

**AREERA PLAN OF WORK**  
**ANNUAL REPORT OF ACCOMPLISHMENTS**  
**AND RESULTS**

**Agricultural and Forestry Experiment Station**  
**University of Alaska Fairbanks**

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Extension, and Education Service

**Certified by:** \_\_\_\_\_  
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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) performs research in plant, animal, and soil sciences, forest science, and natural resources management that assists in ensuring economic and environmental sustainability and protection of living systems. SALRM/AFES generates and disseminates knowledge to stakeholders who include students of higher education and resource users 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 on our stakeholders.

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. Export markets, which are relatively small at present, consist of reindeer meat and antler, grass seed, seed potatoes, and forest products, primarily raw logs.

Research in support of the producers of vegetables, potatoes, and other field crops continues to focus on variety selection, disease resistance, and adaptability to northern environments. Potato cultivar evaluation of new lines from the Sturgeon Bay Germplasm Bank have identified potential new cultivars with resistance to Alaska-specific diseases. A Siberian variety “Kamerovskii” has shown excellent production in comparisons with conventional high-yielding varieties. On-going lettuce research to combat tip burn and head size problems and utilizing germplasm resources of Harris-Moran Inc. and public breeding sources has identified variety and other production inputs that have impacted cash receipts for potato and vegetable production. Cash receipts for all potato and vegetable production has increased from \$6.1 million in 1996 to \$8.8 million in 1999. Research results are disseminated at Experiment Station and Cooperative Extension Service co-sponsored Potato and Vegetable Growers Conference attended by approximately 60 to 70 percent of potato and vegetable growers statewide. Integrated Activities with Extension included a potato late blight monitoring and treatment projects partially funded by Hatch, Extension Pest Management, and state matching funds along with a Natural Resources Grant from the University of Alaska’s President’s Office. The success of the late blight project brought the potato producers from the brink of serious

devastation to complete control with essentially no use of pesticides in 2000. Additional efforts in Integrated Activities with Cooperative Extension are underway in FY2001 with the approval of the new Hatch project “Cultivar Selection, Production Methods, and Market Quality of Vegetables in Alaska”. The P.I. for this project will have a 75% research and 25% extension appointment.

Other successes came in the area of livestock feed production and utilization of in-state energy and protein sources. AFES scientists released a new feed barley variety, ‘Finaska’. This variety originated from a cross of Jo1632/Jo1599 parents from the Plant Breeding Institute in Jokoinen, Finland. It is an early maturing, lodging resistant spring barley with excellent feed quality.

Greenhouse and nursery production account for over 50 % of the cash value of Alaska agriculture. Research to determine light and other controlled environment requirements for greenhouse flower production and resulting recommendations through published articles and extension workshops receive priority. 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. Our greenhouse researcher is a participant in the Northcentral Multistate Coordinating Committee NCR 101 “Controlled Environment Technology and Uses”.

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. Forestry research quantifies timber productivity of the northern forest lands and provides resource managers with appropriate information for timber management decisions and stand prescriptions. One tangible outcome has been the efforts of Alaska Forest Refinery Inc. to pursue financing to construct a wood refinery for ethanol production possibly employing up to 125 people in the Tok area.

Finally, the relatively new animal science project “Reproductive Performance in Domestic Ruminants” addresses both the requirements for Multistate Research and Integrated Activities. Though new, accomplishments for this project are the results of collaborative efforts of multistate research (W-112), integrated activities with Cooperative Extension and stakeholders from the Alaska animal industry. Both dairy production and beef and reindeer numbers are down significantly and on-farm applied research and outreach activities of this project has captured the attention of livestock and dairy producers in Alaska.

**Expenditures:**

Hatch General:                   \$552,787

Hatch Multistate:               \$163,889

McIntire-Stennis:	\$48,500
State Match:	\$1,173,370
Total FTE (SY):	6.4

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## **PLANNED PROGRAMS**

### **Key Theme: Horticultural and Agronomic Crop Production**

#### **Potato and Vegetable Crops**

Accomplishments: (ALK-95-07, NRSP-4) Alaska Agricultural Experiment Station horticulturists continued field and laboratory research on evaluation of production practices, cultivars, and diseases of potato and vegetables. Resistance to bacterial, fungal, and viral diseases in potatoes was addressed through comprehensive cultivar evaluations. Relatively basic research on the taxonomy of pathogenic fungus *Rhizoctonia* in concert with cooperating labs in other states and countries has discovered new disease causing groups, the understanding of which will result in better disease control methodologies. One hundred and eighty potato lines from the Sturgeon Bay Potato Germplasm Bank were screened for resistance to Black Scurf disease and cultivars have been identified with moderate resistance and will be further tested. Variety trials of 32 commercial varieties under irrigation identified Lemhi Russet (20 ton/A), Green Mountain (19.6 ton/A), and Chieftain (19.4 ton/A) as top producers of table stock. A promising Siberian variety 'Kamerovskii' yielded 18.9 ton/A and along with other Russian varieties will be further evaluated in 2001. Andover was the best producer among eight chipping varieties. Applied research and demonstration to enhance vegetable production included continuation of on-farm lettuce variety trials for head size, tip burn, and marketability. Each year, new varieties of iceberg head lettuce are added and compared in grower fields with current varieties. Additionally, 84 lettuce varieties and breeding lines provided by Harris-Moran Co. continue to be evaluated in producer fields for disease and tipburn resistance. Other research included weed control in transplanted vegetables using metam sodium, effect of packing on potato tuber greening, and evaluation of Russet Norkotah potatoes from different seed sources. A combination Experiment Station/Cooperative Extension late blight treatment and monitoring project initiated in 1998 following an outbreak of the disease (first major outbreak in the state) has successfully maintained a blight-free potato crop in 1999 and 2000.

Impact: Results from applied studies are presented each year to the joint SAES/CES sponsored Potato and Vegetable Growers Conference to 60 to 70 percent of the statewide potato and vegetable growers. 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. The value of production over that same period has increased over 50 percent for potatoes and 35 percent for lettuce. The success of the late blight treatment and monitoring project has brought the

industry from the brink of serious devastation to complete control with essentially no use of pesticide in 2000.

