AREERA PLAN OF WORK

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

Agricultural and Forestry Experiment Station
University of Alaska Fairbanks

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

Certified by: _____

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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 Natural Resources and Agricultural Sciences and the Agricultural and Forestry Experiment Station (SNRAS/AFES) generates and disseminates knowledge to stakeholders for the successful management and development of land resources in Alaska, the Western Region, and the nation. Management and development of the natural resources of Alaska historically and presently have supported and stabilized the state's economy. With $50 per barrel oil and possible development of additional oil reserves (i.e. ANWR and the National Petroleum Reserve-Alaska) and the proposed natural gas pipeline, Alaska's economic future and probable population growth will likely result in renewed pressure on utilization of other natural resources along with concerns over multiple land uses and new problems at the urban-wildland interface. The Agricultural and Forestry Experiment Station is a leader in maintaining the sustainability of the use and development of agricultural, forestry, and other natural resources in the state of Alaska. These efforts are jointly funded by federal formula funds, state matching funds, and other state, federal, and private sector funds. The report that follows summarizes the accomplishments of SNRAS/AFES in terms of outcomes and impacts to our stakeholders. Since the 2003 report, the land in farms as reported by the Alaska Agriculture Statistics has remained stable at approximately 900,000 acres. However, population demographics near Alaska's largest city, Anchorage, has shifted to the farmland north of the city and significant acreage of some of the best soils for agriculture in the state have been sold off for subdivisions and other non-farm uses. Projections point toward this trend continuing. Cash receipts for agriculture remained essentially flat in 2003 at $50 million. 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. Total receipts for all crops remained stable at approximately $23 million.

Research in support of conventional and organic producers of vegetables, potatoes, and other field crops as well as home gardeners continues to focus primarily on variety selection, new crops, disease resistance, and adaptability to northern environments. Recent reductions in state funding have resulted in filling fewer faculty and support staff vacancies. That has been partially addressed by sharing of resources between the Experiment Station and Cooperative Extension and the introduction of new USDA-ARS scientists both at Fairbanks and Palmer.

Since a large share of agricultural income in Alaska comes from ornamental plants and greenhouse crops, related research now aims to help growers develop new crops, increase profit, and accurately time production for targeted markets. 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. Economic production in a controlled environment requires efficient use of space and utilities and knowledge of light requirements for bloom and fruit set. All of these activities are carried out in Integrated Activities with Cooperative Extension and provide alternative niche crops for in-state commercial greenhouse and nursery producers.

The domestic livestock activities of the animal scientist we share with Cooperative Extension centered on dairy outreach and has assisted producers in Delta Junction located in interior Alaska, Point MacKenzie, and the Matanuska Valley. Research within AFES has largely centered on alternative livestock species such as reindeer, muskox, and bison in direct response to requests by the livestock producers of Alaska.

Forests are one of the major renewable resources of Alaska. Alaska's forests provide habitat for wildlife, forest products and opportunities to expand production of forest products and the scenic backdrop for much of the tourism industry. The forest products exports have traditionally emanated from southeast Alaska's Tongass National Forest. However, in 2004/2005 a small wood chipping industry has developed in southcentral Alaska and a first shipment of 40,000 tons was made to Korea from the new port at Point MacKenzie. Research by the Department of Forest Science quantifies timber productivity of northern forest lands and provides resource managers with appropriate information for timber management decisions and stand prescriptions.

Expenditures:

Hatch General:	$611,121
Hatch Multistate:	$ 32,527
Hatch Animal Health	$ 2,821
McIntire-Stennis:	$104,764
State Match:	$733,147
Total FTE (SY):	7.0

PLANNED PROGRAMS

Key Theme: Greenhouse/Nursery Production

Innovative Use of Natural and Supplemental Light for High Latitude Crop Production

Alaska's position at northern latitudes results in extreme temperatures and light fluctuations. Controlled environment production systems and technologies offer diverse opportunities to extend the growing season, increase productivity, improve quality, and allow local production of previously considered unfeasible crops.

Accomplishments: (**ALK-00-09, NCR 101**) Lettuce producers at high latitude require mechanical transplanting to gain maximum benefit of the short growing season. The most suitable transplant for field transplanting has a compact well developed root system and short hypocotyls. We compared perlite (white) and peat (dark) media as well as white and black nutrient film technique (NFT) film for germination transplants. Results showed perlite or white plastic mulch aid in production of a compact transplant. It also suggested a high red to far-red reflected ratio may explain the shorter transplants using a white media or film. In other work, *Rudbeckia hirta* (cultivar Toto Gold) was grown at 8 or 16 hr day length. We studied the effects of alternating short and long day conditions. Plants were shifted to the opposite day length after 21 days. Long days resulted in flowering 12 weeks from seeding while initiated visible buds at continuous short days failed to develop into a flower. Plants grew 18 cm with long days but less than 8 cm with short days. Although 3 weeks of short days slightly slowed flower development compared to continuous long days, overall height was reduced resulting in high quality flowering plants. Toto Gold and the compact sunflower Pacino Gold were grown at 16 degree C using five day and night temperature combinations. Different day and night temperatures promoted growth and flowering compared to steady daily temperatures. The 12-hour day length resulted in flowering at the rosette stage without stem extension and thus an unmarketable plant.

Impact: Daily light duration, type and amount control performance and production time of crops in greenhouse and protected environments. By understanding and manipulating environmental relationships we can show producers how to consistently produce highly desirable, well branched flowering plants at premium market value. Our research also addresses marketing opportunities by developing predictive production times. Since rate of growth and development is highly dependent on light, knowing amount and levels of production light allows us to exactly forecast crop progression and optimum harvest. Results from research funded by this Hatch and matching state funds has leveraged additional federal grant funds for research in greenhouse berry production ($167,153), controlled environment production ($185,700), and greenhouse crop production ($417,884).

Controlled environment production systems **(ALK-03-13)** provide exceptional opportunities in areas with inclement climatic conditions and variable day-length to meet year-round local demand for perishable high quality fresh market berries, vegetables, and floral crops. This research, funded by USDA Special Grant funds was leveraged by Hatch funding. High tunnel greenhouses erected for the 2004 season supported production of tomatoes, cucumbers, beans, raspberries, onions, leafy greens, and herbs for high-end markets such as restaurants and gourmet shops. Despite higher than normal temperatures

during the 2004 growing season and smoke from nearby wildfires, vegetables and fruits grown inside high tunnels matured earlier for harvest than in adjacent field locations. This work combined with geothermal resources resulted in collaboration with Chena Hot Springs Resort. The hot springs efficiently drive and energize seasonal and year round high value sustainable field, greenhouse, and controlled environment production of fresh market vegetables, berries, flowers, herbs, and leafy greens. In a pilot study, the high tunnel structures supplied these commodities throughout an extended summer season. Then with modification (a second polyethylene layer, end walls, supplemental lighting, and geothermal heat) these structures could produce limited commodities essentially year round.

Impact: Controlled environment production systems provide exceptional opportunities to meet year-round demand for locally produced perishable high quality fresh market berries, vegetables, and floral crops in area with inclement weather conditions. Lucrative crops were identified and selected based on economical analyses mapping production costs, local market demands, consumer preferences, and profit margins.

Source of Federal Funds: Hatch General and Hatch Multistate
CSREES Special Grants

Scope of Impact: Multistate

Key Theme: Horticultural and Agronomic Field Crop Production

Horticultural Crop Production for Alaska

Accomplishments: (**ALK-01-11**) We evaluated 1265 woody perennials, herbaceous perennials, annual flowers, herbs, and vegetables in 2004. Tomato trials initiated in 2003 were continued and identification of recommended outdoor cultivars made. The top four ranked cultivars were Prairie Fire, Glacier, Sub-Arctic 25, and Northern Delight. Twenty-six native wildflowers, grasses, and weeds were grown in soils treated with increasing levels of NaCl, $CaCl_2$, $MgCl_2$, and urea applied to simulate road and airport runway salt. All species grew on all salt concentrations, but the grass cultivars performed best on the higher levels. In trials on peonies, no differences in flower production were detected when silt loam soils were amended with peat moss or compost. The most productive peony cultivars in 2004 were Duchess de Nemours and Felix Crous.

Impact: The vegetable research is designed for small market producers of vegetables and landscape nursery plants as well as home gardeners. The goal of producing a US Grade 1 cut flower has been met. We have also found new market opportunities for air-dried and freeze-dried peonies. Excitement is growing as one commercial producer in Anchorage is marketing to local grocery stores and florists. Both annual and perennial vegetable crop trial information was requested by Territorial (OR) and Denali (AK) seed companies. The annual and perennial flower research information is being utilized by seed companies, nurseries, growers, landscapers, and home gardeners to identify Alaska-

hardy perennials and disease resistant annual flowers for home and commercial production. Specific trial information was requested by Johnny's Selected Seeds (ME), Territorial Seeds (OR), Pan American and Ball Seed Co. (IL), and Goldsmith Seeds (CA). Salt tolerance results was utilized by the Alaska Department of Transportation and utilized in developing seed mixes for roadside revegetation.

