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. However, the use and management of Alaska's land resources currently play a minor role in an oil and gas based dominated economy. As oil reserves decline, other land resources including agriculture and forestry can play a greater role if there is a dedicated effort directed toward entrepreneurial efforts in land resource related industries. The Agricultural and Forestry Experiment Station is a leader in maintaining the sustainability of the use and development of 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. The Experiment Station and Cooperative Extension are reporting separately; however, integrated activities are included in this report. We will meet with Cooperative Extension in 2004/2005 to prepare a joint Plan of Work for the next 5-year cycle.

Since the 2002 report, the land in farms as reported by the Alaska Agriculture Statistics has remained stable at 920,000 acres. Cash receipts for agriculture dropped slightly from $52 million in 2002 to approximately $50 million in 2003 accounted for primarily by losses in aquaculture. 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 relatively 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 vacancies including an important horticulture position in Palmer. That has been partially addressed by sharing of resources between the Experiment Station and Cooperative Extension. A new horticulture specialist will address both conventional and organic potato and vegetable production beginning in 2004. Applied research and outreach in vegetable

crop production is an Integrated Activities project between AFES and CES and includes extensive on-farm research and demonstration with cabbage, lettuce, and baby greens as well as laboratory and field research with *Sclerotinia sclerotiorum*. Integrated Activities with Extension continued with potato late blight monitoring and treatment project partially funded by Hatch, Extension Integrated Pest Management, and state matching funds. This continues to be a very successful program that has resulted in complete control of late blight with no use of pesticides over the past three years. In view of budget constraints, this program may have to be either reduced or eliminated in 2004.

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. A very successful alternative livestock conference was held in April 2003 with 64 participants including essentially all producers of alternative species. Speakers were from such diverse locations as Alaska, Yukon Territory, North Dakota, and Colorado.

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. Research by the Department of Forest Science quantifies timber productivity of the northern forest lands and provides resource managers with appropriate information for timber management decisions and stand prescriptions. Additional funding from Special Grants to investigate New Crop Opportunities resulted in new programs that address value-added marketing of such diverse products as birch sap drinks, bark baskets and art, ethanol production from black spruce biomass, and potential pharmaceuticals derived from tree bark.

Expenditures:

Hatch General:	$567,435
Hatch Multistate:	$ 66,358
McIntire-Stennis:	$ 87,303

State Match: $897,608

Total FTE (SY): 7.0

PLANNED PROGRAMS

Key Theme: Greenhouse/Nursery Production

Controlled Environment Production of Small Fruits, Berries, Floral Crops, and Greenhouse Adapted Food Crops

Accomplishments: (**ALK-03-13, NCR 101-01**) Controlled environment production systems and technologies offer diverse opportunities to extend the growing season, increase productivity, improve quality and allow local production of crops once considered infeasible at this latitude. Interactions of light, daylength, and temperature were studied for their effects on improving the marketability of greenhouse grown flowers and food crops that have included black-eyed Susan, forget-me-nots, raspberries and strawberries to mention a few. Raspberry plants of summer and fall bearing types have been acquired to initiate production, growing techniques, and management studies in traditional greenhouse and high plastic tunnel environments. Findings have resulted in improved local production by providing new information on such factors as day length, light quality, and temperatures that enables growers to market small fruits and flowers to restaurants, stores, and directly to consumers. Market analyses to determine local demands, profitable crops, and marketing strategies are being initiated to establish knowledge and background for successful planning, creation, and operation of local greenhouses and controlled environment production. Results from research funded by this Hatch and matching state funds has leveraged additional federal grant funds for research in greenhouse berry production (~$200,000) in 2003 and controlled environment production (~$450,000) in 2004.

Impacts: Controlled environment production systems 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. Recommendations tailored to northern conditions, infrastructure, and climate are indispensable to the successful management and operation of controlled environment enterprises. Research results are presented at Extension workshops, in bulletins and national lay publications as well as refereed journals. Greenhouse/nursery production in Alaska is relatively small compared to the larger markets of the lower 48 states.

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

Scope of Impact: Multistate

Horticultural Crop Production for Alaska

Accomplishments: (**ALK-01-11**) Plant evaluations at the Georgeson Botanical Gardens included 1325 woody perennials, herbaceous perennials, annual flowers, herbs, and vegetables. Two new cultivars were added to the list of recommended vegetables: Small Wonder spaghetti squash had an impressive yield for a small, single serving squash; Papaya Pear also yielded well and had a sweet mild flavor. Both All-America Selection s are recommended for both home and for market production. Three years of trials resulted in Sub-Arctic 25, Prairie Fire, Northern Delight, and Oregon 11 being recommended for outdoor tomato production. An unusually severe mid-fall frost provided an opportunity to evaluate a number of previously untested flower cultivars capable of surviving temperatures 12 degrees (F) below freezing. Wildflowers germination biology successfully identified optimum germination conditions including light requirements and seed treatment. Additional research leveraged by Hatch funds included Special Grants research with peonies production for cut flower markets and selection of salt tolerant native grasses and flowers for reclamation along salted highway right-of-ways.

Impact: The vegetable research is designed for small market producers of vegetables and landscape nursery plants as well as home gardeners. It provides comparative trial information that is useful in developing regional truck farms and expanding produce choices as farmers markets. Field tomato trial information was requested by Territorial Seed Co., annual and perennial vegetable trial information as well as breeder seed for Yukon Chief sweet corn, was requested by Denali Seed Co. of Anchorage. The annual and perennial flower research is utilized by seed companies, nurseries, growers, landscapers, and home gardeners to identify hardy perennials and disease resistant annual flowers for home and commercial production. Exporting flowers from Alaska is a possible outcome of research on high latitude peonies. The late bloom period provides a commercial advantage for Alaska growers. In 2003, over 25,000 visitors toured the Georgeson Botanical Garden. The July “Day at the Georgeson Botanical Garden” co-hosted by Extension 4-H alone draws well over 500 people each year. The botanical display garden and Annual Flower Evaluation circular (co-authored by stakeholder volunteers), represent the most popular community service program in the Agricultural and Forestry Experiment Station.