Source of Federal Funds: Hatch General

Scope of Impacts: Alaska Specific

[The vacant Horticulture research/extension position listed in the 2000 Plan of Work has been filled and a Hatch project entitled “ Cultivar selection, production methods, and market quality of vegetables in Alaska” (**ALK-01-02**) has been submitted for approval by CSREES. This project will be included under Integrated Activities in the 2001 accomplishment report].

#### Forage Crops for Northern Latitudes

Forage research in interior and southcentral Alaska centered on legumes and grasses for dairy, commercial, livestock, and hay production. Based on needs expressed by dairy and forage producers, trials involving grasses and legumes produced at similar latitudes, no-till establishment, companion cropping systems have been conducted at multiple locations to evaluate cold-hardiness, forage quality, and sustainable production practices.

Accomplishments: (**ALK-95-06, ALK-98-06, ALK-92-01**) High quality forage for dairy cattle, beef cattle, and alternative livestock nutrition remains a high priority. Of particular interest are grass and legume varieties grown at similar latitudes. Forage research in interior and southcentral Alaska included perennial grasses and legumes and grass/legume mixes have been established conventionally and no-till. In southcentral dairy regions, timothy, brome, and reed canary grass are the leading grass species (3.5 to 4.0 tons/A) while red clover continues to be the top producing legume (as much as 5 tons/A dry matter) . Red clover interseeded in reed canary grass and timothy produced excellent dry matter and protein yields when good snow cover was present but legumes, in general, winterkill where snow is removed by winter winds. 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 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 feed base for domestic livestock in Alaska. Performance trials at Fairbanks, Delta Junction, and Palmer evaluated released varieties and genetic materials from circumpolar origin. These include genetic materials from the 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**) Release of 'Finaska' variety barley. This variety originated from a cross of Jol632/Jol599 parents from the Plant Breeding Institute Jokioinen, Finland and is an early maturing, lodging resistant barley with excellent feed quality. 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: Greenhouse/Nursery Production**

##### Environmental Plant Physiology of Greenhouse Produced Crops

Efficient use of greenhouse and controlled environment facilities requires cultural techniques and recommendations to be defined. Uncovering the effects of environmental conditions on plant growth is essential to produce plants for various targeted markets.

Accomplishments: (**ALK-95-05, NCR 101-01**) Studies continue to determine environmental conditions required for improving marketability of greenhouse produce crops such as cyclamen, dwarf carnations, forget-me-nots, and selected food crops such as raspberries. Plant development of flowering cyclamen varieties was tested at a range of

temperatures and other environmental variables and predictive models developed. Recommendations are to grow 68 F until flower initiation then reducing the temperature to 60 F improves enhances cut flower quality and flower color. Research for the state flower forget-me-not demonstrated that imposing a cold period (42 F) from three to six weeks reduced time-to flower by 2 weeks. Results from a multistate project (NCR 101) with raspberries, found chilling requirement of 1000 hr. at 40 F brought on proper flowering and that imported single cane plants from **CA** and **WA** resulted in easier handling and management than for multi-cane raspberry plants.

Impacts: Research results are presented at Extension workshops, bulletins and national lay publications as well as refereed journals. Greenhouse/nursery production in Alaska accounts for over 50 % of the total value of agricultural production. Research carried out under this project provides information and hard recommendations for optimum environments for flower production to greenhouse operators not only in Alaska, but nationally.

Source of Federal Funds: Hatch General and Hatch Multistate

Scope of Impact: Multistate

[This project will terminate 3/31/01 and will be replaced with “ Innovative use of natural and supplemental light for high latitude crop production” (**ALK-00-09**)

#### Horticultural Crop Production for Alaska

Accomplishments: (**ALK-96-01**) Plant evaluations at the Georgeson Botanical Gardens included 1220 woody perennials, herbaceous perennials, annual flowers, herbs, and vegetables. *Spiraea miyabei*, Delphinium : Centurion Sky Blue, *Sorbaria sorbifolia*, Solidaster: Yellow Submarine, Veronica: Baluriesen, *Centaurea Americana*, and *Valeriana officinalis* were added to the list of adapted perennials for interior Alaska. The use of dark treatment of seedlings in the production of *Cosmos bipinnatus* increased the cumulative number of flowering stems by 40 % and earlier flowering. Continuing evaluation of vegetables identified new recommended varieties Early Dividend broccoli, Sombrero Red and Red Royale red cabbage and Dynamo green cabbage, Easter Egg and Snow Queen radishes, and Merlot and Bakita red leaf lettuce. Field cultivation of Lingonberries demonstrated that vegetative growth was inhibited by wood chip amendments but growth was improved with uncomposted fish waste.

Impact: SAES horticultural researchers maintain and publish an ongoing list of Alaska-adapted varieties of vegetables, flowers, and nursery plants. The market for these adapted varieties and other research carried out under this project include six flower seed companies, 11 grass seed and 12 seed potato producers, 12 native plant outlets, and 32 nursery stock producers. In addition, 28 fresh fruit and berry producers are currently listed in the Division of Agriculture Food and Farm Products Directory. This represents a 37 % increase in ‘niche’ market participation in the market place over the past 10 years. The cosmo/photoperiod research has lengthened the commercial production season for



field-grown cut flowers. Outreach for this program includes SAES bulletins, circulars, and the Georgeson Botanical Notes.

Source of Federal Funding: Hatch General

Scope of Impact: Alaska Specific

**Key Theme: Plant Disease Control/Biocontrol**

Managing Plant-Microbe Interactions in Soil to Promote Sustainable Agriculture

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. 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. *T. atroviride* utilizes those organisms as a food source and no fungistatic effects from the invaded pathogens were observed. *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. 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. Production of the enzyme chitinase apparently plays a role in hyperparasitism involved in the suppression of disease. Other studies evaluated *T. atroviride* in the control of grape bunch rot and gray mold (*Botrytis cineria*) in the laboratory, effects on CA grown grapes were not significant under field conditions.

