Alaska (University of Alaska Fairbanks) Annual Report - FY2021

Contributing Organizations

University of Alaska Fairbanks

Directors

Pete Pinney - Research & Extension Signed

Executive Summary

Overview

Alaska is recognized for its immense size and sparse population and its cultural, geographic and environmental diversity. The state represents a major region of renewable and nonrenewable natural resources in the United States. Its 365 million acres include the nation's largest oil reserves, coal deposits and the two largest national forests. Alaskans harvest many non-timber forest resources including berries, mushrooms, saps, oils, chaga, roots, wildflowers and more. Alaska has a diverse geography that offers soils for production of food, fiber and biomass fuels as well as a multitude of recreational and tourism activities. The vast stretches of boreal forest offer insight into arctic ecology, tree growth trends and the effects of climate change.

Alaska's natural resources have historically been the foundation of the state's economy though resource industries have been mostly extractive in nature. The use and management of these resources is a predominant force in the planning and delivery of any teaching, research, Extension and engagement programs. The University of Alaska Fairbanks (UAF) in general and its Agricultural and Forestry Experiment Station (AFES) and Cooperative Extension Service (CES), in particular, meet the challenges of increasing demands for research, education, outreach and community engagement that are relevant to sustainable management of Alaska's resources and bring community ideas to the university for further development of the state's resources.

Alaska's economy has become dependent upon revenues related to petroleum development. To diversify its economy, the state is moving toward non petroleum natural resources for economic opportunities that are cost-effective and sustainable. The programs of AFES and CES play a vital role in linking the knowledge generated at the university to meet the needs and interests of Alaskans. Citizens are provided opportunities through engagement to influence future research and education priorities.

While Alaska imports a high percentage of foods and other agricultural products, growers in the agricultural sector produce fresh market potatoes, specialty crops and herbs; cut flowers including peonies; vegetables and herbs; forages, grains and manufactured livestock feeds; controlled environment products, and a variety of niche market crops. Livestock enterprises in Alaska are varied in size and species of animal in production. Producers need information specific to northern latitudes that will protect the environment and ensure an abundant and safe food supply for both humans and animals.

As the population grows, more locally and regionally produced food will be needed to provide greater food security. Many Alaskans live a subsistence lifestyle or supplement their diets with fish and game meat. Alaska also has a large military population, and most have not previously preserved game meat or fish. Alaska has one of the nation's highest rates of botulism, so it is imperative to provide much needed information on safe preservation of dietary staples. Alaska also has one of the fastest growing senior populations, who faces the challenge of remaining active and healthy in a demanding environment. Other concerns that define health and nutrition programming are the high rates of child and adult obesity and diabetes. Due to high levels of fine particulate matter regularly occurring during Alaska’s cold winters, and high levels of radon detected in some areas, indoor air quality is also a particular Alaska concern.

High energy costs remain a critical issue, particularly in rural Alaska, where fuel oil runs $8 or $9 a gallon. Research and outreach will continue to focus on new and alternative sources of energy, wood and biomass and energy conservation. AFES will work to provide new information to manage renewable resources and to improve technology for enhancing the economic well-being and quality of life at high latitudes. While foresters, farmers and land managers use research results, all Alaskans benefit from the wise use of land resources. Research projects will be in response to requests from producers, industries, and state and federal agencies for information on plant, animal and soil sciences, forest sciences and resources management.

AFES priorities, like national priorities, are to enhance sustainability of food and agricultural systems; adapt to and mitigate the impacts of climate change; support energy security through the development of renewable natural resources; ensure a safe, secure and abundant food supply; improve human health, nutrition and wellness; support environmental stewardship through the development of sustainable management practices; and strengthen individual, family and community development and resilience. Experiment station researchers will continue to publish research in scientific journals, conference proceedings, books, and in experiment station bulletins, circulars, newsletters, research progress reports and miscellaneous publications. Scientists will also disseminate their findings through conferences, public presentations, workshops, field days and mediated platforms like websites and blogs.

The mission of CES is to use research-based knowledge to educate, engage and support the people and communities of Alaska, connecting them with their university. CES provides factual and practical information while bringing Alaskans' issues and challenges to the university. CES is committed to promoting the sustainability and economic security of individuals, families and communities by providing practical, non formal education, including conferences, workshops and cooperative work with community, regional and tribal partners. Outreach is also provided through numbered publications, faculty consultations, newsletters, blogs and social media platforms like Facebook pages, YouTube channels and Twitter feeds.

CES priorities address national priorities by helping families, youth and individuals be physically, mentally and emotionally healthy; enhancing workforce preparation and life skills; strengthening food safety and security; and fostering greater energy independence. Programming respects cultural and ethnic diversity and is responsive to emerging stakeholder needs and interests. Programs result from client requests, various regional and subject matter advisory groups, surveys and needs assessments. Collaborations with other universities and with other units within UAF, the University of Alaska statewide system, federal and state agencies, nongovernmental organizations and private industry are planned to continue.

Stakeholders include K-12 students, higher education students, researchers, individuals, businesses, industry, government, nongovernmental organizations, and families and communities throughout Alaska, the circumpolar North and the nation. The combined efforts of AFES and CES bring the university to Alaskans while bringing community concerns and issues back to the university. State-defined critical issues link specific public needs with our broad mission in order to allow the concentration of resources (money and people) that will promote high-quality work. Critical issues will be used to provide guidance for faculty, staff and administrators to direct current and new programs and find or retain faculty expertise.

The next section of this summary explains the rationale driving a five-year focus on four critical issues: Agriculture & Food Security; Natural Resources, Ecosystems & Sustainable Energy; Healthy Individuals, Families & Communities; and 4-H & Youth Development. Climate change is not listed separately, as it is woven throughout our work on all four critical issues.