Source of Federal Funding: Hatch General
CSREES Special Grant

Scope of Impact: Alaska Specific

Field Grown Potato and Vegetable Crops

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

Production Practices, Cultivars, and Disease of Potato and Other Horticultural Crops

Accomplishments: **(ALK-01-09)** In 2004, 17 potato cultivars were included in irrigated yield trials. Average yield of US #1 potatoes was 43.4 Mg/ha with Chieftain yielding highest at 54.4 Mg/ha. In management optimization trials, Russet Norkotah, Shepody, and BakeKing exhibited 10 percent increase in marketable yield when in row spacing was decreased from 28 cm to 23 cm. A similar trend was noted on other top yielding cultivars. In other trials, we evaluated horticultural characteristics of 40 potato cultivars that may have market garden potential and information was shared at grower and Master Gardener meetings around the state. Flame weeding techniques were evaluated on three potato cultivars for organic systems and determined that potato plants can survive flaming that kill weeds.

Impacts: Fresh market potatoes are Alaska's most valuable crop ($3.3 million in 2003). The management optimization trials give farmers tools to increase marketable yields while minimizing adverse environmental impacts. The variety trials provide commercial scale growers with yield comparisons that will influence their seed purchasing decisions for the following seasons. Specialty potatoes are sought after by consumers at local Farmers Markets and present a lucrative opportunity for small operations. The diverse potatoes grown in the demonstration trial may give competitive marketing advantages to the early adapters of these varieties. The flame weeding information will enhance the small but growing organic market in the region. Results from applied studies are presented each year to the joint SAES/CES sponsored Potato and Vegetable Growers Conference. These presentations over the past 11 years have established recommended varieties of potatoes and vegetables grown by Alaska producers as well as providing production practices information.

Source of Federal Funds: Hatch General

CSREES Special Grants

Scope of Impacts: Alaska Specific

Cultivar Selection, Production Methods, and Market Quality of Vegetables in Alaska

Accomplishments: **(ALK 01-02)** Head lettuce cultivar evaluation continued for marketable heads, head diameter, and internal tip burn. Seed availability is a major problem for growers in Alaska since the relatively small number of commercial producers creates a small demand. As a result, we must continually test available tip burn resistant cultivars for possible substitution on relatively short notice. Alpha variety crisphead lettuce has performed well in recent years and is the favored cultivar among lettuce producers. However, seed availability is uncertain in the near future. For comparison, a tipburn susceptible type, Calicel and a tipburn resistant cultivar, Salinas were included in all plantings. Cultivars Sniper and Liberty compared favorably with Alpha in 2004 trials and are candidates for replacing Alpha. While tipburn is unsightly, the primary reason for unmarketable heads was small head size. Field trials on green storage cabbage compared four cultivars at three spacings (12, 14, and 16 inches). Cultivars Gideon and Survivor remained green in storage until December and cultivars Arena and Safekeeper II remained marketable into January. Gideon had the larger head size and showed less response to spacing. Field trials with baby greens compared yields of arugula, mustard, kales and Asian greens at three fertility levels. Young leaves of brassica greens for specialty salad mixes were harvested in three to five weeks after direct seed planting. In most cases, the lowest fertility level was sufficient because of the short growth period. Kale grew thick leaves and showed growth response to higher fertilizer rates. Different species of greens respond differently to fertility and environmental conditions and should be seeded and fertilized differently and mixed after harvest. New Crop Opportunities studies investigated specialty greens for an untapped in-state retail and restaurant market. Increased value-added marketing continues to offer avenues for increased production a wide range of vegetable crops.

Impact: Cool season vegetables can be produced in abundance during Alaska's summer, but production costs and changing markets continue to be a challenge to local growers. The purpose of this research is to study cool season vegetables and provide data on production methods that can be used to produce profitable crops in northern latitudes. Local production of leafy green salad vegetables can provide high quality plants for consumption by local residents and summer visitors. Salads have health benefits from high fiber and low calories and encourage healthy lifestyles. The short time in storage and transport are especially important to growers for shelf life of lettuce and baby greens. On the other hand, cabbage sales can be extended through the winter by choosing cultivars and production practices that promote storage quality. The Alaskan Grown program “fresher by far” fostered by the Alaska Division of Agriculture and the Agricultural and Forestry Experiment Station has resulted in increased awareness of the benefits of locally grown produce over that shipped in from the lower 49 states. Results from applied studies are presented each year to the joint SAES/CES sponsored Potato and Vegetable Growers Conference. These presentations over the past 10 years have

established recommended varieties of potatoes and vegetables grown by Alaska producers as well as providing production practices information.

Management Practices for Forage and Turfgrass at Northern Latitudes

Accomplishments: (**ALK-02-05)** *Forage Crops*: Nonirrigated forage grass/legume (reed canarygrass/red clover; var. Palaton/var. Altaswede) trials involving seeding rates and nitrogen (N) rates and time of application were established in 2002 at Palmer. Dry matter (DM) yields of grass only and mixed stands responded to N rate and seeding rate and composition (ratio of grass to legume) in 2003. In 2004, the 1st, and only, cut was taken in mid-June. Nitrogen fertilization had no effect on yield of red clover alone, but did increase yields in grass monoculture and mixed stands with increasing N rate. Higher red clover seeding rates, stand composition, and N fertilization resulted in higher content and production of protein in 2003. However, only N fertilization increased protein production in 2004. Results, both at Point MacKenzie and Palmer during the three years of this study supports the requirement for irrigation to be assured of sustainable forage production. *Turfgrass*: Cultivars of bentgrasses, adapted Kentucky bluegrass (KBG), and roughstock bluegrass (*Poa trivialis*) were established on a sand-based green in 2001. In 2002, cultivars showing poor overwintering characteristics were either reseeded to new cultivars or overseeded with selected cultivars to evaluate playability at a relatively early stage of the season. They were evaluated for winter survival, earliness, overseeding success, color, texture, and overall quality again in 2004. Banff Kentucky bluegrass (KBG) demonstrated earlier greenup than Nugget KBG. However, Nugget showed best overall quality in spring and early summer. With the exception of Trueputt (*Poa reptans*), the *Poa* cultivars (including introduced species) showed less winter injury and earlier greenup in 2004. 18th Green and Velvet/SR7200 performed on par with Nugget in greenup and outscored Nugget throughout the summer of 2004 in overall quality. Overseeding with both *Poa trivialis* and bentgrass varieties resulted in rapid recovery of winter-damaged cultivars to playable greens and represents a feasible alternative following severe winters at northern latitudes. In 2004, best performing green cultivars were seeded in a green trial at a local golf course to evaluate cultivars under playing conditions. Irrigated fairway turfgrass variety trials involving 24 cultivars of indigenous and introduced turfgrass species were established at Palmer in June 2002. All cultivars were evaluated for winter injury beginning in April of 2004. The order of greenup in 2003 was generally fescues = Kentucky bluegrasses> hairgrass> velvet bentgrass> creeping bentgrasses> perennial ryegrass. In 2004, the order was Kentucky bluegrass>Hairgrass>fescues>> velvet bentgrass>creeping bentgrasses. However, all cultivars except perennial ryegrass survived the winter and demonstrated turf quality comparable to the indigenous cultivars by late May and through the summer season.

Impacts: Results from the turfgrass research have been transferred to golf course superintendents and other turfgrass users. Information was disseminated primarily through a golf course superintendent field day and one symposium presentation to government agency landscaping personnel. We are evaluating selected cultivars and turfgrass maintenance methodology on a demonstration green at the Settler's Bay Golf Course and superintendents are changing turfgrass practices based on our results. Alternatives to traditional cultivars such as Nugget Kentucky bluegrass will be valuable

in view of changing availability of seed sources. Turfgrass for golf greens, fairways and sports fields is increasing in importance as the population of the state increases. Our work with varieties and management practices will be the first definitive work for this economically important and recreationally important crop. While this is a relatively new project, it has had a definite impact by stimulating interest among local golf course superintendents and sports field managers.

Source of Federal Funds: Hatch General
USDA Special Grants

Scope of Impact: Alaska Specific

Cicer Milkvetch, Forage Galega, and Lupinaster Clover as Potential Forage Crops for Alaska

Accomplishments: (**ALK-02-01)** Six cultivars of cicer milkvetch (*Astragalus cicer*) and one cultivar of forage Galega (*Galega orientalis*) were planted in test plots at Fairbanks and Delta Junction, Alaska in 2002. A few test rows of lupinaster clover were seeded at both locations in 2002 and 2003. Replicated plots of lupinaster were planted in Fairbanks in 2004. The Fairbanks location is near neutral in soil reaction and typically has snow cover in winter while the Delta site is acidic and has high winter winds that leave fields barren of snow most of the winter. These crops are small, hard seeded perennial legume crops and were slow to establish and no harvests were obtained in 2002 or 2003. No harvests were made at Delta any year due to poor survival and growth. At Fairbanks, all cultivars in the variety trials, were harvested twice in 2004 (mid-June and early August). For the harvest management study, a uniform first harvest was taken on all cultivars in mid-June; the second harvest was cultivar dependent and occurred from early July to mid-September and cutting height varied from 5 to 15 cm. The mean total seasonal yield in the variety trials was 6.8 Mg/ha for the cicer milkvetch and from 6.3 to 6.9 Mg/ha. In the harvest management trial, yields decreased with cutting height and increased as the season progressed. Preliminary results of this work indicate that cicer milkvetch and forage galega has potential as a high protein alternative forage in some regions of Alaska.