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 Helpera, a commercial product containing *T. atroviride* spore suspension was found to be effective in partially controlling these diseases in cotton (damping-off) and ginseng (rusty root and early disease under small plot tests. 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: Traditional and Alternative Livestock Production**

Production and marketing of animal products in Alaska remains in the developmental stage but does contribute significant value to the state's economy. The developing nature of the livestock industry is exemplified by comparing Alaska's livestock management practices with those in the lower 48 states. For example, very few (less than 10 percent) of dairy producers use Dairy Herd Improvement testing or artificial insemination. In conjunction with the W-112 multistate technical committee the Alaska Agricultural Experiment Station and Cooperative Extension Service are making good progress with the more traditional beef and dairy industries. Additionally, we are providing some research and outreach service to the smaller but very vigorous alternative livestock industry which includes reindeer, elk, and muskox.

### Reproductive Performance in Domestic Ruminants

Accomplishments: (**ALK-00-01, W-112**) 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:

- Radiotelemetric detection of estrus and silent ovulation in dairy cows. Results show silent ovulation does occur in postpartum dairy cows but at a lower rate than previously assumed (95% vs 42%) when only visual detection was employed.
- Investigation of whether a precise correlation exists between behavioral and biological estrus and to determine if knowledge of milk E2 (estradiol) concentration could be used as a means of identifying the onset of estrous in dairy cows. Results indicated that knowledge of milk E2 is a useful tool for dairy cow AI management if on-farm E2 tests were developed.
- Investigation of reindeer bull management and its effects on reproductive physiology of reindeer cows. Reindeer cows were tested in two groups; early or late exposure to bulls. An additional variable of time of calf weaning was also included. 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.
- An investigation of different means of estrous synchronization in dairy and beef cattle using privately owned cattle on three dairy farms and one purebred beef herd and effectiveness of early pregnancy testing on three farms were initiated in 2000. No data has been summarized for these studies.

Impacts: Successful reproduction in herds of ruminant animals produced on farms in Alaska is paramount for the establishment of livestock production and economic viability

in subarctic regions. Outcomes from this research demonstrate the effectiveness of reproductive management technologies and techniques that will be used to improve reproductive efficiency on Alaska livestock farms and ranches. Identification of estrous activity early using radiotelemetry will identify for dairy farmers the real time of return to cyclicity and thus ability to conceive. On-farm estradiol testing may assist in identifying more efficiently the appropriate time for AI. For reindeer herders, bull management effects timing of breeding and thus improve reproductive success. Both dairy production and beef and reindeer numbers are down significantly and applied research and outreach activities closely tied to farm operations is critical.

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

Accomplishments: (ALK-98-07) The only commercial diet available to reindeer producers contains 66% imported feed ingredients. The objective here is to evaluate an Alaska produced diet consisting of dry-rolled barley concentrate (80%) and ground bromegrass hay (20%) fed in a confined animal management system. Outcomes were judged in terms of both reproductive success and calf weight gain. All females dropped calves and calf weight gains were comparable to free-ranging reindeer. Additional trials will investigate different diet composition.

Impact: Results indicate that reindeer will consume, gain weight and be reproductively successful on a predominately barley-based diet. In 1992, there were approximately 40,000 reindeer on Alaska's Seward Peninsula. Historically, 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. 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 loss of animals. Also there are existing, though relatively small, confined operations in the so-called railbelt. In either case, research to establish baseline nutritional information for CAFOs needs to continue.

Source of Federal Funding: Hatch General

Scope of Impact: Alaska Specific

#### Other Reindeer Research:

- 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.
- Reindeer Range. Summer range habitat was evaluated for forage species, quality, and biomass for 15 major habitat types.
  - Satellite Telemetry with Reindeer. 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.

Impacts: This research provides the only support for an economically sustainable agricultural industry wholly owned and operated by Alaska Natives and which brings in over \$1.0 million annually in meat and by-product sales. This is a major economic factor in the economy of the rural villages of the region.

### **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 and export markets in the Asian far east continue to show promise.

#### Marketing Alaska’s Agricultural and Processed Seafood Products

Accomplishments: (ALK-96-06) Untrained consumer sensory panels, laboratory analyses of physical and chemical properties of products, questionnaires addressing panelists’ attitudes, demographics including shopping patterns, general attitudes about environmental friendliness, nutrition health, and product safety were used to assess acceptability of Alaska grown products. Consumer and producer literature included vignettes of the Agricultural and Forestry Experiment Station, sensory panels, the Georgeson Botanical Garden (variety testing and demonstration garden), the state Alaska Grown Program, and other outreach efforts carried out cooperatively with the Cooperative Extension Service. Consumer sensory panels using University of Alaska students and staff, community events, general population at Fairs, and at Ag Appreciation Day event. The classroom was used to conduct sensory panels, prepare marketing strategies, and create logos for numerous agricultural products marketed under the “Alaska Grown” label. These included fresh market carrots, tomatoes, potatoes, and spinach; processed hot dogs, barley trail cakes, salsa, Pollock fillets, arrowtooth flounder fillets, and honey. Outreach and media publications and pamphlets were distributed through farmer markets, supermarkets, Cooperative Extension Offices, other state and federal agencies, and through farmers themselves.

Impact: Market share of both wholesale and retail outlets have increased and more stores are advertising Alaska Grown products. Cash receipts from Alaska Grown vegetables has increased over 50 percent since 1992 and 22 percent since 1995. In 2000, growers

contributed matching funds to assist in the advertisement of Alaska Grown products.  
Example: Alaska Grown is miles fresher!

Source of Federal Funds: Hatch General

Scope of Impact: Alaska Specific

#### Federal-State Marketing Improvement

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. This project will quantify the demand for Alaska grown fresh market and value-added potatoes and vegetables.

Accomplishments: A survey was prepared and distributed to wholesale and retail enterprises in Alaska requesting their opinions of Alaska grown vegetables relative to price, packaging, labeling, product quality, amounts purchased, preferences, and other marketing attributes. Eleven of sixteen companies responded with the following main conclusions: 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. Survey results were sent to major growers for their response and the survey results will be made available to a larger audience at the Potato and Vegetable Growers Conference in March 2001.