Critical Issue: 4-H & Youth Development

Research shows that youth need sustained, healthy relationships with adults in order to thrive. CES will continue to promote positive youth development through education with a focus on leadership skills, using the 4-H mission mandates of science, citizenship and healthy living. Organized 4-H clubs, school enrichment programs, after-school activities and summer camps will continue to achieve youth development goals.

The focus of Alaska's 4-H program is supporting the healthy maturation of youth from childhood to adulthood. Training throughout the state, promoting life skills and using the 4-H model of youth development, will be the foundation of all youth development programming.

Critical Issue: Agriculture & Food Security

Alaska imports over 90 percent of foods and other agricultural products consumed in the state. Growers' products are primarily for in-state consumption and use, including fresh market potatoes, forages, grains and other livestock feeds, greenhouse flowers and vegetables and a variety of "niche market" crops and products. Commercial horticulture includes cut flower and peony production, greenhouse operations, turf management, lawn maintenance and sod production. Proper knowledge and planning of soil-disturbing activities can prevent major impacts on other resources. Rhodiola is a new high-value specialty crop, and faculty have been working with an Alaska growers' cooperative to develop best practices.

Identification and education of food leaders across Alaska through the Local Food Leader training program, developed at Iowa State University Extension, is a pathway to local food security. Equipping food leaders to work towards equitable, sustainable, and balanced local food structures results in increased food security and healthy food systems. Partnerships have developed with the Alaska Food Policy Council, the Alaska Farmers Market Association, and the State of Alaska Division of Public Health to deliver certification courses and outreach throughout Alaska.

Animal enterprises in Alaska include dairy, beef, swine, reindeer, poultry and nontraditional livestock such as muskox, yak and bison. Agriculture research will address areas of animal agriculture, home animal production, agronomic crops including oil seeds and cover crops, and home and commercial vegetable production. Agricultural soils, fertilizer and compost research and outreach are also part of this program area. We provide pesticide applicator certification courses and Master Gardener courses. Our statewide Integrated Pest Management (IPM) education program has operated since 1981 assisting individuals to understand invasive pests and control options.

Agriculture outreach includes the primary areas of animal agriculture, animal health, horticulture, soil science and agroforestry. As Alaska expands its in-state consumption and export markets, producers will require increasing access to research-derived information specific to northern latitude environments and knowledge applied from research in other states.

Critical Issue: Healthy Individuals, Families & Communities

Concerns for Alaskans include high rates of obesity and recurring food safety issues such as botulism. Nutrition outreach will address childhood obesity with nutrition education in after-school programs and nutritional programs in community venues as well as cooking programs that emphasize preparing healthy foods.

Food safety programming will encompass food preservation, safety, preparation and product development. Food safety education will utilize various resources and strategies to ensure that all types of foods, including Indigenous foods, are properly stored, prepared and preserved so that food is safe for consumption. We offer Certified Food Protection Manager courses as well as workshops on preservation methods, from canning or fermenting to freezing.

Home and energy Extension programming addresses indoor air quality, home maintenance and repair, energy use and conservation. Emergency preparedness impacts such areas as families and communities responding to natural and man-made disasters. The state records frequent earthquakes, flooding and other natural disasters which underscores a need for emergency preparation as well as periodic radon testing related to ground shifts.

Training is conducted with youth, teachers, 4-H leaders, youth group organizers, parents and community partners to provide techniques for working directly with youth in the area of nutrition and physical activity. Groups like StrongWomen help community members increase their physical activity.

Critical Issue: Natural Resources, Ecosystems & Sustainable Energy

Communities increasingly depend on Alaska's natural resources for viable economic development. Policies to sustain this growth that mirror sociological and technological change will be critical. Major Alaska resource development activities are now centered in the oil and gas industries. Headquarters for these industries are located in the urban centers where there is access to various transportation and advanced communication systems. However, urban communities lack infrastructure to engage in value-added activities that would enhance development of non petroleum industry.

Additionally, these efforts should provide underserved populations in rural areas real options for economic development and improved quality of life. Outreach will address stakeholder needs for unbiased, science-based information about natural resource management issues in forestry, mining, water, recreation and alternative, sustainable energy sources. Alaska's forest and agricultural resource potential for bioenergy production is immense but requires more research. The economic potential of Alaska's forests is under-realized in timber and non timber products.

The forest ecosystem and agricultural lands can play a role in diversifying the economy of Alaska. Concern for the health and survival of resource biodiversity will continue to be a central issue in resources management in Alaska and elsewhere. As energy continues to become a growing concern throughout the world, the boreal forest has the potential to provide products necessary for fuel alternatives to petroleum and coal.

Merit and Scientific Peer Review Processes

Updates

None

Stakeholder Input

Actions taken to seek stakeholder input that encouraged their participation with a brief explanation

New unit-based needs assessment guidance for IANRE will be part of an onboarding package in process through the evaluation specialist's project for the Western Extension Leadership Development program. A new slate of members was recruited for the statewide advisory council. Leadership changed meeting invitations to be shared with the unit, which has improved connections with the Communications team.

Methods to identify individuals and groups and brief explanation

IANRE has made improvements to making all reasonable efforts in raising awareness about its educational resources to a wide variety of Alaskans. IANRE invested more time in FY21 to Instagram to reach a younger demographic, as insights from our Facebook indicate that the majority of our audience on that platform is in the 40+ range. IANRE also used paid promotion for relevant videos because YouTube has risen to the top of the market in terms of the social media platform with the most reach. IANRE's in-house editor also began submitting content to Alaska Pulse, a monthly magazine focused on healthy lifestyles. Alaska Pulse is distributed in Alaska's first and second-largest cities and is available electronically and in print.