Impact: Conventional forage legumes in the southern 49 states (i.e. alfalfa) do not produce well in Interior Alaska because of lack of sufficient winterhardiness and, in some cases, low survival in acidic soils. Cicer milkvetch is a long-lived, rhizomatous high quality forage and is currently being utilized in British Columbia in regions where alfalfa production and feeding (bloating) is problematic. This project will provide farmers in central Alaska with expanded options by providing information about management of new legume forage crops.

Selection, Variety Testing, and Evaluation of Cultural Practices for Alternative Agronomic Crops in Alaska

Accomplishments: (**ALK-02-06**) Drought conditions in interior and southcentral Alaska in 2004 resulted in less plant height and heading in cereal grains than the long term average. We continued evaluation of the hulless barley, hulless oats, and hard red spring

wheat, previously selected from northern Canadian sources for testing against the standard Alaskan varieties (Thual hulless barley, Toral oat, and Ingal hard red spring wheat). We also introduced two two-row hooded forage barley cultivars from Montana for testing against Alaska 6-rowed hooded forage cultivar Weal. Yields for 2-row hulless barley yielded greater that the 6-row barley at three locations. We made a final selection from a hulled, 6-row barley x feed barley cross for potential release as a new variety in 2005. The new variety was compared to Otal, Finaska, and Albright. It was 2 days earlier in maturity with comparable lodging resistance and yield. There were 12 selections from hulless 6-row, barley cross that were made from 50 plots in 2003. 2004 was the first year that all twelve selections were tested against the parent Thual. Average yields and lodging resistance were greater than Thual and selections will continue in 2005.

Impact: This study is a continuing collection of information that provides yearly updates on new and better adapted crop varieties, the response of agronomic crops to dryland farming conditions, and provides a database for local producers to determine the economic viability for those crops. Future studies of the effects of irrigation on these agronomic crops will broaden this information database. Agricultural crop production in Alaska is limited by insufficient infrastructure and transportation. Since farmers can't compete in world markets they are interested in local niche markets. Reliable information on high value agronomic niche crops such as hulless barleys and oats, grass seed, and oilseeds as well as horticultural niche crops like flowers, vegetables and nursery plants is important to local producers trying to fill and sustain the demand from local markets for niche crops.

Source of Federal Funds: Hatch General
USDA Special Grants

Scope of Impact: Alaska Specific

Key Theme: Marketing of Alaska Grown Products

Alaska Seed Growers' Assistance Program

Accomplishments: The native seed industry is in a fledgling stage. Presently, the commercial growers are producing approximately fifteen to twenty percent of the statewide demand. This percentage can easily be increased through a cooperative effort between government and industry. This project is a cooperative effort between the Agricultural and Forestry Experiment Station and the Alaska Plant Material Center (APMC). The primary purpose is to develop a program to educate seed growers and users in the most effective and efficient methods of commercially producing and utilizing seed of native plants for use in Alaska. The APMC developed informational flyers for 'Benson' beach rye, 'Nortran' tufted hairgrass, 'Gruening' alpine hairgrass, 'Arctared' creeping red fescue, 'Sourdough' bluejoint reedgrass, 'Reeve' beach wildrye, 'Egan' American sloughgrass, 'Nugget' Kentucky bluegrass, 'Wainwright' slender wheatgrass, 'Norcoast' Bering hairgrass, 'Solomon' thickspike wheatgrass, 'Service' big bluegrass, 'Alyeska' polargrass, and 'Kenai' polargrass. During this reporting period, hundreds of

digital photographs were taken for educational use; an educational listserv was initiated as a forum for seed growers and an outline of the new statewide revegetation manual was prepared.

Impact: Reports from state and federal agencies, as well as growers, about the Alaska Seed Growers Assistance Program, have been very positive. Comments about the availability of the plant flyers on the web include the following: ... “outstanding and very useful”, ... “informational and easy to read”. These plant flyers will be very useful to connect the needs of Alaska communities and Agencies with the Alaska Native Seed Growers. The Alaska Department of Transportation hopes that this information will enable Alaskans to grow the seed needed for revegetation. The results of this program are expected to enable better communication between Alaska agencies and Alaska Native Seed Growers. Questions come from the public about environmental impacts on Alaskan landscapes from planting non-native seed. This program will consolidate the massive research findings on revegetation in Alaska into a user-friendly revegetation manual. The plant flyers will show the feasibility of growing native plant seed of grasses and forbs for profit and usability. By placing this interpretively written and designed information on the Web, the impact is multiplied by thousands of businesses, growers, and agency folk having ready access to the information.

Key Theme: Traditional and Alternative Livestock Production

<u>Reproductive Performance in Domestic Ruminants</u>

Producers of domestic ruminants experience economic loss associated with inefficient reproductive management practices. The purpose of this research is to examine the effects of extreme temperature and extreme changes in day length on a seasonal basis on high latitude 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. Radioimmunoassay of endogenous steroid during pregnancy in reindeer has been completed. Results of progesterone assay indicate concentrations increasing immediately after conception and remaining elevated until just prior to parturition (previously reported). Results of estrogens (Estradiol beta, estrone, and estrone sulfate) indicate nadir concentrations from conception until between 19 and 23 weeks of pregnancy when the three estrogen hormones increased dramatically, with peak concentrations occurring at parturition. The use of Melengestrol Acetate (MGA), a commercially available progestin based livestock feed additive, was investigated for use as a tool to reduce destructive and dangerous rutting behavior expressed by reindeer bulls during the breeding season. However, the MGA treated bulls showed no depression in rut associated aggression and all began approaching estrus females within thirty minutes of entering the pen. Analysis of systemic testosterone, feed intake, body weight behavioral observations, and antler production data are currently in progress.

Additionally, the effectiveness of two estrous synchronization tools in reindeer cows were investigated: (1) controlled internal drug releasing devise (CIDR) containing progesterone initiated prior to the onset of the breeding season and (2) a two PFG2a injection protocol. Estrous synchronization was achieved with 100 percent effectiveness in reindeer cows receiving the progesterone containing CIDR. The use of CIDR and prostaglandin for estrous synchronization in reindeer cows resulted in radiotelemetry identification of mating in 5 cows while endocrine profiles indicated 10 of 11 cows conceived during a one week harem period.

Impact: Successful reproduction in herds of ruminant animals produced on farms in Alaska is paramount for the establishment of livestock production in the north and the economic viability and sustainability of Alaska livestock production enterprises. Results of these studies demonstrate the effectiveness of reproductive management technologies and techniques that can be used to improve reproductive efficiency on Alaskan livestock farms and ranches. Demonstrating the effectiveness of applying reproductive management techniques to diversified livestock provides the farmer low-cost tools without risking private stock. Not all technologies translate equally well from traditional livestock to more exotic species and our ability to identify those that are effective under Alaskan conditions enhances the producers ability to maximize productivity, and hence profits. The market value of the offspring (~$5000/muskox; $1500/reindeer) is a significant portion of the income generated by the Alaskan diversified livestock industry. Synchronizing and timing estrus results in highly synchronized, predictable calving, reducing costly labor, and maximizing calf survival. Enhanced understanding of reproductive biology and reproductive management of reindeer and musk ox will enhance the productive capacity of these animals and the sustainability of enterprises producing these northern latitude adapted species in Alaska.

Source of Federal Funds: Hatch General and Hatch Multistate
USDA Special Grants
Scope of Impact: Multistate

<u>Spatially Modeling the Distribution of Beef Cattle and Reindeer on Ranges at High Latitudes</u>

Alaska imports more than 90 percent of its food supply, including most red meat. With the current market structure, imported food is generally less expensive than Alaskan-grown food. This is principally caused by a lack of marketing and distribution infrastructures since existing ranching enterprises cannot support processing, distribution, and marketing investments. Much effort and research is currently being devoted to increasing production of meat animals, thereby stimulating economic development in Alaska.

Accomplishments: **(ALK-03-03)** Over 84 days from January through March, 2004 we collected data on 50 temperature sensors placed in cattle distribution pastures. Utilizing the collected data, we constructed a thermal map of the study area through interpolation and principal component analysis. The first component delineated the overall temperature response as it related to spatial arrangement. We then obtained aerial

imagery of the area using a tethered blimp camera arrangement and produced a mosaic of the area. Software development for the model proceeded rapidly. New routines were for KRESS, our multi-criteria evaluation modeling software. Multistate modeling and software development research with Oregon State University and UC Davis is continuing and near completion. Latest efforts are focused on a technical manual to accompany release of the program to selected 'beta' testers. Data collection for a related reindeer project has begun and formal collection will begin in April 2005.