Source of Federal Funding: Hatch General
CSREES Special Grant

Scope of Impact: Alaska Specific

Key Theme: Horticultural and Agronomic Field Crop Production

Field Grown Potato and Vegetable Crops

Alaska Agricultural Experiment Station horticulturists and Extension horticulturist continued field and laboratory research on evaluation of commercial production practices, cultivars, and diseases of potato and vegetables. 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. **Our effort in this area has been diminished by the loss of the potato pathology position at Palmer. Response to this loss will be addressed in the next cycle of our Plan of Work.**

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

Accomplishments: **(ALK-01-09, NRSP-4)** This program investigated cultural practices, disease control, and yield evaluations in field trials for of potato varieties having commercial potential. Applied research evaluated irrigated variety trials including white and red potatoes, chemical seed treatment, seed weight and seed cutting of Russet Norkotah on both yield and quality, plant spacing on yield and quality of Yukon Gold potatoes, and herbicide comparisons on potatoes/vegetable rotations. Major findings included: Cal-White (47 MT/ha) and Bake King (41 MT/ha) were the highest yielding white potato varieties and Dark Red Norland (47 MT/ha) the highest yielding red potato. Correlations of potato seed weight and seed cut on eventual tuber size found that cut seed generally yielded less than whole seed of the same weight. Study of taxonomic relationships, evaluated via anastomosis, rDNA-ITS sequencing and virulence between subsets of *Rhizoctonia Solana* in potatoes continued in 2003. However, with the retirement of the potato pathologist, this research will be discontinued.

Impacts: 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. For example, results demonstrating yield and quality advantages for Cal-White potatoes over other commonly used varieties would increase gross income by $600/A for a grower adopting recommended practices and varieties. For an 80-acre potato farm, that results in a $48,000 increase at 2003 prices. The SAES/CES potato late blight monitoring program continued in 2003 with again no use of fungicides required for any commercial fields resulting in sizeable savings for fungicide applications. Basic research with virulence and taxonomic relationships in *Rhizoctonia* has involved researchers from other states and countries and has resulted in improved understanding of the nature of the disease and control strategies in crops.

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)** Applied research and demonstration to enhance vegetable production included continuation of on-farm lettuce variety trials. Nineteen cultivars of head lettuce were tested on two commercial farms including a mid- and late-season planting and evaluated for tip burn, white mold, and marketability by the researchers and the farmers. New cultivars that are commercially available were compared with varieties currently being grown. These trials result in ongoing assessment of cultivars being used by producers plus new replacement cultivars when disease resistance begins to breakdown. Similar trials were conducted on two farms and on Experiment Station fields for 12 storage cabbage cultivars. Other variety evaluations were conducted at PREC for 10 types of specialty greens (3 arugula, 4 Asian greens, and 3 kales) at three fertility levels demonstrated that lower fertility were sufficient for the short growing season of the immature greens. New Crop Opportunities studies investigated specialty greens for a heretofore untapped in-state retail and restaurant market. Increased value-added marketing continues to offer avenues for increased production a wide range of vegetable crops. Field experiments targeting *Sclerotinia* (white mold) in vegetables, particularly lettuce, continued at PREC and on-farm. As reported last year, use of the biological control agent Contans WG showed promising results for control of white mold in laboratory and growth chamber trials. Further field trials in 2003 confirmed preliminary results that sclerotia survived overwinter and infected subsequent crops.

Impact: Salad crops can be produced locally in the summer to supply local markets with short transport and storage times. 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. The SAES/CES potato late blight monitoring program continued in 2003 with again no use of fungicides required for any commercial fields resulting in sizeable savings for fungicide applications.

Management Practices for Forage and Turfgrass at Northern Latitudes

Accomplishments: (**ALK-02-05)** Forage grass/legume (reed canarygrass/red clover) trials involving seeding rates and nitrogen (N) rates and time of application were initiated in 2002 at two locations; Point MacKenzie and Palmer and evaluated for establishment. Both trials were evaluated for overwintering, DM yield, and forage quality. Red clover at the Point MacKenzie location winterkilled. Drought stress reduced stands and resulted in minimum establishment year yields at Palmer in 2002; however, interseeded clover and grass showed good winter tolerance. Dry matter and protein yield of grass only and grass/red clover mixed stands responded to N application rate but not to time of

application. The most significant result of these trials in 2003 was the importance of high red clover seeding rates and stand composition resulting in high production of protein. The turfgrass work was initiated in 2001 and overwinter evaluations of the cultivars on a sand green showed bluegrasses and fescues in general and northern adapted 'Nugget' Kentucky bluegrass in particular green earlier, demonstrated best survival, and best overall quality in spring and early summer. The more traditional and less adapted bentgrasses required longer to recover and greenup; however, they eventually filled in to desirable quality but not until late summer. The best overall bentgrass performer was 18th Green developed by the University of Manitoba Canada. Overseeding with roughstock bluegrasses and bentgrasses resulted in rapid recovery of winter-damaged greens to playable conditions. An on-site research green was put in at the Settlers Bay Golf Course near Anchorage and included the most promising cultivars from our research green. Irrigated fairway turfgrass trials involving 24 cultivars including northern adapted Kentucky bluegrass, fescues, perennial ryegrass and less adapted bentgrasses were initiated in 2002. All overwintered successfully and the order of greenup in the spring was fescues>bluegrasses> bentgrasses>perennial bluegrass.