Impact: Farmers have been made aware of the product buyers are looking for, the prices they are willing to pay, and how to effectively promote their products to buyers. Buyers will be more aware of the availability and ability of producers to provide products, what price the farmer needs to receive for economic sustainability, and effective promotion methods of Alaska products to consumers.

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

Scope of Impact: Alaska-specific

#### **Key Theme: Forest Products**

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

The objectives of this project 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.

Accomplishments: (ALK-97-01) Forest Productivity: Experiment Station foresters completed stem analysis for poplar and aspen and continued curve fitting to establish equations and tables for use in assessment of site productivity to allow ranking for management and investment purposes. The establishment of a network of permanent sample plots (PSPs) continued for the development of growth and yield models. A total of 231 PSPs are complete and will be used to estimate fiber production potential. It was determined that in mixed stands, spruce seedlings do not fill in resulting in open stands and thus not fulfilling the stand potential. Tree Volume Study: Researchers addressed the problem of non-standard tree volume tables (buyer vs seller) for northern forest species with initial emphasis on white spruce. Results thus far show that volume equations for Tok and Fairbanks are similar, but the equations from the Delta Junction region were significantly dissimilar. Additional samples will be taken in 2001 in Delta before publishing final tables. Ethanol Production: Ethanol production from vegetative biomass has generally been addressed with corn, sugar beets, barley, and other agricultural commodities. Much of the northern forest consist of unmarketable fiber for traditional forest products as well as byproduct waste from marketable trees. This study will investigate utilization of this forest biomass for commercial ethanol production and in particular to provide estimate of fiber quantities and annual allowable cuts. Experiment Station researchers have determined an adequacy of fiber to supply 350 tons per day for refineries using the Paszner process to produce biofuel ethanol.

Impacts: Site productivity and tree volume information aimed at filling information gaps and standardizing and refining tree volume tables will provide forest managers with improved means for performing management prescriptions and making economic decisions regarding initial silvicultural treatments and adequate regeneration. One tangible outcome has been the efforts of Alaska Forest Refinery Inc. to pursue financing to construct a wood refinery for ethanol production possibly employing up to 125 in the Tok area where unemployment is a chronic problem.

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

Scope of Impact: Alaska Specific

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## **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 with less than 1 percent having undergone significant commodity production or 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, 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 since 1972. The recently terminated long-term evaluation of disturbed tundra colonization will be replaced by a new project as soon as a replacement is recruited for the retired P.I. This program will take on renewed importance with new energy development projects proposed. 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 perm-frost soils with resulting impacts on the soils moisture regimes and carbon flux and stores. In cooperation with scientists in WCC-093 “Western Region Soil Survey and Inventory, the National Cooperative Soil Survey (NCSS), the Natural Resources Conservation Service, (NRCS) we field tested the hydric soil criteria for the new Soil Taxonomy order Gelisol. The soil monitoring network on Alaska’s North Slope that was utilized also provided important soil interpretations useful to native villages and corporations of the region, oil and gas interests, mining industry, and government agencies for environmental compliance and permit processing. This work ties in with Alaska Native interest lands and provides cooperative working relationships with the native villages, BLM, and private industry. 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. 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 and is providing information that will assist small grain farmers in minimizing soil erosion and improving moisture content and general soil structure and health.

Forest science research makes up a significant percentage of federal formula funds coming to SALRM/AFES. While not specifically required by AREERA, we include research summaries and impacts for McIntire-Stennis funded projects. In many cases this research supports and augments some of 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. 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:	\$179,596
Hatch Multistate:	None
McIntire-Stennis:	\$393,916
State Matching:	\$685,354
Total FTE (SY)	7.2

**PLANNED PROGRAMS**

**Key Theme: Reclamation and revegetation of disturbed lands**

Ecosystem Management for Establishment of Woody Plants on Disturbed Lands

This project terminated 4/30/00 and was replaced by:

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

Accomplishments: (**ALK-00-02, WCC-021**) Agricultural and Forestry Experiment Station (AFES) scientist evaluated plant species and growth media for revegetation of a new mine site at Usibelli Coal Mine in interior Alaska (adjacent to Denali National Park). Norcoast Bering hairgrass, a cultivar developed by AFES performed better than other grass species and native alder was found to colonize on grass plots receiving fertilizer, but showed little colonization on unfertilized controls. Sandstone overburden proved to be a better growth media for plant establishment than topsoil material for the first two years but differences disappeared by the third year and topsoil materials were showing better plant performance by the fourth year. A study on a proposed mining site in southcentral Alaska evaluated revegetation for wildlife habitat, initial slope stabilization with seeded grass, and plant diversity. After 10 years, revegetative success was greatest on a paper birch-white spruce site and species diversity was the same on both the seeded and unseeded plots. Most seeded species had essentially disappeared by year 7 in the



long term did not impede natural colonization. Accomplishments for the recently initiated project to study ectomycorrhizae (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 there sufficient commonalities exist for development of common revegetation inoculum.

Impacts: 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. In terms of the bottom line, it helps ensure continued development of nonrenewable resources in an environmentally safe manner. In relation to the new project, development of a common EM inoculum could provide a low-cost and environmentally friendlier substitute for use of fertilizers to provide certain required nutrients such as phosphorus and micronutrients.

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

Scope of Impact: Multistate

#### 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 of FY02. Historically this position produced 28 years of research on reclamation of North Slope oil field disturbances. This program will take on renewed importance with new energy development that is part of a state and national policy shift.]

#### **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**) Experiment Station scientists established environmental soil monitoring at five locations on a transect from the Arctic Coastal Plain to the Brooks Range to field test the new Gelisol order in Soil Taxonomy. They found that reducing conditions occurred at temperatures below  $-4$  C and soils with ice-cemented permafrost within 60 cm have redoximorphic features in the upper 25 cm characteristic of hydric soils. Despite the fact that these soils have soil temperatures during the growing season barely above freezing, they are technically hydric soils. In both Atkasuk and Barrow, the AFES monitoring work is in cooperation with the native villages with the obligation to provide soils and monitoring data to help them manage their lands. 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:

- Contribution of more than 60 pedon data sets of permafrost-affected soils to the National Soils Survey Center (NSSC)
- Provide data to the National Technical Committee on Hydric Soils regarding growing season and biological zero in arctic and subarctic regions.
- The pedon data generated provided the base for U.S. contribution to the database of the Circumpolar Soils Map project
- 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 10 journal articles and 4 book chapters and numerous symposium presentations.