Impact: We expect that Alaskan livestock managers will be able to use the final animal distribution model to more effectively and efficiently manage their livestock. Through this increased efficiency, livestock producers will be able to develop strategies to allow animals to more effectively use landscape thermal patterns, thereby increasing animal weight gain and decreasing feed costs especially during the winter. The Alaskan livestock industry should prosper from this effect and grow to better provide for the needs of the growing state population. Through the use of the Alaskan animal distribution modeler, livestock impacts induced grazing and trampling will be mitigated and transferred to areas of the landscape that can better recover from their effects. This will protect the land base from degradation and decreased yields in the future thus leading to a more sustainable livestock production system. Management efforts to control erosion and point source pollution of waterways and riparian corridors caused by livestock can be modeled to predict the effects from these actions. This will lead to reduce environmental liability and lessen the chances of litigation by citizens concerned with the ecological health of the watersheds.

Source of Federal Funds:	Hatch General
	USDA Special Grant
Scope of Impact:	Multistate

<u>The effects of compaction during baling, color of plastic wrap, and preservatives on the quality of haylage in Alaska (New Project)</u>

Most years, hay producers do not have sufficient dry weather to produce good quality hay. The production of fermented hay (haylage) is a viable solution that has not been investigated in Alaska. Haylage was baled using different levels of compaction, colors of plastic wrap, and with or without preservative. One year's data was collected and is quality analysis is being carried out.

<u>Feasibility of Intensively Raised Reindeer Utilizing Grazed Forages and Alaskan Produced Feed Ingredients</u>

Impact: (**ALK-98-07**) This project terminated in 2004 and provided critical information on locally produced feed that could potentially replace imported high protein feeds (soybean meal). A palatable, digestible, and relatively inexpensive reindeer diet was developed using barley, brome hay, and fishmeal. The feed cost of Alaska produced feed rations ranged from $266 to $283 per metric ton compared to $446 per metric ton for a ration made from components shipped into the state. One local producer reduced his feed costs by half using the diet formulations developed by this project.

Feed and Forage to Optimize Reindeer Production and Meat Quality
(New Project)

Accomplishments: **(ALK-04-07)** In the first year of this project, we initiated the layout of a long-term pasture including fence construction and pasture development. Three 100 m x 100 m pens were constructed along with a combination of gates and raceways to allow movement of animals from one pen to another and to a handling facility where they could be weighed and sampled. Fifteen male reindeer were set aside for a long-term pasture study.

Impact: A palatable, digestible, and relatively inexpensive reindeer diet was developed using barley, brome hay and fishmeal, feedstuffs readily available in Alaska. Female reindeer readily consumed this diet while exhibiting good weight gain and reproduction. Using barley as the main energy source in a diet for reindeer in Alaska is desirable due to its relatively low cost and availability ($153 US/metric ton; Delta Farmers Co-operative, 2003). Smooth brome grass (Bromus inermis) is successfully grown on rotational croplands in Alaska and was used as a fiber source in the reindeer diet. In Alaska, fishmeal can often be priced competitively with soybean meal on a unit-protein basis ($0.71 per unit protein of soybean meal compared to $0.70 per unit protein of whitefish meal purchased in Fairbanks, AK). All components necessary to manufacture a balanced reindeer ration could be purchased from local producers and feed stores at a cost of $266.84US/metric ton for a maintenance diet and $283.29US/metric ton for a growth diet. Comparatively, a reindeer ration using components shipped into Alaska was available commercially in Anchorage, AK at a cost of $ 445.85 US/metric ton. Feed costs for reindeer can be greatly reduced if producers can mix their own rations using locally available feedstuffs. Reindeer fed a diet made from locally grown components exhibited good production. A local reindeer producer reduced his feed costs in half by using the diet formulations developed by this project.

Mineral Flux in Reindeer Animal Health

Accomplishments: **(ALK-03-07)** The bioaccumulation of trace metals, particularly Hg, in tissues of animals produced as human food is important for both the health of the animal and the people that consume them. Mercury can enter the animal through consumption of lichen in free ranging deer as well as fishmeal as a by product of the fishing industry. In hair samples from free-ranging deer, we found 45.5 ng Hg/g and 19.0 ng Hg/g in fishmeal fed deer. These results show that bioaccumulation of Hg in both feed sources is well below levels considered a human health risk.

Impact: A diet using fishmeal as the protein source is being developed at the University of Alaska Fairbanks. It is important to determine for both health of the animal and human consumers if reindeer tissue is accumulating mercury from the fishmeal. The results of this experiment suggest mercury levels in reindeer tissue fed fishmeal are well below levels believed to be a health concern and are lower than levels found in free-range animals.

Food Product Development

The Alaska Reindeer industry in Alaska seeks to provide a stable meat supply and economic development for rural communities. The goal of this project is to provide Seward Peninsula reindeer producers the information needed to produce and deliver high quality reindeer meat products to national and international markets on a year-round basis.

Accomplishments: A field slaughter was conducted using reindeer from the Larry Davis herd near Nome in February 2004. Twenty-six animals were harvested and the forequarter was hot processed in the field and packed in plastic lined wax boxes to freeze at ambient temperature. The boxed meat was shipped to the SFOS Fishery Industrial Technology Center on Kodiak Island where it was processed (ground, sliced, or cubed) frozen. It was then vacuumed-packed and transported to Fairbanks where it will undergo sensory panel evaluation of meat quality.

Impact: This research has demonstrated that reindeer meat has a good nutritional profile with low fat content, favorable fatty acid composition, and high content of vitamin E. This high quality meat is also very tender and has specific flavor attributes, which make it attractive to consumers and gourmet chefs. We will provide Alaska reindeer producers with information to develop an operational plan that will enable them to meet the demand of upscale markets and consumers. Results of a triangle sensory evaluation of reindeer meat (AFES and CES cooperating) indicates that consumers can identify a difference between reindeer fed two different feed rations.

Educational Outreach: The reindeer educational outreach program is designed to augment school curricula by using reindeer as a platform to integrate region-specific information and knowledge with conventional disciplines of math, science and geography. This ongoing program provided educational and vocational outreach to educators, students, and community members in Fairbanks and Nome. Information and lesson plans have been added to the reindeer curriculum, which has been formatted for publication in print and online. Demand for both the reindeer curriculum and presentations have increased and teacher and student satisfaction remains high.

Source of Federal Funding: Hatch General
Hatch Animal Health
USDA Special Grants
Scope of Impact: Alaska Specific

Key Theme: Forest Products

Forest Stand Characterization and Growth and Yield for Alaskan Northern Forest

Credible data and information are critical requirements for responsible forest management decision-making and financial investment. Much growth and yield data, currently available, are suspect, inadequate, or insufficiently precise. Goals are to

quantify tree fiber production of Alaskan Northern Forest lands and to provide resource managers with appropriate equations, tables, and graphs essential for basic, state-of-the-art forest resource management decision-making and stand prescriptions.

Accomplishments: (**ALK-03-12**) In 2004, we completed a compendium of Alaska Northern Forest research projects on CD for distribution to the Joint International Canadian Institute of Forestry/Society of American Foresters meeting in Edmonton, Alberta. Site Index (ongoing): Published and presented polymorphic aspen site index curves along with good progress in expanding the network of permanent sample plots. Paper was revised for regional journal. Black spruce curves were completed as part of M. Sc. Thesis. Levels of Growing Stocks (LOGS): Initiated in 1986 with plantations at Bonanza Creek and Tok. The purpose of this study is to determine the effect of initial escapement or spacing on crop tree growth. 18-year height and diameter data on white spruce at Bonanza Creek was summarized along with white and black spruce, tamarack, and lodgepole pine tree height data. Escapement Effects on White Spruce: Knowing escapement-tree diameter relationships addresses economics (planting cost) and early wood quality, and early growth (essential for forest stand prediction models). Using data from1071 black spruce and 2024 white spruce, determined and verified bark equation. Phytochemicals: Alaska Forestry refinery Inc. venture capital pursuit continues; Alaska birch samples from five sites were evaluated for betulin and related chemicals and results indicated that three species had higher levels of betulin and betulinic acid than what is found in eastern U.S. Northern Forest Productivity: We developed site index curves from height-over-age measurements. Site index equations and curves permit objective assessment of site productivity for each species and allows ranking for management and investment purposes. A spinoff from the ongoing ethanol project identified other non-timber forest products (NTFP) from foliage, bark, wood, and sap with chemical, pharmaceutical, and food product potential as well as niche market possibilities for Alaska Natives.

Impact: Alaska Northern Forest Cooperative already is benefiting forest resource owners and managers through dialogue, collaboration, and the draft research compendium. Site Index curves will be used to better manage forestland, e.g., compare land for fiber production & investment purposes, prepare stand prescriptions for habitat, estimate biomass & carbon sequestration. LOGS plantations relate empirical height/diameter to trees/acre; thus, help managers make cost effective prescriptions for planting, natural regeneration, and spacing. Early Height Growth data is critical to improve stand growth model accuracy and predict time for seedlings to reach breast height & free-to-grow status. In addition to fiber yield, PSPs provide data on stand composition, structure, and succession, important for forest management and ecological modeling. Accurate cubic-foot Tree Volume Equations are critical tools for predicting stand volume (total & commercial), biomass, standing fuel, and carbon sequestration. Sale of small trees and slash for Phytochemicals can offset management activities and even provide a profit and improve local economies. Forest Resource Management Community Types will standardize land classification and prescription development and improvement forest resource management, reduce critical mistakes, and improve economic decision-making. Soils information complements the community type data set and identifies soils limiting

factors and treatment hazards. Both soils and community types expand the ecologic knowledge of the Northern Forest.