Methods for collecting stakeholder input and brief explanation

No significant changes.

A statement of how the input will be considered and brief explanation of what you learned from your stakeholders

Input is gathered annually at public events like the Alaska State Fair and Tanana Valley State Fair, where public feedback is recorded by boothsitters and routed to the appropriate employee for a response. In FY21, we received a request that led to hard copies of the Extension publication "Dressing Children for Cold Weather" being translated into Spanish, Chinese and Tagalog and distributed to local families.

IANRE continued to adapt to the pandemic enviroment and offered "Walkabout Wednesdays" where stakeholders could join conversations on agriculture virtually through the broadcast on Facebook Live. On the last Wednesday of each month, participants also had the option to join in person outdoors for a farm tour at the Matanuska Experiment Farm and Extension Center. This format gained continued engagement with the public through in-person questions, social media comments, and post-broadcast views. IANRE learned about multiple stakeholder interest areas including phenology, sustainable foraging, and community garden spaces; garden planning, composting, small grains, potatoes and variety trials; youth activities like crafting and at-home kits; and birding and animal tracking.

In FY21, requests for specific speakers and topics at conferences continued to guide conference agendas. Requests for programming helped shape what is offered. The evaluation specialist worked with the Western Region Evaluation Network to procure needs assessment resources and will continue to help CES and AFES faculty and staff identify emerging issues. Community needs are an important consideration when assessing how to create or fill staff and faculty positions. Community presentations with Q&A sessions were held during FY21 for several IANRE recruitments.

AFES and CES will continue to serve the needs of the people of the state of Alaska. Input will reflect ideas and advice given by client user groups, students, expert advisors, state and national peers and collaborators and UAF administration. The four critical issue areas identified reflect the concerns of all major stakeholder groups, and will continue to be the highest priorities in workload planning and resource allocation. Stakeholder needs will continue to be a driving factor in determining AFES priorities for research and CES priorities for programming.

Highlighted Results by Project or Program

Critical Issue

4-H & Youth Development

Fostering positive youth development through mentoring and culturally relevant education in healthy living, STEM, civic engagement and leadership for Alaskan youth	Project Director	Organization	Accession Number
	Alda Norris	University of Alaska Fairbanks	7000098

Alaska 4-H Adapts Activities for Online Learning

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Research shows better outcomes for youth who have connections with caring adults. According to Alaska Children’s Trust, 45,000 Alaska children do not have access to an afterschool program, yet 78 percent of Alaskan parents say such programming helps working families. As the 4-H Essential Elements note, the youth development field recognizes that positive development requires structure, support, skill-building, and "strong links between families, schools and broader community resources." 4-H is uniquely positioned to provide culturally relevant opportunities for Alaska’s youth in healthy living, STEAM, civic engagement and leadership. However, the pandemic was an obstacle to face-to-face programming. The 4-H slogan is "Learn by Doing." Not being able to “do” made it challenging for learners. Alaskan youth needed support for engaging in community-building activities online.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Agents redesigned programming to adapt to online delivery. 4-H youth participated in watercolor and art lessons, livestock educational activities and even a yak farm tour by Zoom. Many 4-H offices distributed at-home activity kits on gardening, computer coding and cultural activities, such as making a story knife. The leader's council in Fairbanks faciliated the distribution of 700 kits in four themes, assembled by teen volunteers. Hybrid events included a drive-through plant sale, a virtual state competition, a drive-in livestock auction, national online competitions and a drive-up awards program. In the Interior, programs received praise for their continuity throughout the pandemic. Alaska 4-H's tribal extension educator in Dillingham used creative solutions to reach isolated families. Kenai Peninsula District 4-H rolled out a six-week 4-H On series days after a shutdown due to the pandemic. The series engaged 15-30 youth and leaders weekly. Daily prompts were given in areas such as public speaking, creative writing, painting, photography, sculpting and healthy living. After the initial two weeks, topics extended to include weekly Livestock Learning Hour workshops during which 4-H youth shared information with one another on how to feed, care for and show animals they've raised as 4-H projects. There were classes on poultry, rabbits, sheep and cattle.

Briefly describe how your target audience benefited from your project's activities.

Rising to the challenge of having to switch programs to new modalities of learning has enabled Alaska 4-H to broaden its outreach online, and has given youth and their caring adults opportunities to continue to "Learn by Doing." In particular, programming at a youth facility was able to continue despite pandemic visitor restrictions. The facility staff set up the necessary equipment for a Zoom session at the unit, and 4-H agents continued to meet with youth weekly. One of the agents noted that it was a sign of the significant trust built in their eight-year partnership for a secure facility to allow web-based communication with an outside entity. Overall, 4-H participants appreciated the continued activities that helped keep them connected to the community. Several parents responding to a Bethel agent's survey noted teamwork and collaboration as areas of increased learning for themselves and their youth, and one noted their youth was "able to connect to their new friends in their community."

Briefly describe how the broader public benefited from your project's activities.

The 2019 Alaska Youth Risk Behavior Survey notes that "since 2007, there have been significant increases in students feeling sad or hopeless, and considering, planning for, and attempting suicide in the past 12 months." In addition, less than half of the high schoolers that responded, or only 48.6 percent "felt comfortable seeking help from three or more adults besides their parents." The community connections offered by Alaska's 4-H programming increase the chances that youth will form bonds with additional caring adults like leaders and mentors, helping mitigate these risks.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Alaska 4-H has many impressive examples of adapting to pandemic circumstances and keeping youth in the state connected to their communities.