Impacts: The inability for dairy and beef farmers to grow high protein feeds such as alfalfa, and other conventional forage legume crops or to have access to locally produced soybean meal commonly available in the southern 49 states requires expensive imports of protein supplements. The production of interseeded winterhardy grasses and clovers is a viable answer to this dilemma. This research has demonstrated the feasibility of using high producing Palaton reed canarygrass interseeded with Altaswede red clover to produce a harvestable crop with over 1000 lb protein produced per acre and, at the same time, provide excellent roughage and energy when harvested at optimum maturity. 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. Results of our trials were published in a Research Progress Reports for immediate use by stakeholders.

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 (**ALK)-02-01**

This was the first year after establishment. Results were largely negative due to poor establishment due to drought and poor survival overwinter. Funding for irrigation at the Delta Junction site has been acquired and should improve future establishment of all test crops particularly small seeded legumes.

No-Till Forage Establishment in Alaska

As reported in 2002, this four-year research study at six locations in Alaska (from 59 ° 45' N to 64° 55' N) concluded that no–till seeding into declining grass stands is not likely to be successful in Alaska. Although this is negative in its impact, it is extremely important for farmers to recognize, given the high cost of equipment, labor and other resources, that their efforts will likely result in failure.

Future Recommendations/New Hypotheses: Future research should emphasize determining why these practices did not succeed, develop better techniques to improve results, and finding alternative forage crops that will work in no-till establishment.

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

Accomplishments: (**ALK-02-06**) Breeding lines from nine years of Hatch-funded breeding work by Dr. Stephen Dofing and others obtained from other circumpolar location are continuing to be evaluated in a project partially funded by University Natural Resource funds. In particular, experimental lines originating from crosses involving 'Otal', the earliest and most popular variety grown in Alaska and, in the 1980s one of the leading spring barleys in Canada, and 'Thual' an excellent Alaska hulless feed barley. In 2003, barley breeding selections were compared with three adapted varieties (Otal, Finaska, and Albright) for all plant growth characteristics. One selection with the best characteristics was made after harvest for future testing and release as a named variety in 2005. In a parallel series of selections for Sunwheat, (dwarf, open pollinated) have been found to have early uniform maturity, head size, and shape. The seed was harvested and distributed local farmers for evaluation and eventual release as a named variety as early as 2005.

Impact: This study is a continuing collection of information on new and better-adapted cereal varieties, response to dryland conditions, and provides a database for local farmers to determine the economic viability for these crops.

Source of Federal Funds: Hatch General
USDA Special Grants

Scope of Impact: Alaska Specific

Key Theme: Marketing of Alaska Grown Products

Projects under this theme are either terminated or in abeyance pending development of a new Hatch project which will be included in the next 5-year Plan of Work .

Key Theme: Traditional and Alternative Livestock Production

Reproductive Performance in Domestic Ruminants

Accomplishments: (**ALK-00-01, W-112**) The accomplishments for this project are the results of collaborative efforts of multistate research (W-112), integrated activities with Cooperative Extension, and involvement of stakeholders from the Alaska animal industries. Outcomes included the following:

- Studies provided a description of seasonal endocrine changes and validates a radiotelemetric estrous detection system in farmed Alaska reindeer. Radioimmunoassay for progesterone has been completed and accurately identified 7 out of 10 matings. Females became pregnant following only one or two mounts of one to three seconds in length.
- In 2003 conclusions based on endocrine data indicate that reindeer cows at Fairbanks entered the breeding season by early September. Researchers found that in the absence of mating, cows continued polyestrous activity through the winter, experiencing 6-8 estrous cycles prior to March with no significant variation in cycle length.
- Results show that female reindeer remain fertile into late winter/early spring. Two different endocrine patterns characterized the onset of anestrous (no estrous cycling) with progesterone falling to zero and staying at that level of elevated progesterone.

Controlled Internal Drug Releasing (CIDR) was used in studies on both reindeer and Muskox in 2002/2003 with the following results:

- The modified CIDR containing synthetic progestin coupled with bull introduction resulted in close synchrony of estrus. Eight of nine cows conceived during one week. Radiotelemetry correctly identified breeding activity among muskox cows with 100 percent accuracy.
- 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.

Impacts: At present, reindeer and muskox herds represent primarily Alaska Native enterprises and offer economic opportunities in extremely rural settings. For reindeer and muskox herders, bull management effects timing of breeding and thus improve reproductive success. These studies provide the only current description of endrocrinology of pregnancy in reindeer and muskox. The data demonstrate the efficacy of radiotelemetry to detect estrous in reindeer and muskox. 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 well from traditional livestock to more exotic species and our ability to identify those that are effective under Alaska conditions enhances the producers ability to maximize productivity and profits. The market value of the offspring (~$5000/muskox and $1500/reindeer) is a significant portion of income generated by the Alaskan diversified livestock industry. Research efforts for the project will increasingly involve additional species including bison.

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

Ovarian Activity and Bull Management in Farmed Muskox

Impact: Raising domesticated muskoxen for qiviut production is an emerging industry in Alaska. The chief challenge is management of bulls and cows during the breeding season. Bulls are fiercely protective of their harem and may inflict severe injury on producers and/or other animals, restrict access to cows by producers and restrict cows access to feed and other resources. Obvious benefits grow out of truncating the normal harem period without compromising conception and pregnancy rates among cows. The preceding work demonstrated the efficacy of bull introduction as an effective, low-cost tool for initiating and synchronizing estrus in farmed muskoxen. It has also demonstrated the importance of the bulls presence in the onset of seasonal ovarian activity. Modified cattle CIDRs are an effective means of synchronizing estrus. Although insertion and removal requires proper muskox handling facilities, the retention rate was 100%. By using this technology, the harem period was truncated from 6-8 weeks to 1 week while achieving excellent pregnancy rates. A radiotelemetric estrous detection system is a very effective tool and can be used with confidence in subsequent research. Results and recommendations of this research is being given to muskox farmers throughout Alaska and other states and provinces by dissemination to the Alaska Diversified Livestock Association by the Cooperative Extension Livestock Specialist and by inclusion in extension and scientific presentations, in the scientific literature and an upcoming extension publication on reproductive management of muskoxen.