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

Scope of Impact: Alaska Specific

GOAL 4: Greater harmony between agriculture and the environment.

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

Overview: Alaska is faced with an economic need to develop its renewable and non-renewable resources to contribute to the well being of our citizens. At the same time, we must also conserve the ecological integrity and biodiversity of the landscape. A significant portion of SNRAS/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. Hatch and McIntire-Stennis projects under this goal address these issues.

Expenditures:

Hatch General:	$153,139
Hatch Multistate:	$107,696
McIntire-Stennis:	$390,519
State Matching:	$774,813
Total FTE (SY)	7.9

PLANNED PROGRAMS

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

Black Spruce Forest Soils in Boreal Regions of Alaska: Their Characterization, Organic Carbon Pool and Relationship to Forest Management

Accomplishments: (**ALK-03-02)** Very little information exists regarding the characteristics of soils associated with black spruce and a great need exists for a soils information baseline for modeling climate change, boreal forest management, and future soil inventory. An understanding of black spruce dominated sites is important for both ecological modeling and for land management. Alaska black spruce forest soils are poorly described**;** some have never been described. The physical environment and properties of soils formed under black spruce in the boreal region of Alaska were investigated. The study sites were selected to be associated with existing Permanent Sampling Plots and Site Index plots of the on going Growth and Yield Program in the Forest Science Department. Since the beginning of the project 33 soil pits have been sampled on nearly all segments of the landform including ridge tops, shoulder slopes, back slopes and flood plains. The dominant exposure on back slopes is north where the soils are cold and often with permafrost. The thickness of the organic horizon ranged from 10 to 18 cm in well-drained soils and >30 cm in poorly drained sites. Distribution of black spruce roots is mainly in the organic and upper mineral horizons. The limiting factor to rooting depth is not drainage but restricting layers such as bedrock. Generally the midslope sites have the highest productivity because of the optimum soil moisture and temperatures.

Impact: Contrary to the commonly believed idea that black spruce only grows in cold wet sites, this study found that black spruce grows on almost all landforms in interior Alaska and on soils with a wide range of properties. Thus management practices may be considered in the optimum sites. Soils associated with black spruce forest have never been fully characterized. This study will provide the first data set of the soil properties in black spruce forest. The soil properties will be used to interpret the factors affecting the forest growth and yield and also help to establish forest management guidelines.

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

Scope of Impact: Multistate

<u>Soil Carbon Balance and Nitrogen Dynamics Following Disturbance by Wildfire and Logging in Interior Alaskan Forests</u>

Because boreal forest soils constitute a huge reservoir of carbon, a clearer understanding of the responses of boreal forest soil respiration to disturbance will be critical to successfully assessing its likely future role in atmospheric carbon balance. The expanding role of forestry in Alaska and in the circumpolar north requires a clearer understanding of the responses of boreal forest floor microbial dynamics to disturbance is a key to sustaining productivity over the long term.

Accomplishments: The objectives of this project is to examine the impacts on soil respiration and nutrient dynamics of two disturbance agents in interior Alaska forests: fire, currently the dominant stand initiating disturbance and logging, which currently is of little importance by any measure. During the summer of 2004, we obtained our first full season of respiration measurements using root exclosures in three replicate pairs of transects in the 2001 Survey Line fire area along the Tanana River. This allowed us to

separate the major components of respiration, autotrophic (roots) from heterotrophic (microbial decomposition) to determine how fire changes microbial activity. This provided the clearest evidence to date that post-fire soils experience an overall decrease in microbial respiration. In 2004, that decrease was approximately 22 % of unburned heterotrophic respiration rates and indicated that although total C loss following fire is higher than before owing to lack of photosynthesis, that total C loss is mitigated by slowed decomposition. Wildfires consumed nearly 2.7 million ha of the boreal forest of the eastern Interior in 2004 and allowed opportunity for establishment of wildfire research sites. We are collaborating with researchers associated with the NSF-funded Bonanza Creek Long Term Ecological Research (LTER) project to sample a network of recently burned sites.

Impact: The real impacts of this project will accrue primarily to the public via management agencies, such as Alaska's Department of Natural Resources (especially Division of Forestry and Division of Lands). Projects designed to sequester carbon and sell credit for it are increasing in number. To work in Alaska, any such scheme must be based on a clear understanding of and accounting for the future role of Alaska's boreal forest soils in sequestering or releasing carbon under changing disturbance regimes. This project, in concert with other related projects at UAF, will help provide that understanding.

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

Scope of Impact: Alaska Specific

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

A total understanding of the interaction between the environmental dynamics that regulate forest growth at the landscape scale in interior Alaska is just starting to develop. The purpose of this study is to develop a computer model on the functional aspects of forest ecosystem dynamics at a broad landscape scale in interior Alaska.

Accomplishments: (**ALK-01-01**) Analysis of seven major long-term studies on tree growth dynamics performed in interior Alaska over a 35 year period has been completed. These involved N, P, and K fertilization studies of aspen, birch, and white spruce, an environmental monitoring study of black spruce, and a soil amendment and drought study on treatment effects at key successional turning points in both upland and floodplain successional sequences (LTER sites). The primary results of the studies reported last year, included new knowledge on stand level dynamics, species level dynamics, and landscape level dynamics. At the stand level, young aspen stands were nutrient limited but this limitation decreased as the stand aged. The birch stands did not show a nutrient limitation. White spruce only showed a nutrient response for two years. However, the combination of thinning and fertilization resulted in growth increases for up to 28 years. Sugar and sawdust soil amendments resulted in growth reductions for the first two years after application. Drought treatments resulted in growth decreases even on flood plain sites. The complexity of ecosystem dynamics across the landscape is related to a differential structure and interaction of the process limiting factors. This "law of the minimum" simply stated implies that no single factor (nutrient level, water availability,

etc.) determines site productivity. We found even a change in amplitude of a limiting factor (thinning a stand) will affect the response to other factors of production.

Impacts: The climatic and nutritional controls of forest growth in interior Alaska are starting to become clear. These studies will help us to understand the state factor structure of the major controls for forest growth and ecosystem function. An understanding of the structure of the major controls of forest growth will give us an enhanced ability to predict the consequences of forest management activities prior to harvest on the growth of trees within the stand. The models developed from these studies will also allow for better predictions of the effects of climate change on the functioning of forest ecosystems in interior Alaska.

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

Scope of Impact: Alaska Specific

Key Theme: Reclamation and revegetation of disturbed lands

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

Accomplishments: (**ALK-00-02, WCC-021**) Revegetation success can be improved by mimicking natural processes both above- and below-ground. Symbioses among plant roots and certain beneficial fungi will be assessed in disturbances on deglaciated sites, floodplains, and mined sites to determine whether there are sufficient commonalities in these communities in southcentral and interior Alaska that a common revegetation strategy could be developed or whether different strategies will be needed for each site. Roots and soil/litter cores were collected from three locations in 2003 and 2004 from the Exit Glacier in Kenai Fjords National Park. To date, at least one EM fungal species (Cenococcum) has been found at there and at other sites in Interior Alaska. At Exit Glacier, high water levels resulting from the unusually warm weather prevented sampling from the same areas as previous years. We were therefore unable to further confirm our earlier hypothesis that a common EM inoculum can be developed for use across latitudes. We sampled the hillside; however, since we had not sampled the area before and will that data will require further evaluation.

Impact:

As data on ectomycorrhizal (EM) colonization are accumulated across the various sites, we are assessing differences and similarities among the EM communities at various latitudes within Alaska. The EMF communities analyzed so far appear different, largely as a result of different plant communities. Some EMF species do appear in common through at least some of these communities. This will allow us to consider whether a common inoculum can be used throughout the state or whether the latitude of origin needs to be considered, as it does for seeds. Development of a common EM inoculum could provide a low-cost and environmentally friendlier substitute for use of chemical fertilizers to supply certain required nutrients, particularly phosphorus and micronutrients

in the reclamation of disturbed lands. Benefits of a latitudinal source of inoculum is being tested in another study. To date, it appears the inoculum source does make a difference, but it may be site characteristics (chemical, biological), rather than latitude that makes a difference - at least with the data collected so far.

Impacts: Source of Federal Funds: McIntire-Stennis

Scope of Impact: Multistate

Key Theme: Plant Disease Control/Biocontrol

Managing Plant-Microbe Interactions in Soil to Promote Sustainable Agriculture

Accomplishments: (**ALK-94-01, W-1147**) ALK-94-01 terminated in 2004; however, this research continues under the aegis of W-1147. Biological control agents are under study to improve the understanding of the underlying mechanism of mycoparasitism that affect plant pathogens. We investigated host improvement through the use of molecular markers in potatoes to identify genes associated with disease resistance. Over 17 years, this research has shown that *Trichoderma atroviride* is a cold tolerant, versatile, aggressive hyperparasite that can parasitize a wide spectrum of pathogenic fungi including *B. cinerea, P. erythroseptica, P. infestans and R. solani.* A coordinated biochemical response has been observed in *T. atroviride* during biocontrol of plant pathogenic fungi. We found production of fungal cell wall enzymes play an important role in hyperparasitism involved in the suppression of diseases.