Impacts: Makes the connection between actual observed conditions in northern regions and soil properties used to identify hydric soils and 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

#### Carbon Flux and Soil Organic Matter

Accomplishments: AFES researchers working with scientist from other state and countries, are characterizing the soils of arctic ecosystems and relating soil organic matter quality. They found that for the arctic coastal plain and foothills significant portions of soil organic carbon stores were in the lower part of the thawed active layer while forest transition sites contain low amounts of carbon in subsurface layers. 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: This project provides field soil data as a basis for models of winter carbon flux to the atmosphere for the arctic system. 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, contingent upon CSREES approval, will be replaced by “ Site Treatment Strategies to Promote Natural Regeneration of *Picea Clauca* in Boreal Forests of Interior Alaska”

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 are pursuing multiple objectives related to forest floor organic matter decomposition pathways and nutrient cycling dynamics. 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. Other studies of secondary metabolites leached from foliage of *Ledum* as well as *Empetrum* and mosses *Sphagnum* and *Hylocomium* were evaluated for their effects on *Picea glauca* seed germination and N dynamics. No effects of any leachates were found on seed germination or seedling growth; however, net N mineralization was markedly decreased by leachate from *Ledum* and *Empetrum* but only in the short-term. Future studies will utilize <sup>15</sup>N pool dilution techniques and mass spectroscopy to determine what ‘inhibition’ mechanisms are involved.
- Carbon Balance in Black Spruce Forests. Investigation of black spruce forests as potential net sources of carbon dioxide to the atmosphere in a warming climate. Results show that soil carbon dioxide evolution is strongly affected by understory plants which can remove significant amounts of carbon that would otherwise be lost to the atmosphere.

Impacts: Results of these and companion studies will contribute to our understanding of the impact of boreal forests as a sink or source of carbon dioxide to the atmosphere and assess the role of nutrient cycling and soil chemical change on the productivity of commercial tree species in northern forests. This information was used to produce a Spatial Information System based model (SAFED) to simulate boreal forest productivity across the Alaska interior

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

Feed production systems in interior Alaska have received very little scrutiny related to their effects on soil quality. Minimum tillage plot established at Delta Junction in the

early 80s with variables of tillage and residue management at northern latitudes are being examined for soil chemical, biological and physical properties.

Accomplishments: (**ALK-98-06**) Researchers 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.

Impact: Wind and water erosion can significantly impact soil conditions in the Delta Junction agricultural region and has resulted in over 25,000 acres on farm land being qualified for the federal Conservation Reserve Program. These results would strongly support minimum or no-till land preparation particularly for small grain production to minimize soil loss and improve moisture holding capacity in this drought prone area.

Source of Federal Funds: Hatch General funds

Scope of Impact: Alaska Specific

#### Dairy Waste Management at Northern Latitudes

Anticipated regulatory guidelines for 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.

Accomplishments: Liquid manure application rates, methods, and time of application to oats and brome grass were compared with conventional application of chemical fertilizers. In first year of all studies, liquid manure produced greater yields than equivalent rates of chemical fertilizers and spring applications were superior to fall. First year N recovery efficiency (NRE) for brome grass was 45% and 41% for the 1X and 2X liquid manure rates, respectively compared to 48% and 60 %, respectively, for equivalent fertilizer rates. In the second year, portions of the residual nutrients from year one liquid manure were recovered and fate of the nutrients N and P will be subjected N and P balance analysis. Nitrogen mineralization rates from manure applications in southcentral Alaska are unknown. Buried bag techniques under field conditions are being utilized by a graduate student to develop this needed information.

Impacts: Results from this research will assist dairy and other livestock producers meet ever increasing regulatory requirements for confined animal feeding operations and for

appropriate recycling of nutrients to reduce sources of pollution and reducing costs of on-farm feed production.

Source of Federal Funds: USDA-CSREES Special Grants

Scope of Impact: Alaska Specific

**Key Theme: Forest Protection**

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

Develop methodology for digital mapping of spruce bark beetle infestation classes based on multi-temporal analysis of existing Landsat TM data. Most satellite change detection techniques for estimating insect infestation rely on multi-temporal images. Typically images are taken before and after a heavy infestation. These multi-temporal images are spatially co-registered as a prerequisite before any change detection is started. A critical assumption is that no positional error in the co-registration. However, there is always residual error in image co-registration models. The default position then is usually that sub-pixel co-registration error is not important.

Accomplishments: (**ALK-99-02**) AFES researchers found that under some conditions the above assumption is not true. Using Landsat Thematic Mapper and Advanced Very High Resolution Radiometer imagery. They found that small co-registration error in change detection analysis can be very important as a bias source in estimating change. This false change is especially large in change estimates from heterogeneous images. They tested a statistical resampling technique, the bootstrap, to estimate the bias associated with positional error in multi-temporal change detection studies.

Impact: Remotely sensed images are being used increasingly in forest protection including fire management and insect infestation. Damage to the forests in southcentral Alaska by the spruce bark beetle has been devastating and has increased potential for fire many-fold. Use of Landsat imaging has become an increasingly important research and management tool and the accuracy of the images has been significantly improved by these research findings.

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.

Identify sensitive forest biodiversity resources related to forest structures, especially old growth forest structures and how they develop, change, and contribute to biodiversity. Determine how forest management practices match natural patterns in long-term development. Contrast forest growth with major climate features.

Accomplishments: (**ALK-95-03**) Natural regeneration of white spruce is often less than desirable. Forest researchers have been evaluating a reference stand of white spruce seedlings in the 1983 Rosie Creek burn area since 1989. Of 2389 seedlings in the data set, 2126 have survived through the 2000 season. Best performing seedlings were from the 1983 seed crop. Height growth in 1998 and 1999 (dry years) were below the 1997 trend line indicating a sensitivity to climate events. In 2000, a late spring and cool wet summer contributed to the best growth in two decades. 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. Height increases of well-positioned seedlings was 45 % greater in 2000 than in 1999. These results tend to confirm earlier indications that drought stress is probably the limiting factor in natural regeneration of white spruce at low elevations in Alaska's interior. Seedlings from the first seed crop following the fire (1983) has demonstrated better regeneration and position to become canopy dominant. Researchers reconstructed mean summer temperatures in central Alaska for the period 1800-1996 using x-ray maximum latewood density and carbon 13 isotope methodology of tree rings. The warmest period in the 200 year reconstruction was noted to be between 1970 and 1996.