Sources of Federal Funds: Hatch General and Hatch Multistate
Special Grants

Scope of Impact: Multistate

Spatially Modeling the Distribution of Beef Cattle and Reindeer on Ranges at High Latitudes (**ALK-03-03 New Project)**

Accomplishments: Temperature data was collected at the Matanuska Experiment Farm to develop a model relating temperature to landscape topographical features for use in an animal distribution model specific for Alaska. We also developed a near-earth remote sensing platform on a tethered helium blimp. This will be used to obtain low-cost data layers necessary for the operation of the animal distribution model. We then videotaped cattle observations on the ASAES beef herd. These are in preparation of Alaska's participation in the western region animal distribution model involving California, Oregon, Montana, Idaho, and Alaska. Additionally, we developed a module with Oregon State University for performing a Relative Operating Characteristic (ROC) analysis to statistically indicate model performance never before used in cattle distribution models.

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 model to predict the effects from these actions, thereby, allowing livestock managers to devote more energy and their limited funds to management techniques that have the prospect of being more successful. 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

Scope of Impact: Multistate

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

Accomplishments: (**ALK-98-07**) We tested formulation of reindeer feed composed of Alaska-grown ingredients including whitefish meal and Finaska barley to determine in what proportion they can be used by herders to curtail their production costs while maintaining good nutritional balance. Diets were evaluated in terms of feed consumption, animal growth, reproductive success and calf weight gain. Female reindeer readily consume 1.5 % of body weight per day in winter and 3.2% in summer. In 2003, 12 out of 13 female deer on Alaska–grown diets dropped viable calves. In other studies, whitefish meal, salmon meal, Thual barley, and Finaska barley were evaluated for animal performance compared to a feed with a protein source from imported soybean meal. Thual has higher digestibility and lower fiber but higher production cost than Finaska. During summer, reindeer had greater intake rates with whitefish meal and Finaska barley, but showed no difference in weight gain. During winter reindeer showed a preference for the soybean based feed.

Impact: A palatable, digestible, and relatively inexpensive reindeer diet was developed using barley, brome hay and fish meal, 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, fish

meal 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: Flux of copper (Cu) and zinc (Zn), two trace minerals important for animal health, was determined for reindeer during the winter of 2003. We used lignin as an inert reference substance to calculate apparent digestibility of Cu and Zn in diets. Levels of Cu and Zn in milled ration fed to deer were set according to NRC recommendation for ruminant animals. Apparent digestibility of Cu and Zn in the diet of adult female reindeer were -106 and -72, respectively indication they were in a positive mineral balance and that present dietary concentrations in formulated winter diets are too high.

Impact: Reindeer typically lose weight during winter even if fed ad lib. The early results of this work indicate reindeer are excreting more Cu and Zn from the diets being fed than they are absorbing. The concentrations of trace minerals required in winter diets may be well below NRC recommended levels.

Educational Outreach: This ongoing program provided educational and vocational outreach to educators, students, and community members in Fairbanks and Nome. A one-credit UAF curriculum development course was conducted for Fairbanks educators. We also received support from the College of Rural Alaska for curriculum development in Nome. A one-credit UAF Reindeer Husbandry Internship was provided in Fairbanks in a collaborative effort between the Reindeer Research Program and the Tanana Chiefs Conference. Successful curricula development for local schools resulted from the course. Establishing a working relationship with educators in Nome will give our educational outreach program, diversity by utilizing traditional and cultural knowledge. E have also developed a vocational training program for local people interested in commercially raising reindeer.

Source of Federal Funding: Hatch General
Hatch Animal Health

Scope of Impact: Alaska Specific

Key Theme: Forest Products

Forest Stand Characterization and Growth and Yield for Alaskan Northern Forest

Accomplishments: (**ALK-03-12**) A series of individual productivity studies continued in 2003. Alaska Northern Forest Cooperative already is benefiting forest resource owners and managers through dialogue, collaboration, and the draft research compendium. SITE INDICES (ongoing): Site indices were developed for trembling aspen, birch, black spruce, balsam poplar, black cottonwood, tamarack, and white spruce characterizes stand composition and structure, habitat biodiversity, fuel loading and soil to better model and predict natural forest stands. Published and presented polymorphic aspen site index curves along with good progress in expanding the network of permanent sample plots. LEVELS OF GROWING STOCKS (LOGS): Initiated in 1986 with plantations at Bonanza Creek and Tok. We provided appropriate espacement guidelines for northern forests. Optimization of forest plantation establishment and reduce stand maintenance costs was accomplished resulting in a higher value product. EARLY HEIGHT GROWTH OF SPRUCE: We determined of number of years required to reach breast height (free-to-grow status) continued. Results showed it took an average of eight years to reach that height and data allowed construction of growth trajectories for yield forecasts and ecological change. 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). INDIVIDUAL TREE VOLUME EQUATIONS: Using data from1071 black spruce and 2024 white spruce, determined and verified bark equation. 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. PHYTOCHEMICALS: 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.

Impacts: 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:	$190,007
Hatch Multistate:	$ 73,753
McIntire-Stennis:	$381,616
State Matching:	$611,582
Total FTE (SY)	8.5

PLANNED PROGRAMS

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

Hydric Soil Properties of Permafrost-Affected Soils in Northern Alaska

The Hydric Soil study was completed in 2003 and final conclusions related to the establishment of regional indicators for hydric soils and delineation of wetlands were made. The conclusions and recommendations were presented at the 2002 American Society of Agronomy meetings and to the National Technical Committee on Hydric Soils. The conclusions challenged the definition of biological zero as 5 degrees C and proposed the definition be changed to **"the soil temperature at a depth of 50 cm below which the growth and function of locally adapted plants are negligible".** The National Technical Committee agreed to this new definition.