Impact: Economically important crops such as potato have been grown for many years using chemical fungicides. However, the development of fungicide-resistant strains of pathogens and the increasing awareness of the adverse ******

With a diminishing number of means to control disease, growers are seeking alternatives that are both safe and effective. 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. The expectation of our research is to reduce the dependency of chemical fungicides in the control of plant diseases through the development of superior biological control agents and disease resistant varieties. T. atroviride is environmentally benign and safe to humans and animals.

Source of Federal Funding: Hatch Multistate

Scope of Impact: Multistate

Key Theme: Soil Health and Sustainable Agriculture

Yield and quality of barley and bromegrass as affected by zero/minimum tillage, fertilizer rate, and cutting regimes

Accomplishments: The long-term tillage research has been conducted for 21 years at Delta Junction. Soil samples (0-5 cm, 5-10 cm, 10-25 cm, and 25-45 cm) from no-till, minimum till, and conventional till with and without straw and two N treatments were analyzed for available and total nutrient (N, P, K) organic carbon, Eh, and pH. No-till resulted in increased soil C in the 0-5 cm depth only. Straw retention had no effect on organic C; however, N application with no-till resulted in increased yield. Unlike similar studies at lower latitudes, straw residue and N application had little effect on soil C or barley yield and tillage had a lesser effect over a longer period of time. This observation is likely the result of the short growing season and cold, dry climate and year round winds decreasing decomposition rate of residue on the soil surface and incorporated in the soil. New field experiments on bromegrass hay yield and quality responsive to N rate (0, 50, and 150 kg/ha) and cutting frequency (one and two cuts) was initiated at the Fairbanks Experiment Farm. However, yield and quality data is not yet available.

Impact: The results of a 21-year tillage study provide guidelines for soil conservation practices for reduced soil loss from wind erosion, quantitatively measured C sequestration, and provides an estimation of mineralizable N and subsequent improvements in N use efficiency. The findings from this study confirm improved soil health and quality is correlated with less tillage disturbance in the surface; however, minimum tillage comes with a sacrifice in grain production in interior Alaska.

Key Theme: Forest Protection

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

Accomplishments: (**ALK-99-02**) The influence of pre-fire (1986) vegetation and topographic variables (slope, aspect, and elevation) on burn severity and effects of burn severity on post-fire vegetation recovery (2002) was conducted on a 17,000 ha burn. A chronosequence of Landsat TM and ETM+ images was analyzed to estimate vegetation recovery. Burn severity was strongly controlled by vegetation type with needleleaf forests experiencing much higher burn severity than broadleaf forests, shrubs, and woodlands. Vegetation peaked 8-14 years post-fire and recovery was highest for areas with the highest burn severity. Topography had less influence on recovery than did burn severity. Self-replacement of existing vegetation type was common particularly in moderate burn severity areas. However, shifts between needleleaf and broadleaf was rare. In general, the area shifted toward an open needleleaf woodland and shrubland. This project terminated in 2004 and results have been submitted as a manuscript “Influence of vegetation type and topography on burn severity in interior Alaska” to the Canadian Journal of Forest Research.

Impact: The spatial and temporal variability of wildland fires in Alaska influences landscape dynamics and is critical toward understanding the mosaic nature of the interior region. Variability in burn severity creates differences in substrate and seedbed quality, which leads to the differential germination and survival of boreal forest species. This research demonstrated that areas vegetated with spruce forest experienced higher burn severity than broadleaf forests and unforested areas. Moreover, this pattern was density dependent, with increasing density resulting in increasing burn severity. The results supports the hypothesis that broadleaf patches can act as fire breaks on the landscape.

Assessment of the MODIS leaf area index product in Alaska

Accomplishments: We evaluated the 2002 MODIS leaf area index product by comparing the pattern of leaf area values during the spring greenup period and by examining the leaf area values across an elevational and latitudinal gradient. The positional accuracy of the product was assessed by comparing the locations of recent wildfire burns with the leaf area images. We found that leaf area estimates that were too high in some areas of Alaska (i.e. foothills of the Alaska range and some tundra locations in the Arctic. We determined the reason for these high estimates was due to the algorithim being dependent on biome land cover maps that are not accurate in Alaska and also due to high near infrared reflectance from broadleaf shrub and forest communities in the boreal forest and tundra of Alaska. **A summary of this research "Assessment of the MODIS Leaf Area Index Product in Alaska" will be published in the International Journal of Remote Sensing in 2005.**

Impact: Accurate estimates of forest leaf area are important for assessing forest damage by insects, wildfire danger, and forest productivity and carbon dynamics. This is the first research that investigated the validity of the MODIS leaf area estimates at high latitudes. Because there are several significant problems with this product, and therefore it may overestimate leaf area in Alaska, it should be used with caution in terrestrial ecosystem modeling.

Source of Federal Funds: McIntire-Stennis formula funds

Scope of Impact: Alaska Specific

Key Theme: Forest Ecosystems and Biological Conservation and Diversity

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

Accomplishments: (**ALK-01-08**) The response of boreal forest diversity to climate change was assessed on a global basis. We looked at genetic diversity, species diversity, and landscape or ecological diversity. The boreal forest is characterized by a limited number of species of larch, spruce, pine, fir, birch, and poplar, which have transcontinental distribution across Eurasia and North America. Boreal genetic diversity

is spread among vast numbers of the few tree species and reflecting many genotypes with specific adaptations to local environments that promote the survival of the species. A principal risk for the boreal forest from climate change is that major portions of the current distribution of tree species might become climatically unsuitable for their survival. Trees might die from fire and insects much faster than populations of the species could migrate, resulting in the loss of many adaptive genes. We found that some elements of the record of recent boreal forest disturbance are consistent with evidence of necessary to establish a specific climate warming effect on disturbance. Indexed tree growth *vs* climate relationships have been developed for white spruce and black spruce for five climate scenarios. Several black spruce populations are showing negative effects of summer warming on growth.

Impacts: These results highlight the importance of both regional scale investigations of climate variability influences on biodiversity and syntheses. Because boreal forests contain lower numbers of species overall than temperate and tropical forests, they have generally not been rated as a high priority for biodiversity-sustaining practices in management and for conservation. However these new insights suggest that regional centers of boreal species diversity do exist and are important. Perhaps even more significant, genetic diversity appears to be very high in boreal forest tree species. As a result, rather than looking at biodiversity as being low in boreal forests, it may be more useful to further examine whether there are compensatory relationships between the different forms of diversity, so that while species diversity is low, genetic diversity is high and provides the principal form of adaptation to a diverse and changing environment. Because much of the species diversity in boreal forests can be found in older forests that are declining in both management and as a result of climate-related insect disturbance and fire, specific management attention is needed to sustain older boreal conifer ecosystems.

Source of Federal Funds: McIntire-Stennis and NSF Funds

Scope of Impact: Alaska Specific

Key Theme: Forest Management and Harvest

Stream Temperature Response to Timber Harvest Activities in Interior Alaska

Accomplishments: (**ALK-99-06**) A comprehensive annotated literature review has been compiled on ice thickness and ice-bridges. Freeze-thaw models have helped make a general recommendation that water depth be greater than 2 m for ice bridge sites and that upwelling areas be avoided. Literature review, modeling work, and stream water temperature data indicate a strong association between air temperature and water temperature for mid-sized to large streams. It also shows a systematic increase in temperature longitudinally from headwaters to mouth for small streams exposed to direct solar radiation. Work with the SNTEMP and SSTEMP models is continuing. Our work showed little increase in stream temperature directly related to effect of timber harvest on watershed substrate heating due to the high latent heat of fusion and heat of vaporization

relative to the specific heat of soil and regolith. However, the permafrost table is likely to be lowered, the rate of seasonal frost-thawing increased, and the maximum depth of seasonal frost decreased. This effect may be most pronounced during the second and subsequent years after harvest.

Impact: Information gained to date has contributed to the development and passage of revised riparian management standards for interior Alaska and influenced on-going discussions of standards for southcentral Alaska. Information was provided to the Science and Technology Committee of the AKDNR-DOF for their review of Region II, southcentral Alaska riparian standards. Also the techniques and models developed in this project related to soil freezing and thawing may contribute to the assessment of climate change effects on the allowable number of oil-industry workdays on the tundra of Alaska's north slope. The allowable workdays are limited by thresholds of snow cover and depth and the soil frost in fall and spring.

Source of Federal Funds: McIntire-Stennis Funds

Scope of Impact: Alaska Specific

Key Theme: Multi-Resources Planning and Policy

Assessing the Resource Planning Process in Alaska (Terminated 2002)

Impact: The Public Planning Directory is a useful resource that describes the planning agencies, their mandates, areas of expertise, and contact information. This research is used to help agencies and the public in forming more effective negotiating teams for public lands and public resources. The goal was to increase effectiveness of planning projects by developing plans that are created by a fair and cost-effective process based on the best available scientific data for sustainable natural resource use.