Impact: This research provides data on rate of growth of major boreal tree species, how growth is affected by climate, and how much trees grow at different ages and different regions. These data are also being utilized in a large computer model of northern forest regeneration. A finding of significance was the highest sustained summer temperature occurred since 1970, but a nearly equal warm period of reconstructed temperatures occurred in the 1820s and again in the 1860s. 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.

Source of Federal Funds: McIntire-Stennis and NSF Funds

Scope of Impact: Alaska Specific

**Key Theme: Forest Management and Harvest**

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

Forest health and ecosystem diversity has been impacted through man's activities both unknowingly and deliberately. Intervention in natural processes such as fire control, impacts long-term forest health and ultimately the local economy. AFES foresters evaluated historical data concerning man-caused disturbances of northern forest

ecosystems and address implications of forest resource planning and ecosystem management.

Accomplishments: (**ALK-97-01**) Archival searches, personal interviews and site assessment were used to determine locations and types of human-caused disturbance. Findings show that so-called pristine regions identified in planning documents are, in reality, results of timber harvest and/or burning. Man's activities were found to occur some 300 miles north of Fairbanks and that timber harvests were not unknown in the riparian zones found there. Findings also show that fire was used deliberately to burn extensive areas to produce game habitat and control insect infestations.

Impact: Findings show that contrary to public perceptions, so-called pristine interior Alaska forests have seen the impact of major human-caused disturbances including: aboriginal and modern use of fire, fire control to exclude or minimize the historical role of fire, and extensive timber harvest in riparian zones. Historical data implies that appropriate forest resource management that includes harvest and burns may not only be acceptable, but desirable for the long-term health of northern forest.

Source of Federal Funding: McIntire-Stennis Funds

Scope of Impact: Alaska Specific

#### 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 increase ice thickness to the point of negatively affecting fish or fish habitat? This is a new project and results are somewhat limited.

Accomplishments: (**ALK-99-06**) We have completed a review of historic ice-thickness measurements for Alaska streams and rivers as well as the literature related to ice-bridge construction and experiences and the possible effects of river ice or ice bridges on fish habitat. We have initiated a layering model to account for ice thickness associated with changes associated with either buildup of ice-bridge surfaces or with the removal or compaction of snow.

Impact: The annotated bibliography and literature review has been incorporated into a report by the Science and Technology Committee appointed to help review riparian standards under the Alaska Forest Practices Act. Preliminary analysis of summer water temperatures indicates that observed increases in temperature proceeding downstream is independent of riparian buffer modification.

#### Moisture Dynamics in Forest Organic Mat

Moisture content of forest floor organic layer is well correlated with the fire danger rating index. 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.

Accomplishments/impact: 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.

Source of Federal Funds: McIntire-Stennis Funds

Scope of Impact: Alaska Specific

### **Key Theme: Multi-Resources Planning and Policy**

#### Comparative Legal Analysis of Private Property Use and Regulation in the Rural U.S.

[This project terminated 9/30/99. The P.I. went on leave without pay for the period 9/99 to 5/00 to pursue coursework at Yale University. The P.I. has joined the multistate technical committee W-192 “Rural Communities and Public Lands in the West: Impacts and Alternatives”. He is participating in writing the renewal proposal.]

#### Assessing the Resource Planning Process in Alaska

Develop a database of land resources planning cases in Alaska for use in constructing a model for effective planning and evaluate the usefulness of the internet in involving the public.

Accomplishments: (**ALK-98-05**) A literature review of criteria for effectiveness in resources planning and environmental dispute resolution was completed. Developed model survey questionnaire with 26 indicators of effectiveness for use in multiple planning team scenarios. In 2000, tests were made to determine the possible use of the internet and a literature review completed. We used the internet models to assist in planning for a popular local trail system in Fairbanks. Elements used included e-mail one-on-one, distribution lists, and listservs to communicate between stakeholders and planners to develop the plan. We then posted the plan on a website for public review and then posted a survey to illicit responses from the public.

Impact: Results indicate that in Alaska with vast areas unserved by roads, great distances between communities, and great expense for travel, the internet has dramatically increased the means, the level, and the quality of participation in natural resource planning. While internet communication is not in every home in Alaska, internet access is usually available even in the most remote locations (i.e. schools, government offices, etc.). A recent survey showed Juneau to have the greatest per capita access to the internet and the remote village of Galena offers high school degrees to hundreds of students around the state. The electronic “town hall” for resource planning can follow. The



Fortymile Caribou Herd Management Planning Team utilized resources and faculty in the mediation for efforts to successfully restore the herd. The herd has increased 40 % since the plan was put into effect. The P.I. for this project received special recognition from the Alaska Land Manager's Forum.

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. Alaskan's 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 assess the direction they want to pursue in terms of resource development.

AFES resource economists have completed or partially 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) Economic analysis of subsistence whaling which underpins the subsistence economies of the villages on the North Slope. Potential negative effects of oil and gas development on the bowhead must be countered with information related to the value of the resource to the people of the region.

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.

**Expenditures:**

Hatch General:	\$53,147
Hatch Multistate:	None
McIntire-Stennis:	None
State Matching:	\$59,630
FTE (SY)	1.0

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**PLANNED PROGRAMS**

**Key Theme: Development of Regional Economic Models for Rural Alaska**

Regional Economic Modeling for Rural Alaska

Investigate the application of input-output methodologies to modeling rural Alaska Regional Economies for ongoing impact assessment.