Impact: The change in the definition of biological zero will greatly affect the delineation of wetlands in the arctic and will be useful to oil and gas development, native corporations, mining interests and government agencies responsible for environmental compliance and permit processing.

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

Accomplishments: (**ALK-03-02)** The Arctic and Subarctic zones are expected to sustain the greatest impact in the wake of global climate change. Because of the vast acreage in Alaska and the potentially high C storage capacity in the boreal forest zone, an understanding of black spruce dominated sites is important for both ecological modeling and for land management. 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. Alaska black spruce forest soils are poorly described**;** some have never been described. We initiated a study to describe soils of the black spruce forest, especially those with permanent sample plots (PSP); correlate characteristics with stand conditions. In 2003, a total of 16 pits were excavated, studied and sampled in Fairbanks, Delta, Tok Flat, Northway, Brooks Range foothills and the Taylor Highway areas. Samples were sent to the USDA-NRCS laboratory in Lincoln, Nebraska for full characterization analysis. Soil morphological properties are being compiled.

Impact: 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

Winter Carbon Flux and Soil Organic Matter

This project terminated March 31, 2004

Outcomes from this project included seven peer-reviewed journal articles, two book chapters (i.e. C. L. Ping, et al. 2002. Chap.47, *Soil Organic Carbon Stores in Alaska,* pp.

485-494. IN: Lal, Kimble, and Follet, Ed. *Agricultural Practices and Policies of Carbon Sequestration in Soils.* CRC Press LLC.), and numerous national and international abstracts and symposia presentations.

Impact: Results from this project will provide insight into controls on gas fluxes from soils of the arctic system for the cold-season, a period where up to 60% of emissions can occur but about which little is known. We provided real soils data as a basis for models describing winter flux of carbon to the atmosphere for arctic system and ultimately the arctic model will be an essential part of an improved global climate model for prediction of the impacts of climate change.

Source of Federal Funds: NSF and Hatch General

Scope of Impact: Multistate and Multinational

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

Accomplishments: In the summer of 2003, we scaled back the frequency of measurements of soil respiration in burned and unburned black spruce forest plots in the Caribou-Poker Creeks Research Watershed, the site of the 1999 Frostfire experimental wildfire as the pattern of reduced soil respiration had become clear over the past several years. We also began measuring respiration in a contrasting series of lowland black spruce sites burned in 2001. Based on our previous observation that the absence of root respiration was unlikely to account for the entirety of the decline in soil respiration, we included a series of root-exclusion experiments to quantify root contribution. Excluding root respiration caused unburned soil respiration to decline by half, but unburned root-free respiration was still larger than soil respiration in burned areas. This suggests and as others have reported, that fire results in an overall decrease in OM decomposition despite more favorable physical conditions (moisture and temperature) for microbial activity. In related work, others have noted that total forest floor OM declined by 15-20% in 3 years during which roots were excluded and points to high rates of root inputs as the prime cause. It is postulated that removal of root inputs not only eliminates root respiration, but also restricts the supply of labile C to soil microbial populations and thereby slows heterotrophic soil respiration as well.

Impact: As this project began during summer 2001, its real impacts lie primarily in the future. They will accrue primarily to the public via management agencies, such as Alaska Department of Natural Resources (especially Division of Forestry and Division of Lands). Discussions about carbon sequestration as a sellable product for land managers have become more commonplace and serious. 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.

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

Accomplishments: (**ALK-01-01**) This project and an accompanying NSF project under the Long-Term Ecological Research (LTER) program will produce new knowledge. In 2003, we developed a first draft of a review article that will summarize 35 years of ecosystem dynamics in major vegetation types in interior Alaska. This will be published in 2005. Progress was also made in fine-tuning the SAFED model in Visual Basic within the ARC Objects programming environment. The research information developed in the 35-year study summarizes the analysis of seven major long-term studies on tree growth dynamics. The primary results included stand level, species level, and landscape level dynamic. The combination of thinning and fertilization resulted in growth increases for up 28 years in the study period. Low-level fertilization in the LTER sites started to show significant increases in growth 5 years after fertilization. Sugar and sawdust applications resulted in growth decrease in the first two years after application and a drought treatment resulted in significant decreases in growth on floodplain sites as opposed to upland sites. We completed the 5-year study of log decomposition in 2002 and added two new sites that resulted from a fire adjacent to the Bonanza Creek Experimental Forest. During the 2004 we will initiate sampling of the 10-year sampling of the logs and will require three years to complete. We propose that the primary control on forest productivity is related to nitrogen content of tree foliage. We can now identify roles for each state factor on the control of forest productivity.

Impacts: The results of the 35-year study will yield a long-term perspective on the climatic and nutrient controls of forest growth in interior Alaska. The duration of this study and its distribution in various vegetation types across the landscape will start to yield a potential understanding of the effects of climate change on the forest ecosystems found 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**) Roots and soil/litter cores were collected from three locations in 2003: Exit Glacier in Kenai Fjords National Park, the Frostfire prescribed burn, and the Tanana River floodplain. Seedlings collections in 2003 from the Frostfire burn were concentrated in burned areas along a zig-zag path up the north-facing slope. Roots and soil/liter cores were collected along the Tanana River floodplain in stands dominated by Salix, Alnus, Populus, and Picea spp. These are different locations but similar vegetation types to those sampled in 2002. To date, at least one EM fungal species (Cenococcum) has been found at essentially all sites. Cenococcum is ubiquitous and might provide a commonality across a range of latitudes and vegetation. EM had

already formed on paper birch by August of the first year but not on balsam poplar. This observation and preliminary data from different latitudes of origin will determine if a common EM inoculum is possible or if latitude of origin needs to be considered much in the same way as with seed.

