "Managing Plant-Microbe Interaction in Soils to Promote Sustainable Agriculture" December 7-8, 2001 Fairbanks, AK.

Diversified livestock interest in our state has brought pressure on our animal scientist to broaden his program to include species that may not be of interest at lower latitudes (i.e. reindeer and muskox). However, our contributions will continue to focus on W-112 objective 2) **Improve reproductive efficiency through development of technologies and systems to control estrous activities, conception, and fetal/neonatal survival.**

Activities within W-112 address specific reproductive problems that exist in Alaska.

- Alaska is participating with **ID**, **WY**, and **TX** to study detection of interferon induced genes during the post-breeding period in reindeer, muskox, and elk.
- With **TX** to develop infrared system to investigate antler growth and quality in reindeer and elk.
- With **NM** to examine thyroid hormones in muskox at the onset of the breeding system
- With **OH** to develop estrous synchronization protocols for muskox.
- With **TX** to determine the relationship between IGF-1, calving, and antler casting and regrowth in female reindeer and caribou.
- With **WY** to develop estradiol and progesterone assays in muskox and reindeer plasma

As producers begin to see direct results from multistate activities and have access to research finding from other states, we feel they will come around to acknowledge the

importance of multistate participation by our scientists. Among the underserved populations that may benefit from multistate research are the Alaska Native reindeer herders in remote villages. One study being performed under the aegis of W-112 is related to the reindeer cow estrous activity and the impact of presence of male reindeer in that cycle. Research of this type is unique to this region and would not have been initiated without our participation in W-112. This program is also an Integrated Activity with Cooperative Extension. The member scientist has a split appointment with Cooperative Extension and through Integrated Multistate involvement he brings back information that is disseminated in one-on-one contacts as well as sharing the information with CES agents throughout Alaska. The Alternative Livestock Producers Conference held in October of 2000 was attended by over 50 attendees targeted the educational needs of producers. This feedback will invaluable to continued participation in W-112.

Participation in W-147 has been appropriate. The P.I. and research associate involved have developed a state-of-the-art biotechnology laboratory capable of the investigation of biological control of diseases that affect Alaska crops as well as crops in **CA, NM, AZ,** and **MT**. Through involvement with W-147, resources and knowledge from multistate and multidisciplinary colleagues, Alaska has benefited many-fold over working alone and the multiplying factor continues to increase with every year of participation.
Contrary to stakeholder concerns, Alaska's relative isolation argues in favor of participation in multistate research. Our faculty can benefit greatly from collaborative efforts with scientists from other states. Literature review is important to guard against "reinventing the wheel"; however, the value of meeting face-to-face and participating in discussion of common research goals cannot be overemphasized.

With that in mind, Alaska added an additional participant to the W-147 technical committee in 2001 that will assist in development and implementation of economic biocontrol systems to achieve sustainable agriculture. Additionally, in 2001, we will add a participant to W-192 " Rural Communities and Public Lands in the West: Impacts and Alternatives". That individual will address legal aspects of public lands issues and helped write the renewal proposal for the next 5-year cycle.
Participation in coordinating committees will continue at the present level and involve at least one multistate integrated activity with WCC-103.

Integrated Research and Extension Activities

Alaska submitted Form CSREES-Waiver requesting a waiver for FY2000 Integrated Activities from Hatch Act Funds. CSREES granted the waiver and approved our projected Integrated Activities for the 2001-2004. The form CSREES-REPT reporting Integrated Activities for 2001 is included here.

The projections for Integrated Activities for 2001-2004 were based on the Supplement to the Plan of Work submitted to CSREES July 28, 2000. Despite the waiver, we moved ahead with Integrated Activities involving AFES researchers and support staff and CES specialists and agents; an evaluation and brief synopsis of those activities for FY2000 are summarized below:

The SALRM/AFES Palmer Research Center in southcentral Alaska became the Palmer Research and Extension Center in 2001. In addition to housing two split AFES/CES faculty positions in horticulture and agronomy, the Center also provided office facilities for the CES water quality program and the Fisheries and Natural Resources specialist. This is but one example of increased collaboration among research, teaching and extension faculty. Our goal is to increase Integrated Activities to the AREERA target percentage.