Alaska 4-H Delivers On Experiential Learning

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Youth camps have been on a two-year pause because of COVID. Eliminating these camp opportunities adds to the isolation families have experienced over the past year. Since the onset of the pandemic, Alaska has seen an increase in suicide among youth, and there may be additional unseen impacts (Alaska Kids Count, 2020). It is essential to find ways to continue the connection provided by 4-H camps held around the state of Alaska. Such camps are a community effort to provide youth with experiential learning and introduce them to the benefits of 4-H.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Alaska 4-H was a recipient of a Rasmuson Foundation grant in 2021 to deliver camp programming. The intent was to deliver the AK Experience Camp statewide to provide youth with experiential learning opportunities and a sense of community. In addition, we created the Alaska 4-H Summer camp at-home kits. The kits were offered to youth ages 5-18 throughout the state from June through September. Fifty-five youth are participating in the at-home camp kits. Each month, campers receive a packet of supplies, along with the curriculum for experiential learning activities related to: Microgreen Magic, Plant Detectives, Potato Possibilities, and Summer Harvest. Recipients are asked to share stories about their camping experience. In Kodiak, an additional 15 youth received a Kodiak-specific camp kit with activities that normally would be done in person. Kits included supplies needed to construct their own bow and arrow, make a paddle boat from craft sticks, build a s'more oven to cook their s'more ingredients, and bead an Alutiiq-style bracelet.

Briefly describe how your target audience benefited from your project's activities.

Participants are located in Kodiak, Palmer, Fairbanks, Sitka and the Kenai Peninsula. These kits provided the experience 4-H at-home camp kits provide youth with experiential learning opportunities. The kits also provided culturally relevant activities. The Alutiiq Museum graciously provided supplies needed to bead an Alutiiq-style bracelet, found in the Kodiak-specific at-home camp. The kits allowed for a camp experience facilitated at home, building a sense of community throughout the state and offering a buffer against social isolation. Experiences are expected to align with Tufts University research on positive youth development showing that 4-H'ers are twice as likely to

participate in STEM activities during out-of-school time, and twice as likely to make healthier choices. Participant feedback so far shows the activities are fun and easy to do, and that campers gain valuable knowledge as a result of the at-home 4-H camp experience. One camper said, “The kits were a good way to bring the family together and learn about the environment around us. They were a lot of fun.”

Briefly describe how the broader public benefited from your project's activities.

4-H made efforts to keep youth connected with caring adults at a regional level throughout the pandemic.

Alaska 4-H Provides Locally Relevant STEM Programming

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

U.S. teens perform below average in math, according to The Programme for International Student Assessment (PISA) survey results from 2018. In addition, socio-economically disadvantaged students were outperformed by advantaged students in all three core subjects of reading, math and science. Improving youth engagement in science, technology, engineering and mathematics (STEM) can help close these gaps. As PISA notes, “holding a growth mindset is positively related to better academic performance in almost every education system.” 4-H programming is an ideal match to this effort with its widely available STEM curricula and essential elements of inclusive environments, engagement in learning, opportunities for mastery, and a focus on the future.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In FY21, Alaska 4-H programming across the state offered a multitude of STEM-focused programming. 4-H partnered with Arctic & Earth SIGNs and the nonprofit Renewable Energy Alaska Project to offer a statewide STEM program open to 4-H’ers ages 5-12 in recognition of Energy Awareness Month. Participants received kits by mail for a Mars Rover Solar STEM Challenge. Youth engaged with an Alaskan solar researcher, heard from a solar installer about career opportunities, and had a chance to ask questions to a planetary scientist. In Kodiak, 15 Cloverbuds visited a reindeer and asked questions to its handler. An agent worked with Alaska Forum on the Environment on a youth track that annually provides opportunities for youth to showcase their projects related to biology, ecology, conservation and advocacy.
In Fairbanks, 15 middle-schoolers and 5 teen mentors participated in Camp Invention challenges. In Juneau, the agent organized an annual 4-H Plant Sale. The Juneau agent uses the sale to teach 4-H youth and Master Gardeners horticultural practices,such as the proper methods for caring for bare-root tree stock. The Juneau agent also held family workshops and day-camps for 40 participants on container gardening, garlic scape harvests and fish. An at-home camp kit series in the Tanana District included topics like microgreens, potato conduction, and being plant detectives.

Briefly describe how your target audience benefited from your project's activities.

The proceeds from the plant sale are used to fund local clubs, which reduces cost as a barrier to some families. Alaska 4-H also partners with several 21st Century schools to bring STEM opportunities to students of all backgrounds. The Juneau agent facilitated the donation of grow boxes to several youth-serving agencies to make sure equipment is available for STEM teaching. Overall, communities benefit from both the academic aspects for the youth, and the connections built by the program. For example, after a fish canning activity, 4 cases of half-pint jars of smoked salmon were set aside to be shared at a totem pole raising ceremony in Spring 2022 dedicated to survivors of domestic violence. The aforementioned plant sale is an example of capacity building, as it has expanded to partner with seven non-profit organizations and many businesses. Youth built leadership and public speaking skills through their experiences as camp mentors and forum presenters.

Briefly describe how the broader public benefited from your project's activities.

Alaska 4-H helps build community capacity and promote good stewardship practices because of its support of adult and youth connections, community service, and an appreciation for Alaska's natural resources. Alaska 4-H engages youth in STEM activities to help them be lifelong learners and close achievement gaps.