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 the 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. The most reliable inoculum still appears that it would come from local communities since they would match the plant species and would be adapted to that latitude and other environmental conditions. However, as laboratory analysis continues, we may be able to find a few in common, such as Cenococcum. 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. Benefits of latitudinal source of inoculum is being tested in another study. 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.

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-147**) *Trichoderma atroviride* is a cold-tolerant, versatile, aggressive hyperparasite that can parasitize a wide spectrum of pathogenic fungi. A coordinated biochemical response has been observed in *T. atroviride* during biocontrol of plant pathogenic fungi. We found production of chitinases, glucanases, and protenases played a significant role in hyperparasitism involved in the suppression of diseases. These include pink root of potato, damping-off of cotton and early season disease (both caused by *Pythium* spp) and rusty root of ginseng and potato late blight (caused by *Phytophthora infestans*) and are all economically destructive diseases affecting a variety of crops in all regions of the U.S. *T. atroviride* growth was not found to be adversely affected by common fungicides or herbicides even at field applicable levels but was limited by high soil temperatures and sub-optimal dosage. Another means of controlling plant diseases is through the identification of genetic traits involved in host resistance.

Impact: 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

Tillage and Crop Residue Management Effects on Properties of a Subarctic Soil Long-Term Tillage Study

Accomplishments: (**ALK-98-06** Terminated in 2003). Data summarized over the 18 years of the tillage study showed grain yields averaged 0.8 tons/acre for conventional disked, 1.0 tons/acre for minimum till, and 0.8 tons/acre for no-till. The primary advantage of reduced or no-till was improved soil quality in the top 4 inches of soil as measured by soil biomass carbon and nitrogen, low bulk density, and aggregate stability.

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

Source of Federal Funds: Hatch General funds

Scope of Impact: Alaska Specific

Key Theme: Forest Protection

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

Accomplishments: (**ALK-99-02**) Spruce stands become highly susceptible to wildfire following bark beetle infestation. Intensity of wildfire has immediate impact on carbon emission, long-term impact on carbon flux, post-fire regeneration, permafrost dynamics and associated subsurface hydrology. Remotely sensed algorithms such as vegetation indices, ratios, and transformations have been developed at lower latitudes. In 2003, we tested these in high latitude boreal forests to map burn severity. Specifically, we compared these algorithms to map burn intensity at recent burns on a floodplain site and an upland site in Interior Alaska. Thirteen Landsat TM and ETM+ algorithms were evaluated using single bands, band ratios, vegetation indices, and multivariate techniques and each evaluated as both single date and bi-temporal. Based on correlation analysis and field sampled verified assessment of classified burn severity maps, the Normalized

Burn Ratio was consistently the most accurate algorithm for mapping burn intensity classes.

Impact: Accurate estimates of burn severity across large spatial and temporal scales are important as inputs for estimating carbon emissions from wildfire and for modeling and prediction of post-fire plant succession, permafrost dynamics, and carbon flux. This research demonstrated the Normalized Burn Ratio can be reliably applied in high latitude boreal forests of Alaska to map burn severity classes. Results from this research will be used in a workshop on geostatistical methods in GIS to be taught in Fairbanks and Anchorage next winter. A manuscript based on this research will soon be submitted to the Canadian Journal of Remote Sensing.

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.

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**) Large-scale forest fires and outbreaks of tree-killing insects are naturally characteristic of the boreal forest and promote many ecological processes. Particular characteristics of forest disturbance by fire and insects such as rate, timing, and pattern of disturbances are crucial factors in determining the net uptake or release of carbon from the forest to the atmosphere. Although vulnerable tree species and age classes must be present for insect outbreaks to occur, often times climatic events are the trigger or cause of the insect population increase and associated tree mortality. Thus,

since this is a climate-driven system, it is important to distinguish climate change effect from natural operation of the system. 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 suggest that there is a continuing high risk caused by climate warming in managing forest land in southcentral Alaska for spruce forest crops. Under recent climate conditions, and especially under scenarios of further climate warming, spruce bark beetle irruption potential will remain high. As the small surviving understory spruce trees that are not susceptible to bark beetle attack in the region mature to commercial forest dimensions, they will move into the prime susceptibility size and age classes to serve as hosts for spruce bark beetle. Under these circumstances, the regional environment would remain effectively saturated with spruce bark beetles because climate limitations on beetles have been removed. Investments in regeneration and early tending of new commercial stands of spruce, should that be desired, would carry considerable risk because bark beetles would become effective agents of tree mortality at about the time that stands of spruce became large enough to generate commercial value.

The Arctic Council, representatives of the arctic nations of Canada, Denmark (Greenland), Finland, Iceland, Norway, Sweden, and the U.S. launched the Arctic Climatic Impact Assessment (ACIA) three years ago. The member nations developed an international scientific synthesis on effects of climate change and increased ultraviolet radiation from ozone depletion in the Arctic region.

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**) During this reporting period, work continued with the SNTEMP and SSTEMP models to explore their potential for research and operational use in interior Alaska's extreme environment. From this work, we conclude that icebridge construction should not take place in upwelling locations or when river cross-sections have less than two meters of water depth. The specifics of ice growth at channel cross-sections and the influence of ice-bridge construction are also being simulated with a degree-day model for layered media in order to include the effect of snow depth and density on ice growth.

Impact: The Alaska State Legislature passed a bill in 2003 adopting revised riparian management standards for region III (interior Alaska). Work sponsored by this project

contributed to the formulation of these revised standards. A similar effort has been started for region II (south-central Alaska) for which this research will also be relevant.