Agronomic Crops and Soils

Integrated activities centered around best management practices for production of livestock feed crops, primarily forages and small grains as well as investigating new crop opportunities. AFES researchers and CES specialists and agents continued collaborative work at Delta Junction, Point McKenzie, and the Kenai Peninsula. The extension agronomy specialist (75% CES and 25% AFES) cooperated with AFES researchers as co-P.I. on three USDA-funded projects ("Production and Harvest of Quality Forage Products at Northern Latitudes", Hatch funded; "No-Till Forage Establishment to Improve Soil and Water Conservation", SARE funded; and "Dairy Research at Northern Latitudes", USDA Special Grant). We evaluated new and traditional grass and legume forages for yield, quality, and adaptability to climatic conditions in interior and southcentral Alaska, tillage practices for forage establishment, optimum soil management for soil chemical and physical health and quality. Details of this research are summarized under the appropriate Key Theme. Both AFES researchers and CES specialist and agents disseminated products of this applied research at workshops and the annual Delta Farm Forum and Agriculture Symposium. Additionally, CES and AFES jointly sponsored a Forage Workshop in March of 2002 attended by 77 producers and agency personnel.

Potato and Vegetable Crops

AFES researchers and CES counterparts carried out applied research, demonstration, and outreach activities primarily related to variety selection, disease control and management, and weed control. Much of this work is conducted in, but not limited to, southcentral Alaska where approximately 78% of the statewide value of production of potatoes and vegetables reside. Two horticulture/plant pathology researchers at the Palmer Research Center working closely with CES agents in Palmer, Anchorage, Soldotna, Fairbanks, and Delta Junction provide the core for this working group. Our new horticulture researcher has developed a Hatch project "Cultivar Selection, Production Methods, and Market Quality of Vegetables in Alaska" that was recently approved by CSREES. That position carries a 25% CES appointment and is performing applied research and on-farm demonstration for wide range of vegetable crops both traditional and new crop opportunities including specialty greens. This information is presented annually to CES/AFES jointly sponsored workshops. Other AFES/CES collaborative work included potato late blight monitoring and treatment which assisted in controlling an outbreak in 1998 to blight-free fields in 2000 and 2001. Expensive fungicide treatments in 1998 and 1999 progressed to no treatments required in 2000 or 2001 due in large part to the

monitoring program. Outreach included a joint AFES/CES publication on late blight control and presentation of research results at the joint CES/AFES Potato Growers Conference and Vegetable Growers Conference.

Greenhouse Management/Nursery

Collaborative work continued in the greenhouse/nursery production of cut flowers, bedding plants, ornamentals, and other landscaping plants. Research and outreach continued to address physiological response to light, day length, and temperature in controlled environments for species that included cyclamen, dwarf carnations, forget-me-nots, and selected food crops including raspberries. Research and demonstration efforts at the Georgeson Botanical Gardens evaluated woody perennials, herbaceous perennials, annual flowers, herbs and vegetables for survival and productivity at northern latitudes. The latter had a high degree of volunteer and extension involvement. Outreach efforts have included one-on-one contacts with growers and the public, presentations at CES workshops, master gardener program, and the annual CES/AFES Alaska Greenhouse and Nursery Conference (i.e. "Greenhouse Flower Production for Local Markets"), and lay publications including "Annual Flower Plant Evaluations", "Georgeson Botanical Garden Review", "Alaska Spinach, Savory, Succulent, Salad Selection" to name a few.

Reindeer Production

Alaska native reindeer herders have managed herds totaling over 30,000 deer. Those numbers have dropped significantly in recent years from out-migration of deer joining migratory caribou. AFES scientists continued to carry out a number of research and demonstration projects in cooperation with the CES reindeer agent on the Seward Peninsula (due to funding shortfalls, CES has split the land resource agent's appointment between the Seward Peninsula and Palmer). Current projects range from reproduction and disease management to range management and reindeer nutrition. The Extension reindeer agent is acting as the liaison between the researchers, agencies (i.e. NRCS, AFG, and BIA), and the herders themselves and facilitates annual meetings and workshops.

Animal Reproduction

The research animal scientist/livestock split position (CES, 51%; AFES, 49%) addressed reproductive performance of ruminant animals under the aegis of multistate research (W-112) which addresses both traditional and alternative animal species. Research and demonstration collaboration included silent ovulation detection in dairy cows, reindeer bull management effects on reproductive physiology of reindeer cows, and estrus synchronization in dairy and beef. Most of this research was on-farm, directly involving the local extension agents and the producers. Outreach activities included one-on-one contacts with producers, workshop presentations at the Delta Farm Forum, the Agricultural Symposium, and the development and hosting of the Alternative Livestock Conference. This relatively new project should prove to be the cornerstone of our Integrated Activities with Cooperative Extension. It encompasses all the desirable elements of a multistate, integrated research and extension activities.