Critical Issue

Agriculture & Food Security

Selecting and Evaluating Wheat, Barley, Oil Seed Crops and Developing Integrated Crop Management System in Alaska	Project Director	Organization	Accession Number
	Mingchu Zhang	University of Alaska Fairbanks	1019139

Selecting and Evaluating Wheat, Barley, Oil Seed Crops and Developing Integrated Crop Management System in Alaska

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

A large proportion of food consumed in Alaska is shipped from outside, therefore, Alaskans are concerned about food security. This project addresses agriculture's role in addressing these concerns, such as which crops can be grown and what cultural practices are the most efficient and successful for production of those crops. In addition, an increase in energy costs and public pressure on reduction of greenhouse gas emissions have created a demand for biofuel production from agricultural crops (oil seeds, grasses, cereals, etc.). Agriculture producers in Alaska are therefore being asked not only to produce traditional food and fiber crops but to produce biofuel crops as well. As such, new and better adapted oil seed crops that can be used for biofuels, edible oil, and for crop rotation must be developed both from an

agronomic and economic standpoint. High value agronomic niche crops such as malting and hull-less barleys and oilseeds like canola, mustards, camelina, and dwarf sunflowers have been shown to have agronomic potential for Alaska (Van Veldhuizen and Knight 2004*, Geier 2006).

*1. *Van Veldhuizen, R. M. and Knight C. W., 2004. Performance of Agronomic Crop Varieties in Alaska 1978 – 2002. AFES Bulletin 111. Agricultural and Forestry Experiment Station, University of Alaska Fairbanks, Fairbanks, AK.*

**2. Geier, H. 2006. Canola Quality in Alaska, 2004 and 2005 Harvests. Research Progress Report No. 47. Alaska Agricultural and Forestry Experiment Station, University of Alaska Fairbanks, Fairbanks, AK.*

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Average yields for all spring grain and oilseed varieties at the Fairbanks (FBKS) and Palmer (PAL) locations were about equal to the standard test varieties. Significant progress in 2021 included the findings of potential good varieties of two-row barley which were chosen for malting tests in a commercial laboratory. The selected canola reached maturity uniformly. Simulation of weather impacts on small grains grown in Alaska was conducted and results were published in journal.

Briefly describe how your target audience benefited from your project's activities.

Trial results will help small farms and growers choose reliable varieties and better cover crop practices that improve suitability for Alaska growing conditions, We will continue to conduct the field experiment similar to 2021, with a possibility of including some new malting barley varieties from North Europe.

Briefly describe how the broader public benefited from your project's activities.

The results were delivered in the growers' meeting in Harvest Wrap-up in December 7, 2021 with partipants of 20 both online and in site.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The major probles are the migratory birds at seeding time of May and early June, and at harvesting time in late August and early September. Increase in width of buffer zone was used in this year so that it took more time before birds damaged treatments. The other major challenge is the weather. Continuous rain in late August and early September made delayed maturity and created lodging and mold in the treatments. But nothing can be done for the weather.

We will continue to conduct the field experiment similar to 2021, with a possibility of including some new malting barley varieties from North Europe.

Evaluating cover crop performance and cover crop management on soil fertility, soil health soil water use and soil temperature dynamic in the cold climate conditions of Alaska

Project Director	Organization	Accession Number
Mingchu Zhang	University of Alaska Fairbanks	1022120

Evaluating cover crop performance and cover crop management on soil fertility, soil health soil water use and soil temperature dynamic in the cold climate conditions of Alaska

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The project is evaluating the suitability for use of cover crops in interior Alaska. It is addressing the impact of cover crops and their rotational schedules on soil property and soil health indicators and the impact of starter fertilizer on biomass production.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The research plots were set up in May 2020. In 2020, the growth on 2x seeding rate were dense and healthy, but it didn't suppress growth of lamb's quarter (Chenopodium album) and chickweed (Stellaria media). In 2021, the dead biomass 2x clover+ryegrass was thick and prevent the emergence of clover in the spring. But this didn't happen in the 2x alfalfa treatments. For 1x clover + ryegrass, the dead biomass of 2020 also prevented new growth of clover and ryegrass in 2021, but it was less in comparison with 2x clover + ryegrass treatments. Biomass need to be harvested for clover treatment in order to have a muliple year of cover crop growth. In the treatments of alfalfa + wheatgrass cover crop, the dead biomass didn't prevent the new growth in 2021. The weed depression did not happen in 2 x seeding rate of neither clover + ryegrass nor alfalfa + wheat grass treatments. Therefore, weed control is an issue when growing a mixture of dicotyledon and mono cotyleton cover crops. Plant composition coverage were determined.

The biomass of the two year rotation treatments of 1x seeding rate of clover + ryegrass and alfalfa + wheat grass were removed and soil were tilled in fall 2021 for growing barley in 2022 growing season to determine the benefit of cover crops. Prior to biomass removal, above ground tissue samples and soil samples were taken and will be determined for nutrient concentration in tissue samples, and soil samples. Soil nitrogen release will be also determined in laboratory incubation. Other soil health indicators (chemical and biological) will be determined.

Briefly describe how your target audience benefited from your project's activities.

The target audiences are growers of small grains and peony. The research results were delivered in growers meeting "Harvest Wrap Up" on December 7, 2021. There are 11 growers on sites and the other 9 online. After the presentation, questions on cover crops such as legume varieties, nitrogen fixation, weed control were discussed.

Briefly describe how the broader public benefited from your project's activities.

The results were delivered to growers in extension meeting of Harvest Wrap-up. It also delivered to audience who paid a site visit in the experiments.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

There was a Ph.D. student working as summer student in the project.

For 2021 soil and tissue samples, they need to be sent to commerical laboratory to analyze their nutrient concentration. An incubation experiment will be conducted in 2022 at 20oC to determine nutrient release from soil samples taken in fall of 2021.

In 2022, barley will be seeded in the 2 year rotation treatments, barley biomass will be taken in the vegetative growth stage and at grain filling stage to determine N uptake. Soil and biomass samples will be taken in fall of 2022 to continue evaluation of cover crop impact on soil properties and N fixation.