Accomplishments: **(ALK-96-03, WCC 109)**

- The Cook Inlet regional economic model for Kenai, Soldotna, Ninilchik, Anchor Point, and Homer was completed. This IMPLAN model was constructed to investigate net benefits from the Kenai Peninsula ocean sport fishing industries (halibut and king salmon). A major finding of the study was that total estimated compensating variation (Measure of consumer surplus) gained by lower Cook Inlet halibut and salmon sport fishers in 1997 was \$19.2 million, distributed among residents of the Kenai Peninsula Borough (\$3.9 million), other Alaskans (\$5.0 million), and other U.S. residents (\$10.3 million). The Katchemak Bay watershed regional economic model was completed with the major finding that the area economy has evolved from being resource production based to being service based. Additionally, transfer payments and investment income have become more prominent features in budgets of residents. These changes have had profound implications for the management of the spruce bark beetle infestation. AFES 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.

- Economic Analysis of Subsistence Whaling

AFES economists in cooperation with the North Slope Borough and communities of Barrow, Kaktovik, and Nuiqsut evaluated the unique features of the Bowhead whaling cash/non-cash economy by determining: 1) the food value of bowhead whales on a caloric and protein content basis and the replacement costs of commercially available substitutes, 2) to depict whaling as an industry and determine the benefit to the community from the money spent by those involved in whaling, and 3) to determine the economic value of whaling to the residents of the North Slope Borough based on their expressed preference for trade-offs (i.e. gas and oil development and revenue) they would make in exchange for changing the number of whales taken.

Accomplishments: Scientists have collaborated with community and industry leaders to best structure the economic model. Two economic techniques, non-market valuation and regional input-output modeling (IMPLAN) will be used. The collaborative data gathering stage is complete. We have organized a panel session on subsistence whaling for the International Institute of Fisheries Economic and Trade Conference held in July 2000. Tapes of the discussion on socio-economic issues with respect to subsistence whaling are available for educational use.

Impact: 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. 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

### Marketing Alaska's Agricultural and Processed Seafood Products

Despite increasing demand for knitted products by Alaska native knitters from qiviut and an emerging market for meat products, the muskox industry is not growing. AFES scientists are cooperating with the Institute of Arctic Biology and individuals from the private sector to develop a footprint for industry growth.

Accomplishments: Formation of the Muskox Task Force to address major components needed if the muskox industry is to expand. The Task Force identified the following components: availability of animals, producer awareness of muskox husbandry, markets and marketing, and capital requirements and operating cost. Funding was obtained and a workshop established to meet in Anchorage in November, 2000 entitled “ The Private Sector Must Take Control of the Muskox Industry if it is to Succeed” in conjunction with the annual Agricultural Symposium. Results of that meeting and plans for future work will be reported in the 2001 Accomplishment Report

### **Total Expenditures (All Goals)**

Hatch General:	\$785,530
Hatch Multistate:	\$163,889
McIntire-Stennis:	\$442,416
State Matching:	\$1,918,354
FTE (SY):	14.5

### **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 1999, 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 survey availability was advertised in major newspapers (copies of advertisements are on file), listservs, and Cooperative Extension outreach avenues. The planning survey was presented to a subcommittee of the University of Alaska Board of Regents and results of the on-line survey were summarized and presented to the SALRM/AFES Board of Advisors for use in their program assessment and recommendation process. Survey results were published in hardcopy: Atchison, A, C.E. Lewis, and S. Todd. 2000. “Analysis of the SALRM/AFES Strategic Planning Survey” AFES Misc. Pub.2000-2, University of Alaska Fairbanks, 40pp.

Board of Advisors meetings were held October 26-27, 1999; March 8-9, 2000; and July 17, 2000. AREERA requirements were outlined and their

participation in the stakeholder input process including gaining input from stakeholders that individual B of A members represented.

- An abbreviated version of the survey was made available in hard copy at various stakeholder-attended meetings around the state. 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 11, 1999 (Attendance ~ 75)
  - 2) The Agricultural Symposium November 12-13, 1999 (Attendance ~150)  
**[ These were advertised in the Anchorage Daily News on 11/5/99 and 11/11/99 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 24-25, 2000
  - 4) Potato and Vegetable Growers Conference March 1-2, 2000

Summaries of inputs from all sources were summarized and made available to the SALRM/AFES Board of Advisors and used in meetings with faculty, department heads, Dean, and Director to set research priorities and in initiative proposals to University administration for new position requests.

### **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'

Research Implementation Committee (RIC) and 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>.

### **Evaluation of the Success of Multi and Joint Activities**

Alaska is somewhat isolated with respect to the contiguous 48 states. Additionally, the latitude and climatic conditions encountered are significantly different than even the northern most states of the contiguous 48 states particularly the Western Region. Having said that there are multistate research objectives that address Alaska issues, but perhaps fewer than most other states. 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

(We have or are in the process of submitting Appendix E for an additional representative on W-147 to address economic sustainability and W-192 to address legal and policy issues related to western public lands).

4-NRSP/IR4 A National Agricultural Program to Clear Pest Control Agents for Minor Uses.

NCR -01 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

Survey results from stakeholders and detailed discussion with our Board of Advisors tended to downplay the importance of multistate research. Alaska agriculture is still in the developmental stage similar to the “lower 48” of the 1960s. 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. The new P.I. in animal science has the background and training to pursue the objectives of W-112 and had established working relationships with multistate scientists prior to coming to the University of Alaska. So in that case the fit has been very good. Additionally, perhaps more so with animals than plants, findings from W-112 do address specific reproductive problems that exist in Alaska. As producers begin to see these advantages, 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. 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.

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 will add 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 has been invited to help write the renewal proposal for the next 5-year cycle.

Participation in coordinating committees will continue at the present level will 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 approve our projected Integrated Activities for the 2001-2004. The appropriate forms and the waiver are attached.