Innovative Methods of Involving the Public in Environmental Decisions (New Project)

Accomplishments: **(ALK-02-07)** Most agencies tend to use methods of involving the public that were developed over 30 years ago; i.e. public meetings, open houses, and public hearings. Is this because these techniques are the most effective, or is it because they are just the most familiar? This project will increase the level of awareness of new public involvement techniques as well as their advantages and disadvantages. A detailed case study of the Alagnak Wild River Management Plan was initiated in 2003. Among the questions asked included: What level and type of use is appropriate and consistent with the purpose for which the river was designated under the Wild and Scenic Rivers Act? A web site is currently being designed that will provide information and accept public comments in the draft plan. The reaction of both agency staff and the public to the use of a website as a means of gathering public comment is being compiled. Public involvement was begun officially in April 2004.

Impact: The Alagnak Wild River is one of 156 Wild or Wild and Scenic Rivers in the US, 25 of which are in Alaska. An interdisciplinary team was established to develop alternatives for management of the river based on prior and new public meetings and written comments. Plan completion is scheduled for 2005. The National Park Service will use the plan to guide the management and use of the popular river corridor.

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:

Alaskans need assistance in removing barriers that limit their success and enhance their economic wellbeing. Research, extension, and education opportunities provided by the School of Natural Resources and Agricultural Sciences, 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.

Expenditures:

Hatch General:	$34,731
Hatch Multistate:	None
McIntire-Stennis:	None
State Matching:	$47,286
FTE (SY)	0.7

PLANNED PROGRAMS

Key Theme: Development of Regional Economic Models for Rural Alaska

Impact Analysis for Alaska Natural Resources

Because of shifting needs and the diversity of rural economic markets, impact analyses addressed under this project have, by necessity, also shifted. We added the Alaska snow crab impact analysis in 2002 then scaled it back in 2003 after withdrawal of the processors. The scope of the overall project was revised again in 2003 to include an additional study of an investigation of opportunities for the state of Alaska to participate in the emerging market for carbon credits.

Accomplishments: (**ALK-01-10, WCC 109**) In 2004 we completed the Alaska snow crab impact analysis. There are two analytical parts to the study, which are integrated into one combined model. The first part is the construction of an international snow crab supply and demand model that examines the relationship between snow crab harvests, prices and revenue. The second part of the study is the construction of a regional model that is focused on the economic linkages between the Alaska snow crab industry and the regional economies of Southwest Alaska, the state of Alaska, King County and the state of Washington. We were able to garner a minimum amount of data from harvesters, catcher processors, and shore-based processors to construct a starting point regional model. Final reports were submitted to the Alaska Department of Fish and Game and the Cooperative Institute for Arctic Research.

A second revised objective dealing with opportunities for Alaska in the carbon credit market was initiated in 2003/2004. This market has developed as carbon sequestration and carbon offsets have assumed a more prominent role as prescriptive remedies for global climate change. The study addresses climate change and the impact to Alaska lands and peoples, the markets for greenhouse emissions, the mechanisms for earning credits, and determinants for the price of credits. The opportunity to the state involved offsetting consumption of diesel fuel in rural village generators used for heating and electricity with wood and other alternative energy sources. We performed a case study with three Alaska villages : Dot Lake, McGrath, and Kotzebue (a city currently offsetting a significant portion of their diesel with 10 wind turbines. The amount of emissions saved from not burning diesel could potentially earn credits that would be sold on the carbon market.

Impact: This model offers the single best source to date for the linkages between snow crab harvesting and other industries present in Kodiak, Unalaska/Dutch Harbor, Seattle and St. Paul. A cautious approach, due to data deficiencies can be useful until a similar framework is furnished with more robust data. The snow crab supply and demand market model will be useful as the new management program contains a price arbitration component. Specific results from the model based on the 1999 season simulated exvessel revenue responses to changes in harvests. The combined effects of 2002 harvests resulted in $21,892,161 in additional expenditures spread throughout Kodiak, Unalaska, King County, and St. Paul. The cumulative effects of respending by backward linked industries and the households they employ generates up to $34,360,282, or $13,040,106 worth of additional economic activity. The use of wood to offset diesel offers several benefits to the state: communities in forested areas could use their own resource, it is cheap and less price volatile than oil, transportation and storage is environmentally safe, it could be implemented in conjunction with the states firewise programs to remove potentially

hazardous timber fuel surrounding communities, and local labor and resources are used, rather than imported oil. In 2004 the state legislature passed a bill directing the AK Department of Natural Resources (DNR) to investigate the potential of carbon markets. This study, in close cooperation with DNR, provides primary information necessary for meeting this legislative mandate.

Source of Federal Funds: Hatch General, Hatch Multistate

Scope of Impact: Multistate and Alaska Specific

Total Expenditures (All Goals)

Hatch General:	$798,991
Hatch Multistate:	$140,223
McIntire-Stennis:	$495,283
State Matching:	$1,555,269
FTE (SY):	15.6

Stakeholder Input Process

The following actions have been taken since the inception of the AREERA requirements to seek stakeholder input and participation in the research planning process for projects funded by Hatch, Hatch Multistate, and McIntire-Stennis federal formula funds.

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

- An abbreviated version of the input survey was made available in hard copy at various stakeholder-attended meetings around the state in 2001, 2002, 2003, and 2004. These meetings were attended by the Director and/or Associate 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 13, 2003 (Attendance ~ 48)
  2) The 2003 Alaska Ag Symposium November 14-15, 2003 (Attendance ~100)
  3) Greenhouse and Nursery Conference February 26-27, 2004 (Attendance ~80)

4) Potato and Vegetable Growers Conference March 9-10, 2004 (Attendance ~ 100+)

- In 2001, results of the surveys are presented to the SNRAS/AFES Board of Advisors for use in their program assessment and recommendation process and continue to be reported at semi-annual Board meetings. Board of Advisors meetings were held March 29-30, 2001, October 25-26, 2001, May 1-2, 2002, November 21-22, 2002, April 16, 2003, December 4-5, 2003, April, 2004, and October 27-28, 2004. The participation of the B of A in the stakeholder input process included gaining input from stakeholders that individual B of A members represent.

Results of stakeholder input processes are presented to SNRAS/AFES faculty annually. The outcome of the Expert Advisory session, stakeholder inputs, and a summary of AREERA requirements were presented at a faculty retreat in February 2002 and 2003 for the purpose of developing a new Strategic Plan for the School. The first draft of the new Strategic Plan was presented to our Board of Advisors at their November 2002 meeting. The new Strategic Plan ("Working for Alaskans: A Wealth of Knowledge", Strategic Plan 2004)) was adopted by the faculty and the Board of Advisors in 2003 and published in 2004.

We also initiated a process in 2004 to develop a Matanuska Experiment Farm Master Plan.

Stakeholder Input: Open House November 8, 2004. Fifty-five community participants attended and we received over 25 written comments.

Program Review Process

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

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

Evaluation of the Success of Multi and Joint Activities

Alaska participates in the following multistate research and coordinating committees:

W-1147: Managing Plant-Microbe Interactions in Soil to Promote Sustainable Agriculture
W-112: Reproductive Performance in Domestic Ruminants
W-192: Rural Communities and Public Lands in the West: Impacts and Alternatives
NC-218: Assessing Soil N Availability in Regional Corn Cropping Systems
4-NRSP/IR4: A National Agricultural Program to Clear Pest Control Agents for Minor Uses.
NCR –101: Controlled Environment Technology and Uses
WCC-021: Revegetation and Stabilization of Deteriorated and Altered Lands
WCC-093: Western Region Soil Survey and Inventory

Stakeholder inputs have questioned the importance of multistate research to Alaska's needs. Specifically they point out the relative development of Alaska agriculture compared to most western states. Unlike other small population states in the west such as Wyoming, Alaska has no nearby markets in other more populated states. This coupled with extreme differences in environmental and economic climate found in other states has been a factor in Alaska's limited participation in multistate research. Many of the multistate technical committees do not address the range of research our faculty is pursuing. Exceptions include W-112, W-192, and W-1147. However, the relative isolation of our faculty would argue for more collaboration with scientists from other regions. A clear example is our controlled environment horticulturist. Through involvement in NCR-101, she has developed collaborative projects with Cornell University and University of Minnesota which has led to funding opportunities that were not previously available to her. We will encourage our scientists, particularly young faculty to pursue multistate opportunities.

W-112:

Estrous synchronization and AI.

Characterization of the endocrine physiology of reindeer and muskox plus estrous synchronization protocols were evaluated to enhance management of pregnant animals and survivability of newborn calves.

Progesterone containing CIDRs promoted early formation of a functional CL in heifers and cows, but ovulation inducing treatments (i.e. GnRH, ECP) did not further improve reproductive performance. Pregnancy rates were approximately 20% greater in heifers whose estrous cycles were synchronized using a combined CIDR-prostaglandin protocol than a MGA-prostagandin protocol. Use of a CIDR in an estrous synchronization protocol for natural mating of postpartum anestrous cows tended to reduce the number of days postpartum for cows to become pregnant compared to a single injection of prostaglandin. However, benefits of the CIDR treatment were lost due to early embryonic losses.