Managing Plant Microbe Interactions in Soil to Promote Sustainable Agriculture

Project Director	Organization	Accession Number
Jenifer McBeath	University of Alaska Fairbanks	1025528

Managing Plant Microbe Interactions in Soil to Promote Sustainable Agriculture (Multistate W4147, Objectives 1-4)

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Objective 1. To identify and characterize new biological agents, microbial community structure and function, naturally suppressive soils, cultural practices, and organic amendments that provide management of diseases caused by soilborne plant pathogens.

Objective 2. To understand how microbial populations and microbial gene expressions are regulated by the biological (plant and microbes) and physical environment and how they influence disease.

Objective 3. Implement sustainable management strategies for soilborne pathogens that are biologically based and are compatible with soil health managment practices.

Objective 4. Provide outreach, education, extension and technology transfer to our clients and stakeholders—growers, biocontrol industry, graduate and undergraduate students, K-12 students and other scientists.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

(Objective 1)

Isolation and identification of cold adapted Bacillus spp. soils were collected from interior-Alaska, southcentral-Alaska and Kenai Peninsula. A total of 163 Bacillus isolates were obtained. Among them, 18 showed strong ability to suppress the growth of plant pathogens. Among the isolates, 53 were found adapted to cold temperature. Bacillus isolate 217 demonstrated the strongest suppression against Botrytis spp. and in a lesser degree against *Fusarium* spp. and *Penicillium* spp. Identification of the *Bacillius* isolates were based on their molecular and biological characteristics.

(Objective 2)

Microbiome Studies: This study is conducted in collaboration with Bode Olukolu. High molecular weight DNAs were extracted from the rhizospheres and phyllosphere of peony plants. The metagenomes were subject to quantitative reduced representation sequencing (qRRS) method to understand plant-pathogen-microbiome interactions in peony and in Arctic soils.

Nutrient Recycling Studies: The hypothesis is that in Alaska, plant diseases can facilitate the degradation of plant tissues and hence, impact positively on the recycling of nutrients. In the fall of 2019 and 2021, fallen leaves from aspen trees were collected and divided into two groups depending on the numbers of sori of Melampsora rust disease. The mesh bags contained: 1) leaves with large number of Melampsora rust sori, and 2) leaves with no sori or a limited number of sori. In the spring 2020, after breakup, mesh bags will be excavated. Plant tissues in the mesh bags will be evaluated. Degradation will be evaluated by the loss of weight and minerals.

(Objective 3)

Field trials of Plant Helper (formulated cold-adapted *Trichoderma atroviride*) were conducted in 2020 and 2021 on one (1) and five (5) collaboration peony farms, respectively. Significant findings of the field trials were: 1) reduction in severity and incidence of Botrytis spp. were observed on peony farms, and 2) peony plants treated with Plant Helper demonstrated a delay in the senescence process.

In 2021, *Pytium* sp. was found for the first time in waters and soils on peony farms. It was a major causal agent resulting in the death of peony seedlings and the rootstocks suffered from an unseasonal hard freeze in late spring.

(Objective 4)

In 2021, the number of collaborator farms increased from one in 2020 to six. An effective Botrytis treatment schedule was developed in collaboration peony farms.

Briefly describe how your target audience benefited from your project's activities.

This project will help peony farmers in Alaska to grow healthy plants and produce high quality cut-flowers, using environmentally-responsible means of disease control.

Milestones accomplished so far that will benefit peony farmers include:

1) Discovery of cold adapted, biological control Bacillus spp.

2) Discovery of Pythium spp. as a possible causal agent of Peony,

3) Improvement of Plant Helper treatment plan.

Briefly describe how the broader public benefited from your project's activities.

J.H. McBeath, H. McKee, and K. Thompson presented at the Alaska Farm Conference on November 14, 2021.
Title of the presentation: Peony Disease Research in 2020 and 2021.

Understanding Microbiome in Order to Develop Effective Disease Controls for a Chemical Pesticide-Free Peony Farming System	Project Director	Organization	Accession Number
	Jenifer McBeath	University of Alaska Fairbanks	1020008

Understanding Microbiome in Order to Develop Effective Disease Controls for a Chemical Pesticide-Free Peony Farming System

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The ultimate goal of this project is to assist peony farmers in Alaska to grow healthy plants, which will produce high quality cut-flowers using environmentally-responsible means of disease control. Specific objectives of this proposed project are as follows:

a. Establishment of baseline information of peony farms,

b. Diagnoses of diseases found during yearly disease surveys conducted on the farm,

c. Evaluations of the nutrient levels in peony tissues, using ICP-OES technology,

d. Evaluation of the performance of Plant Helper and Cu-I-PO3 on Botrytis blight control,

e. Initiation of studies on microbial communities in the rhizosphere and phyllosphere of peonies and vegetation in and around the peony farms and,

f. Discovery, identification and characterization of beneficial microbes in Alaska. We hypothesize that: (i) microbes within the microbial communities can be detected at the strain level and quantified, using reduced representation sequencing of microbial genomes method; (ii) the diversity and abundance of the microbial community will be mostly host-genotype dependent; (iii) the microbiome influences host diseases' resistance by acting as a host secondary genome; (iv) that plant nutrient plays a significant role in plant-microbe interaction and biocontrol performance; and (v) that the ability for strain-level profiling of the microbiome will lead to high-throughput detection of beneficial microbes and biocontrols.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Microbiome Studies: This study is conducted in collaboration with Bode Olukolu. High molecular weight DNAs were extracted from the rhizospheres and phyllosphere of peony plants. The metagenomes were subject to quantitative reduced representation sequencing (qRRS) method to understand plant-pathogen-microbiome interactions in peony and in Arctic soils.