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)** 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 will begin 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. Although many rivers have been designated by Congress, very few of them have management plans. Because so few plans have been done for these rivers, the plans that exist receive considerable scrutiny and serve as models for other rivers. This makes the Alagnak a particularly good case for experimenting with new techniques of involving the public, as it is likely to have a higher profile and a larger impact than most resource plans.

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:	$40,994
Hatch Multistate:	None
McIntire-Stennis:	None
State Matching:	$19,017
FTE (SY)	0.5

PLANNED PROGRAMS

Key Theme: Development of Regional Economic Models for Rural Alaska

Impact Analysis for Alaska Natural Resources

The objectives of this research program were to be addressed through two initial studies, an Alaska reindeer industry study and a stellar sea lion study. Unfortunately this second study was not feasible at this time due to limitations beyond the PI's control and was replaced by analysis of proposed federal risk insurance for the Bristol Bay salmon commercial fishery. The reindeer and salmon studies were completed 2003. Publication of the reindeer analysis was delayed until 2004 to fully evaluate the impact of infestation of caribou and resulting decline in reindeer numbers on the Seward Peninsula. 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**) The carbon sequestration/credit analysis study was initiated in 2003 thus efforts in 2003 was primarily determination of the structure of the carbon market and potential opportunities for the state of Alaska. We thus far have found through market research that domestic demand from potential buyers is low at this point in time due, in part, to an absence of a binding international agreement. However, there is some demand side by large CO2 emitters such as electric utilities. These industries are beginning have concerns of potential liability should a legislative mandate materialize. In 2003, we worked closely with natural resource agencies, legislators, and stakeholders to discuss these potential opportunities. Benefits of the Alaska reindeer impact analysis remain unchanged from last year, with the qualifier that continued range conflict issues with caribou intensify the need for information.

Impact: Snow crab impact analysis has gained greater relevance with the prospect of moving toward a rights based management program that might involve an individual harvester fishery quotas, separate processors quotas, and regionalization measures to protect interests of communities with a recent dependence on the snow crab industry. Analysis of the snow crab impact will provide insight into the impact on various regions within Alaska and Washington State. The snow crab market model will be useful to analyse changes in management that affect the size, scope and timing of the harvest. It may assume a position of particular prominence should processor and harvester quotas set up a system that may rely on price arbitration between buyers and sellers and could include a formal price arbitration system where dockside price is set by n 3rd party arbitrator.

Impact of Wild Salmon Risk Management in Bristol Bay Alaska: The salmon industry is the largest employer among Alaska's commercial fisheries accounting for 41 percent of all fishery jobs. Salmon fishing and processing accounts for 15,900 jobs paying approximately $300 million in salaries alone. Annual fluctuations in harvest and markets have caused serious problems in that sector of the economy in recent years. We are investigating the feasibility of a fishery risk management/insurance program similar to the USDA crop insurance program. The risk insurance study is part of a larger effort being directed toward Alaska salmon fisheries to address a severe industry downturn that has accompanied growing prominence of farmed salmon on world markets. This study was able to identify why crop insurance is an inappropriate remedy at this time. Accordingly, the industry is better able to focus its resources at developing alternative programs to address industry problems. The Federal government was able to avoid what may have become a very expensive program of little or no benefit to the targeted interests. This was the first time that the feasibility of a crop insurance program has been analyzed for a capture commercial fishery. Thus the research has value for policy makers, agencies and industry participants who have an interest in applying the model to fisheries.

Impact of Reindeer Impact Analysis: The Alaska reindeer industry study will greatly benefit industry participants, rural communities, policy makers, and agency resource managers in developing long-term strategies for the Alaska reindeer industry. The

regional economic model can be used to evaluate the impacts of a range of alternative policies and states-of-the-world to the industry, the Seward Peninsula region, Alaska, and the nation. The study will also contribute to furthering our understanding of rural economies and the importance of basic industries to the economic development and health of rural areas.

Impact of carbon credit marketing analysis: Through our initial research and evaluation, we have narrowed down the possible opportunities for carbon sequestration to three projects we feel are worthy of investigation: 1) carbon offset program for electrical generators in rural villages, 2) a reclassification of state-owned agricultural land, and 3) changes to current forest silviculture practices to enhance carbon storage in trees.

Source of Federal Funds: Hatch General, Hatch Multistate

Scope of Impact: Multistate and Alaska Specific

Total Expenditures (All Goals)

Hatch General:	$798,444
Hatch Multistate:	$140,112
McIntire-Stennis:	$468,932
State Matching:	$1,528,207
FTE (SY):	16.1

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, and 2003. 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 15, 2002 (Attendance ~ 55)
2) The 2002 Alaska Ag Forum November 16, 2002 (Attendance ~120) **
3) Greenhouse and Nursery Conference February 27-28, 2003 (Attendance ~78)
4) Potato and Vegetable Growers Conference March 4-5, 2003 (Attendance ~ 90)

** The Alaska Farm Forum was a departure from usual annual Ag Symposiums. Each agriculture support program (including Alaska SAES and CES) were asked to present a summary of our current REE programs and our future plans to six groups of stakeholders. We were evaluated on current and planned programs by each group in terms of benefit to the producers present. A report to the agricultural community was published (copy available on request) and included the evaluation of our programs and changes they were requesting for the future.

- 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, and December 4-5, 2003. 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 was adopted in 2003.

Program Review Process

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

signature of the Director on Form AD 416 submitted to USDA-CSREES will indicate approval of the project by the Director and will certify that the proposal has been recommended by a majority of the Peer Review Panel.