Cows with a short proestrus exhibited an increased incidence of short luteal phases, decreased concentrations of progesterone during diestrus, and lower conception rates to either AI or embryo transfer. Estrus synchronization protocols need to optimize estrogen production by preovulatory follicles before ovulation is synchronized with GnRH.

Pregnancy detection and maintenance:

Pregnancy associated glycoproteins have a half life of 2.5 d at d 32 to 40 of pregnancy and may provide an alternative to transrectal ultrasonography for monitoring of late embryonic/fetal mortality.

A training manual for estrous synchronization of ruminants has been completed and is ready for electronic publication. This manual presents the pros and cons of various estrous synchronization protocols that have been developed and/or tested by participants in the W112 project. This manual will provide producers an easy-to-use guide on estrous synchronization, allowing them to make informed production decisions. The participants in the W112 project published over 60 refereed journal articles during the last reporting period, many of which were derived from collaborative efforts initiated through the W112 Regional Research Project

As Alaska producers begin to see direct results from multistate activities and have access to research finding from other states, we feel they will come around to acknowledge the importance of multistate participation by our scientists. Among the underserved populations that may benefit from multistate research are the Alaska Native reindeer herders in remote villages. One study being performed under the aegis of W-112 is related to the reindeer cow estrous activity and the impact of presence of male reindeer in that cycle. Research of this type is unique to this region and would not have been initiated without our participation in W-112. This program is also an Integrated Activity with Cooperative Extension. The member scientist has a joint 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-1147 (formerly W-147) continued in 2004. Through involvement with W-1147, resources and knowledge from multistate and multidisciplinary colleagues, Alaska has benefited many-fold over working alone and the multiplying factor continues to increase.

The following accomplishments and impacts were reported in the W-1147 SAES 422 annual report in 2004.

Goal 2: To understand how microbial populations and their gene expression are regulated by the biological (plants and microbes) and physical environment and how they influence disease. Intended outcome: Further understanding of the molecular basis of biological control mechanisms and the influence of the environment on the expression of these mechanisms.

Milestone: Characterize the molecular mechanisms by which T. atroviride controls plant pathogens. Over 17 years, this research has shown that *Trichoderma atroviride* is a cold tolerant, versatile, aggressive hyperparasite that can parasitize a wide spectrum of pathogenic fungi including *B. cinerea, P. erythroseptica, P. infestans and R. solani.* A coordinated biochemical response has been observed in *T. atroviride* during biocontrol of plant pathogenic fungi. We found production of fungal cell wall enzymes play an important role in hyperparasitism involved in the suppression of diseases.

Impact: We identified unique proteins in *T. atroviride* that were differentially expressed in association with *B. cinerea, P. erythroseptica, P. infestans and R. solani.*

W-192: The Alaska participant on this project has expertise in natural resource policy and law and holds a law degree. She is new to the project and will join the other members of the technical committee as they write the renewal proposal in 2005.

NC-218: The Alaska participant on this project is new but did attend the annual meeting and will be an active member in 2005.

Integrated Research and Extension Activities

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

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

The SNRAS/AFES Palmer Research Center in southcentral Alaska became the Palmer Research and Extension Center in 2001. In addition to housing two joint AFES/CES

faculty positions in horticulture, the Center also provided office facilities for the CES Fisheries and Natural Resources specialist and a Curriculum Coordinator. Our goal is to increase Integrated Activities to the AREERA target percentage.

Agronomic Crops and Soils

Integrated activities continue to address best management practices for production of livestock feed crops, primarily forages and small grains as well as investigating new crop opportunities. The lose of the joint AFES/CES Agronomy Specialist position seriously impacted this program. AFES researchers and CES agents continued collaborative work at Delta Junction, Fairbanks, Palmer, and the Kenai Peninsula. In cooperation with Extension resource development and land resource agents, we hosted a turfgrass field day for golf course superintendents in 2004. A cooperative on-site golf green cultivar demonstration trial was re-established at the Settler Bay Golf Course in 2004 and will be evaluated over the next two years.

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. The Agronomy Specialist position was replaced with a horticulture specialist (75% CES and 25% AFES) in 2004 and the individual in that position is participating in the Hatch project "Production Practices, Cultivars, and Disease of Potato and other Horticultural Crops". That project leader in cooperation with the AFES horticulture researcher at Palmer is evaluating: potato, lettuce, and cabbage variety and management trials, comparison of overhead and drip tape irrigation on vegetables, soil moisture monitoring in transplanted lettuce, and proposed hoop house evaluations. This information is presented annually to CES/AFES jointly sponsored workshops including: The Greenhouse and Nursery Conference, the Potato and Vegetable growers Conference, Ag Symposium, and the Delta Farm Forum (presentations included "Seed Piece Size and Fungicide Treatment", "Compost Tea for Home Gardeners" to name a few. The horticulture/plant pathology researchers at the Palmer Research and Extension Center working closely with CES agents in Palmer, Anchorage, Soldotna, Fairbanks, and Delta Junction provide the core for this working group.

Greenhouse Management/Nursery

Collaborative work continued in the greenhouse/nursery production of cut flowers, bedding plants, ornamentals, and other landscaping plants. Research and outreach addresses 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. Extension oriented publications in 2003/2004 included a number of publications in Greenhouse Product News and Experiment Station circulars and bulletins. Research and demonstration efforts at the Georgeson Botanical Gardens evaluated woody perennials, herbaceous perennials, annual flowers, herbs and vegetables for survival and productivity at northern latitudes. The latter had a high

degree of volunteer and extension involvement. Outreach efforts have included one-on-one contacts with growers and the public, presentations at CES workshops, master gardener program, and the annual CES/AFES Alaska Greenhouse and Nursery Conference, and lay publications including "Annual Flower Plant Evaluations", "Georgeson Botanical Garden Review", "Alaska Spinach, Savory, Succulent, Salad Selection" to name a few.

Reindeer Production

Alaska native reindeer herders have managed herds totaling over 30,000 deer. Those numbers have dropped significantly in recent years from out-migration of deer joining migratory caribou. AFES scientists continued to carry out a number of research and demonstration projects in cooperation with the CES on the Seward Peninsula (details reported above under Goal 1). Current projects range from reproduction and disease management to range management and reindeer nutrition. The Extension reindeer agent position has been terminated but the Extension livestock specialist works with AFES researchers and other agencies (i.e. NRCS, AFG, and BIA), and the herders themselves and facilitates annual meetings and workshops.

Animal Reproduction

The joint research animal scientist/livestock position (CES, 51%; AFES, 49%) addressed reproductive performance of ruminant animals under the aegis of multistate research (W-112) which addresses both traditional and alternative animal species. Most of this research and outreach was on-farm, directly involving the local extension agents and the producers. In 2004, outreach activities included one-on-one contacts with producers, workshop presentations at the Delta Farm Forum, and the Agricultural Symposium. He also presented a series of animal science workshops at four locations around the state and presented his research at two meetings of the Kawerak Reindeer Herders meetings in Nome. He was Alaska's representative to the USDA Small Farms Program, Alaska State Johnes Disease Detection and Management Committee, and Alaska Scrapie Disease Certification Committee. His project has become the cornerstone of our Integrated Activities in livestock with Cooperative Extension. It encompasses all the desirable elements of a multistate, integrated research and extension activities.

Soil Quality /Nutrient Management

No Integrated Activities reported in 2004.

Forest Production/Protection

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

and Private forestry in cooperation with the state Division of Forestry and the U.S. Forest Service.

Community and Rural Development

AFES resource planning researcher cooperated with CES land resource specialists and are developing a database of planning cases in Alaska. A literature review of criteria for effectiveness in resources planning and environmental dispute resolution was completed ("Public Planning Process"). A new project "Innovative Methods of Involving the Public in Environmental Decisions" will involve CES and outreach efforts. In 2004, a interdisciplinary team was established to develop alternatives for management of the Alagnak River based on prior and new public meetings and written comments. Plan completion is scheduled for 2005. The National Park Service will use the plan to guide the management and use of the popular river corridor. The AFES Natural Resources Economist continued work cooperatively with CES on the reindeer industry economic impact analysis through presentation of information at the CES sponsored annual reindeer meeting in Nome.

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

Institution: University of Alaska Fairbanks
State: Alaska

Integrated Activities (Hatch Act Funds)		**Actual Expenditures**			
Title of Planned Program/Activity	**FY2000**	**FY2001**	**FY2002**	**FY2003**	**FY2004**
Potato and Vegetable Crops	Waived	13,459	9,694	8,673	8,978
Agronomic Crops and Soils	Waived	8,953	9,849	6,540	5,954
Greenhouse Management/Nursery	Waived	2,404	2,775	5,758	8,221
Reindeer Production	Waived	616	921	1,544	7,565
Animal Reproduction	Waived	2,718	5,497	6,549	7,084
Soil Quality/Nutrient Management	Waived	2,484	2,248	1,560	0
Community and Rural Development	Waived	324	806	4,032	1,088
Forest Production/Protection	Waived	316	1,047	1,094	1,540
Other Integrated Programs	Waived	5,106	6,090	3,654	3,313
TOTAL		36,425	38,927	39,404	43,743

_____ 04-01-04
Carol E. Lewis, Director Date

Form CSREES-REPT (2/00)