Nutrient Recycling Studies: The hypothesis is that in Alaska, plant diseases can facilitate the degradation of plant tissues and hence, impact positively on the recycling of nutrients. In the fall of 2019 and 2021, fallen leaves from aspen trees were collected and divided into two groups depending on the numbers of sori of Melampsora rust disease. The the .esh bags contained: 1) leaves with large number of Melampsora rust sori, and 2) leaves with no sori or a limited number of sori. In the spring 2020, after breakup, mesh bags will be excavated. Plant tissues in the mesh bags will be evaluated. Degradation will be evaluated by the loss of weight and minerals.

Beneficial microbes: Isolation and identification of cold adapted Bacillus spp. Soils were collected from interior-Alaska, southentral-Alaska and Kenai Penisula. Bacillus spp. A total of 163 Bacillus isolates were obtained. Among them, 18 showed strong ability to suppress the growth of plant pathogens. Among the isolates, 53 were found adapted to cold temperature. Bacillus isolate 217 demonstrated the strongest suppression against Botrytis spp. and in a lesser degree against *Fusarium* spp. and *Penicillium* spp. Identification of the *Bacillius* isolates were based on their molecular and biological characteristics.

Plant Helper field trials:

Field trials of Plant Helper (formulated cold-adapted *Trichoderma atroviride*) were conducted in 2020 and 2021 on one (1) and five (5) collaboration peony farms, respectively. Significant findings of the field trials were: 1) reduction in severity and incidence of Botrytis spp. were observed on peony farms, and 2) peony plants treated with Plant Helper demonstrated a delay in the senescence process.

In 2021, *Pytium* sp. was found for the first time in waters and soils on peony farms. It was a major causal agent resulting in the death of peony seedlings and the rootstocks suffered from an unseasonal hard freeze in late spring.

Briefly describe how your target audience benefited from your project's activities.

In 2021, the number of collaborator farms increased from one in 2020 to six. An effective Botrytis treatment schedule was developed in collaboration peony farms

Briefly describe how the broader public benefited from your project's activities.

This project is helping Alaska peony farmers grow healthy plants and develop a high quality product using environmentally-responsible means of disease control.

The discovery of cold adapted, biological control Bacillus spp., discovery of Pythium spp. as a possible causal agent of Peony, and the improvement of a Plant Helper treatment plan, will benefit the broader public by reducing the need for farmers to use toxic chemicals that contribute to overall environmental degradation.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Publications/Invited Presentation:

McBeath, J.H., McKee, H., and K. Thompson. 2021. Peony Disease Research in 2020 and 2021. Alaska Farm Conference, Nov. 14, 2021.

Developing environmentally-responsible rhodiola farms in Alaska through explication of microbiome	Project Director	Organization	Accession Number
	Jenifer McBeath	University of Alaska Fairbanks	1023854

Developing environmentally-responsible rhodiola farms in Alaska through explication of microbiome

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Rhodiola (*Rhodiola* spp.), a perennial herbaceous, high-valued medicinal plant, is the latest agricultural crop developed in Alaska. This project addresses the issues of 1) enhancement of the growth and development of rhodiola, and 2) development of environmentally benign means of disease control.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Manipulation of the soil microbial communities holds great promise for contributing to more environmentally benign agriculture, with soil microbes promoting plant growth and effectively suppressing pathogenic microorganisms

With the advancement of new tools in molecular genetics, this project intends to initiate a study on the microbial communities in the soils surrounding roots of rhodiola.

The objective of this project is the development of an efficient and economical production system of healthy, robust rhodiola crop.

Briefly describe how your target audience benefited from your project's activities.

The proposed project targets farmers, extension agents, government officials and industry partners in rhodiola production and sales. Information will be disseminated through extension on improved cultural and management practices, such as effective use of *Trichoderma* in disease control. The research will also benefit undergraduate, graduate and postdoctoral research and training.

Briefly describe how the broader public benefited from your project's activities.

The rhodiola *(Rhodiola* spp) is a perennial, herbaceous, high-valued medicinal plant. The roots of rhodiola are in high demand because it is reputed to be effective as an adaptogen (rhodiola tincture is used as an anti-depressant) and is believed to have anti-cancer properties.

The public will benefit by learning about the development and improvements made on cultural and management practices of rhodiola in Alaska and effective use of environmentally benign and safe biological agents such as *Trichoderma* in disease control.

ALASKA GREENHOUSE AND CONTROLLED ENVIRONMENT PRODUCTION USING LEDs AND OTHER EMERGING TECHNOLOGIES	Project Director	Organization	Accession Number
	M Karlsson	University of Alaska Fairbanks	1016282

ALASKA GREENHOUSE AND CONTROLLED ENVIRONMENT PRODUCTION USING LEDs AND OTHER EMERGING TECHNOLOGIES

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

The issue or problem that this project addresses is improving and/or maintaining food security in Alaska. Short field seasons and challenging climatic conditions result in variable and often limited supplies of local produce with high dependency on food brought in from outside (Karlsson, 2017, Meter and Goldenberg, 2014). The substantial distance to large agricultural production areas raises concerns for interference in delivery systems and year-round availability of affordable high quality food.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

1. Advance production and management techniques for Alaska agricultural production in greenhouses and controlled environment production facilities through novel technologies, methods and innovations.

Several studies are in progress for determining the effects and potential implementations of LEDs for greenhouse and controlled environment production. Sustainable greenhouse systems that are specifically well suited and efficient for high latitude vegetable production are also evaluated.

2. Develop sustainable greenhouse control methods to improve resource use efficiency, climate uniformity, production quality, productivity and yields.

LEDs with expected higher energy efficiency and adjustable spectrum, suggest improved resource use while allowing for a more uniform growing environment to support crop productivity and quality. Greenhouse production systems that are based on the extended daylight hours in the summer and transitioning into less light demanding crops during the winter can be expected more resource efficient and sustainable in northern climates.