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 have 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:

#### 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. 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.

### 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 has been submitted to CSREES for approval. 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. Other AFES/CES collaborative work included potato late blight monitoring and treatment which assisted in taking the potato industry from the brink of devastation with a serious outbreak in 1998 to blight-free fields in 2000. 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



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 Production	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
<b>Total</b>		33,277	37,928	42,669	47,410

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

Director 2/26/01  
 Date



United States  
Department of  
Agriculture



Cooperative State  
Research, Education  
and Extension Service

Washington, DC  
20250

November 2, 2000

**RECEIVED**  
NOV 13 2000  
Palmer Research Center  
Palmer, AK

Director-Acting G. A. Mitchell  
Palmer Research Center  
Agricultural & Forestry Exp. Station  
533 E. Fireweed  
Palmer, Alaska 99645-6629

Dear Dr. Mitchell:

This is in regards to the Target Percentages that you have established in complying with sections 105 and 204 of the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA). We have confirmed your Target Percentages as follows:

	FY 2000	FY 2001	FY 2002 and Thereafter
<b>Multistate Extension Activities (Smith-Lever Act)</b>			
<b>Integrated Activities (Hatch Act)</b>	Waiver Requested	3.5	4.0
<b>Integrated Activities (Smith- Lever Act)</b>			

Your institution will be responsible for complying with these percentages and should refer to the Administrative Guidance on Multistate Extension Activities and Integrated Research and Extension Activities for implementation of these requirements. You also may refer to the AREERA web page (<http://www.reeusda.gov/areera/part/>) for additional information and guidance (i.e., Frequently Asked Questions). In addition, if your institution fails to meet its Target Percentages for a specific fiscal year and your institution is not granted a waiver from these requirements for a specific fiscal year, your Federal formula funds equal to the difference between your established Target Percentage and your actual percentage will be disallowed and will have to be repaid to the Agency.

In view of the significant gains in effectiveness and synergy when resources are combined, CSREES encourages all institutions to strive to meet the spirit of this requirement. For those institutions either not targeting 25 percent or the actual baseline percentage based on the lesser of 25 percent or twice the FY 1997 expenditures, we encourage you to target a higher percentage of



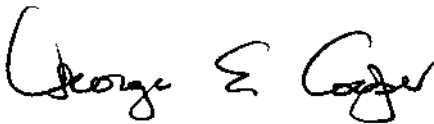
your Federal formula funds to multistate extension activities and/or integrated research and extension activities.

We also have approved your supplement to the 5-Year Plan of Work. This supplement identified the multistate extension and/or integrated activities that you intend to support in meeting these Target Percentages. If you have any questions or concerns about this supplement or your 5-Year Plan of Work, please contact Bart Hewitt at 202-720-0747 or via email at bhewitt@reeusda.gov.

Form CSREES-REPT (2/00), Supplement to the Annual Report of Accomplishments and Results, Multistate Extension Activities and Integrated Activities, will be due March 1 each year and must be submitted as a summary of the multistate extension activities and/or integrated activities that have been used to satisfy the requirements of AREERA sections 105 and 204. If you have any questions regarding these or any other Plan of Work reporting requirements, please contact Bart Hewitt.

We wish to express our appreciation for your patience and assistance in implementing these new requirements under AREERA for multistate extension activities and integrated research and extension activities.

Sincerely,



GEORGE E. COOPER  
Deputy Administrator

cc: Colien Hefferan  
Ralph Otto  
FMB/OEP  
State Facilitator





**ACE/SALRM Business Office**  
University of Alaska Fairbanks  
Room 110, Arctic Health Research Building  
P.O. Box 756180  
Fairbanks, Alaska 99775-6180  
FAX: (907) 474-7439



July 28, 2000

Partnerships Unit  
Cooperative State Research, Education, and Extension Service  
U.S. Department of Agriculture  
Stop 2214  
1400 Independence Avenue, SW  
Washington, DC 20250-2214

Dear Sirs:

Please find enclosed Form CSREES-WAIVER, Form CSREES-BASE, Form CSREES-TARG, and Form CSREES-PLAN for the Agricultural and Forestry Experiment Station (AFES) at the University of Alaska Fairbanks.

AFES is requesting a waiver for FY 2000 Integrated Activities from Hatch Act funds. Projections have been provided for Integrated Activities for fiscal years 2001 through 2004.

Also enclosed is the Supplement to the AFES Plan of Work. This supplement revises the POW section on Integrated Activities with Cooperative Extension. It is the basis for the cost projections beginning October 1, 2000.

Sincerely,

*James Levison*

James Levison  
Executive Officer

Encs.

cc: G. Allen Mitchell  
C. Lewis



U.S. Department of Agriculture  
Cooperative State Research, Education, and Extension Service  
Request for Waiver from Target Percentage  
for Multistate Extension Activities and Integrated Activities

Institution University of Alaska Fairbanks (UAF)

State Alaska

Waiver for (circle one): Multistate Extension Activities  
Integrated Activities (Hatch Act Funds)  
Integrated Activities (Smith-Lever Act Funds)

Fiscal Year (circle one): FY 2000  
FY 2001  
FY 2002  
FY 2003  
FY 2004

Type of Waiver: Pre-waiver (Must be submitted prior to October 1)  
Post-waiver (Must be submitted with Annual Report of  
Accomplishments and Results)

**Justification:**

The Agricultural and Forestry Experiment Station will have to modify its current accounting within UAF's accounting system to accommodate the tracking of Hatch funded integrated activities. The current system does not allow us to obtain an auditable 1997 baseline for integrated activities, or auditable figures for fiscal year 2000 integrated activities. Modifications will be in place by October 1, 2000.

  
Director

7/28/00  
Date

**Note: All reports must be submitted regardless of request for waiver.**









**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**  
 **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:

<b>FY 2000</b>	<u>Waiver Requested</u>
<b>FY 2001</b>	<u>3.5</u>
<b>FY 2002 and thereafter</b>	<u>4.0, 4.5, 5.0</u>

  
\_\_\_\_\_  
**Director**

7/28/00  
\_\_\_\_\_  
**Date**




U.S. Department of Agriculture  
 Cooperative State Research, Education, and Extension Service  
 Supplement to the 5-Year Plan of Work  
 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	Estimated Costs				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Agronomic Crops and Soils	Waived	9,267	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	3,194	3,549
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Soil Quality/Nutrient Management	Waived	2,067	2,356	2,650	2,944
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Forest Production/Protection	Waived	482	549	618	687
Other Integrated Programs	Waived	5,486	6,253	7,035	7,817
<b>Total</b>		33,277	37,928	42,669	47,410

  
 Director  
 Date 7/28/00