Forest Production/Protection

Alaska Cooperative Extension Service has a single Forestry Specialist who works cooperatively with AFES researchers both in applied research, demonstration, and dissemination of information on issues related to growth and yield.

Community and Rural Development

AFES resource planning researcher cooperated with CES land resource specialists and are developing a database of planning cases in Alaska. A literature review of criteria for effectiveness in resources planning and environmental dispute resolution was completed.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution University of Alaska Fairbanks
State Alaska

Check one: ___ **Multistate Extension Activities**
_X_ **Integrated Activities (Hatch Act Funds)**
___ **Integrated Activities (Smith-Lever Act Funds)**

	Actual Expenditures				
Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Agronomic Crops and Soils	Waived	8,953			
Potato and Vegetable Crops	Waived	13,459			
Greenhouse Management / Nursery	Waived	2,404			
Reindeer Production	Waived	616			
Animal Reproduction	Waived	2,718			
Soil Quality/Nutrient Management	Waived	2,484			
Community and Rural Development	Waived	324			
Forest Production/Protection	Waived	361			
Other Integrated Programs	Waived	5,106			
Total		36,425			

Director 3/12/02 Date

Form CSREES-REPT (2/00)

Appendix C

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution University of Alaska Fairbanks
State Alaska

Check one: ____ **Multistate Extension Activities**
✓ **Integrated Activities (Hatch Act Funds)**
____ **Integrated Activities (Smith-Lever Act Funds)**

Title of Planned Program/Activity	Actual Expenditures FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Agronomic Crops and Soils	Waived	9,967	11,360	12,780	14,200
Potato and Vegetable Crops	Waived	6,895	7,858	8,840	9,822
Greenhouse Management/Nursery	Waived	2,491	2,839	3,291	3,549
Reindeer Production	Waived	792	904	1,017	1,130
Animal Reproduction	Waived	4,752	5,416	6,093	6,770
Soil Quality/Nutrient Management	Waived	2,067	2,356	2,650	2,944
Community and Rural Development	Waived	345	393	442	491
Forest Production/Protection	Waived	482	549	618	687
Other Integrated Programs	Waived	5,486	6,253	7,035	7,817
Total		33,277	37,928	42,669	47,410

Pre-Waiver for FY2000 was requested and granted
(See Attached)

G. Allen Mitchell
Director

2/26/01
Date

Form CSREES-REPT (2/00)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Establishment of Target Percentages
for Multistate Extension Activities and Integrated Activities

Institution University of Alaska Fairbanks
State Alaska

Check one: ___ **Multistate Extension Activities**
_X_ **Integrated Activities (Hatch Act Funds)**
___ **Integrated Activities (Smith-Lever Act Funds)**

Options for Determining Target Percentages (Circle one)

A. **25 Percent (Submission of Form CSREES-BASE is waived).**

B. **Target Percentage of** _____ **(two times the Preliminary Baseline Percentage of** _____**).**

C. **(Option only available if higher than option B and less than 25 percent.)**

Target Percentage of _____ **for FY 2000 and thereafter.**

(**D.**) **(Option only available if higher than option B and less than 25 percent.)**

Target Percentage for FY 2000 and thereafter phase-in:

FY 2000	Waiver Requested
FY 2001	3.5
FY 2002 and thereafter	4:0, 4.5, 5.0

S. M. Rittel
Director

7/28/00
Date

Form CSREES-TARG (2/00)

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Establishment of Fiscal Year (FY) 1997 Baselines
for Multistate Extension Activities and Integrated Activities
Summary of FY 1997 Planned Programs/Activities and Expenditures

Institution University of Alaska Fairbanks
State Alaska

Check one: ____ Multistate Extension Activities
X Integrated Activities (Hatch Act Funds)
____ Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Total FY 1997 Expenditures
Current accounting system does not allow us to obtain an auditable FY1997 baseline	
Total	

Total FY 1997 Funds Allocated
(Provided by CSREES)

Preliminary Baseline Percentage

Director

7/28/00
Date

Form CSREES-BASE (2/00)