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

Evaluation of the Success of Multi and Joint Activities

Alaska participates in the following multistate research and coordinating committees:

W-147: Managing Plant-Microbe Interactions in Soil to Promote Sustainable Agriculture
W-112: Reproductive Performance in Domestic Ruminants
4-NRSP/IR4: A National Agricultural Program to Clear Pest Control Agents for Minor Uses.
NCR –101: Controlled Environment Technology and Uses
WCC-021: Revegetation and Stabilization of Deteriorated and Altered Lands
WCC-093: Western Region Soil Survey and Inventory

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

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

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

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

Activities within W-112 address specific reproductive problems that exist in the West and in 2003, the following impact statements were reported on the SAES 422:

1. 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.

2.The participants in the W112 project published 66 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 split appointment with Cooperative Extension and through Integrated Multistate involvement he brings back information that is disseminated in one-on-one contacts as well as sharing the information with CES agents throughout Alaska.

Participation in W-147 has been appropriate. The P.I. and research associate involved have developed a state-of-the-art biotechnology laboratory capable of the investigation of biological control of diseases that affect Alaska crops as well as crops in **CA, NM, AZ,** and **MT**. Through involvement with W-147, resources and knowledge from multistate and multidisciplinary colleagues, Alaska has benefited many-fold over working alone and the multiplying factor continues to increase with every year of participation.

The following impacts were reported for W-147 in 2003:

1.Information on optimal spore concentrations and stickers for seed treatments will benefit the commercialization of Trichoderma atroviride and other biocontrol agents (AK).

2.It appears that the EcoSoils field fermentor is an effective delivery method for biocontrol agents.
3.Research by Pierson (AZ) is a continuation of a long-term effort at elucidating the molecular mechanisms involved in bacterial sensing and its effects on bacterial communication that influences gene expression patterns and therefore community structure.
4.The findings on pathogen diversity conducted by ARS scientists at Pullman, Washington, will be useful for plant breeders who are selecting for resistant or tolerant germplasm.
5.The studies by Borneman (UCR) have led to the identification several bacteria and fungi that positively correlated with suppressiveness against the plant-parasitic nematode Heterodera schachtii., The experimental design utilized in these studies will provide a new investigative approach for soilborne biological control research.

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 2003 is included here.

The projections for Integrated Activities for 2001-2004 were based on the Supplement to the Plan of Work submitted to CSREES July 28, 2000. Despite the waiver, we moved ahead with Integrated Activities involving AFES researchers and support staff and CES specialists and agents; an evaluation and brief synopsis of those activities for FY2001-2002 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 split AFES/CES faculty positions in horticulture, the Center also provided office facilities for the CES water quality program and the Fisheries and Natural Resources specialist. This is but one example of increased collaboration among research, teaching and extension faculty. Our goal is to increase Integrated Activities to the AREERA target percentage.

<u>Agronomic Crops and Soils</u>

Integrated activities centered around best management practices for production of livestock feed crops, primarily forages and small grains as well as investigating new crop opportunities. AFES researchers and CES specialists and agents continued collaborative work at Delta Junction, Point McKenzie, and the Kenai Peninsula. The extension agronomy specialist (75% CES and 25% AFES) terminated in 2003 and CES is no longer participating in the Hatch project “Forage and Turfgrass Management at Northern Latitudes”. That split position was replaced with a horticulture specialist (75% CES and 25% AFES) and the individual in that position will participate in the Hatch project “Production Practices, Cultivars, and Disease of Potato and other Horticultural Crops”.

and in various applied vegetable research and on-farm demonstrations. AFES published "Turfgrass Cultivars for Golf Courses in Southcentral Alaska" for distribution at CES workshops and to the general public. A cooperative on-site golf green cultivar demonstration trial was established at the Settler Bay Golf Course in 2003 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. Much of this work is conducted in, but not limited to, southcentral Alaska where approximately 78% of the statewide value of production of potatoes and vegetables reside. 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. These positions carries split appointments and are performing applied research and on-farm demonstration for a wide range of vegetable crops both traditional and new crop opportunities including specialty greens. This information is presented annually to CES/AFES jointly sponsored workshops. Other AFES/CES collaborative work included potato late blight monitoring and treatment which assisted in controlling an outbreak in 1998 to blight-free fields in 2001, 2002, and 2003. Expensive fungicide treatments in 1998 and 1999 progressed to no treatments required in 2001, 2002, or 2003 due in large part to the monitoring program. Outreach included a joint AFES/CES publication on late blight control and presentation of research results at the joint CES/AFES Potato Growers Conference and Vegetable Growers Conference.

Greenhouse Management/Nursery

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

Reindeer Production

Alaska native reindeer herders have managed herds totaling over 30,000 deer. Those numbers have dropped significantly in recent years from out-migration of deer joining

migratory caribou. AFES scientists continued to carry out a number of research and demonstration projects in cooperation with the CES reindeer agent on the Seward Peninsula (due to funding shortfalls, CES has split the land resource agent's appointment between the Seward Peninsula and Palmer). Current projects range from reproduction and disease management to range management and reindeer nutrition. The Extension reindeer agent continues to act as the liaison between the researchers, agencies (i.e. NRCS, AFG, and BIA), and the herders themselves and facilitates annual meetings and workshops.

Animal Reproduction

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

Soil Quality /Nutrient Mangement

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

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. 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**
Potato and Vegetable Crops	Waived	13,459	9,694	8,673
Agronomic Crops and Soils	Waived	8,953	9,849	6,540
Greenhouse Management/Nursery	Waived	2,404	2,775	5,758
Reindeer Production	Waived	616	921	1,544
Animal Reproduction	Waived	2,718	5,497	6,549
Soil Quality/Nutrient Management	Waived	2,484	2,248	1,560
Community and Rural Development	Waived	324	806	4,032
Forest Production/Protection	Waived	316	1,047	1,094
Other Integrated Programs	Waived	5,106	6,090	3,654
TOTAL		36,425	38,927	39,404

Carol E. Lewis, Director _____ Date

Form CSREES-REPT (2/00)