3. Disseminate information about controlled environment technologies, methods and approaches to producers throughout the state.

As we gain knowledge and understanding of LEDs and other production techniques, we anticipate additional publications and outreach efforts in this area.

4. Teach up-to-date greenhouse, indoor farming and controlled environment technologies to beginners, producers, and students in formal educational programs.

Briefly describe how your target audience benefited from your project's activities.

In the fall of 2020, the course Applied Plant Science was offered to undergraduate students. This course had a significant emphasis on the sustainable use of resources and the management of light and other climatic conditions. The course Greenhouse Management was offered in the spring of 2021. The college level greenhouse management course includes substantial information on modern control and management techniques for greenhouses and controlled environments. Understanding and implementing greenhouse- and season extension environments are essential for efficient local northern crop production. Both the sustainable agriculture and greenhouse management courses will be offered in the spring of 2022.

5. Publish research findings, prepare educational materials, and exchange information with stakeholders, extension personnel and researchers in the U.S. and internationally

Results and experiences on the efficient use of LEDs, protocols for basil and spinach production and the nutritional value of locally grown produce and herbs have been communicated at state, national and international scientific conferences, as well as in post-secondary education and producer oriented gatherings. The annual ASHS (American society for horticultural science) conference was held in August of 2021 as an in-person (Denver, Colorado) and online meeting. This conference provided information and several presentations on findings related to the use and adaptation of LED lighting technologies in research and crop production along with the use and implementation of controlled environment facilities for crop production in various geographical locations and climates.

Briefly describe how the broader public benefited from your project's activities.

As we gain knowledge and understanding of LEDs and other production techniques, we anticipate additional publications and outreach efforts in this area.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The pandemic has reduced in-person activities and the connectivity with students, producers and the public. The lack of in-person scientific conferences and meetings has limited opportunities to receive and engage in conversations of current trends, industry challenges, technical advances and research directions. These issues may specifically affect Alaska because of the remoteness and separation from major agricultural production areas, limited number of colleagues, and institutions providing education, research and outreach. Virtual and online opportunities have been engaged and used where possible but tend to fall short of personal and direct connections. Combinations of traditional communication lines with those developed during the pandemic can be anticipated to work well and more effectively for outreach and dissemination of information in the future.

Various communication channels are used to reach and meet the needs for information, education and training to various groups throughout the state. We are continuously communicating with producers and individuals interested in pursuing or already engaged in the use of various production systems such as fields, high tunnels, greenhouses and indoor controlled environments. Training opportunities in topics related to horticultural production are regularly offered and presented to students at secondary and post-secondary levels. Presentations are also provided at local, regional, national and international meetings, conferences and workshops on crop production in various environments including greenhouses, high tunnels, season extension techniques and field conditions. The limited in-person contacts and meetings in 2020 changed and reduced the number of direct interactions. As communities and the university are able to resume activities and events, traditional interactions along with online tools for training and development are likely to continue and increase.

The international conference on Light in Horticulture originally planned for June 2020 was postponed to an online format in May of 2021. Although the online conference was well attended and allowed for some limited individual and direct contacts, the interactions were not comparable to an in-person conference.

Presentations are provided at local, regional, national and international meetings, conferences and workshops on crop production in various environments including greenhouses and other indoor growing approaches, high tunnels, season extension techniques, and field conditions. In the fall of 2019 and early 2020 prior to the pandemic, activities and conferences were conducted on schedule. As in-person events were reduced or canceled in 2020, online opportunities increased. Several conferences, workshops and meetings went online with opportunities for participation, presentations and the display of research findings and information.

We are continuing the initiated studies and are adapting research protocols based on earlier findings to more effectively use the available greenhouse research facility. The setup for the LED research is updated for improved efficiency. Our outreach efforts are anticipated to go back to events similar to those provided prior to March 2020 along with methods that worked well during the pandemic to provide information at grower gatherings, response to information requests, scientific and producer oriented publications, and formal instructional secondary and post-secondary activities.

Virtual Boundary to Aid in Reindeer Reintroduction on Remote Ranges

Project Director	Organization	Accession Number
G Finstad	University of Alaska Fairbanks	1023850

Virtual Boundary to Aid in Reindeer Reintroduction on Remote Ranges

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Reindeer producers on the Seward Peninsula, AK have lost 75–100 percent of their herds through commingling and out-migration with wild caribou. They now wish to reintroduce reindeer to many of the vacant grazing allotments. Grazing allotments in Alaska are large and remote with no roads or trails and range animals are challenging to monitor because of demanding overland travel. Reindeer exhibit a strong behavior to return to their home range which will be a location hundreds of miles away and wayward animals will be difficult or impossible to recover.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Sixteen satellite collars; four different models using two commercially available satellite systems were purchased and the capabilities of each were tested and costs of each estimated. Software components and databases were generated for creating virtual boundary polygons using Google Maps. A series of scripts were created to automate the processing GPS satellite collar data to upload locations into the virtual boundary database. An application was developed to create a Google Map of the collar locations for collar id’s belonging to the authenticated producer. An application was developed to evaluate collar locations in relation to virtual boundary zones and send messages to the producer via text message or email according to the settings in the virtual boundary database.

Briefly describe how your target audience benefited from your project's activities.

This project was generated at the request of the Seward Peninsula reindeer producers as they articulated that development of this range management tool would be critical in the rebuilding of the reindeer industry in Alaska. The cost/benefit data will allow the producers to independently develop their own system to fit their needs and budget after this project is complete. The benefits to producers aren't expected to fully take effect until the system has completed the beta testing and been implemented, which is expected in the next year.

Briefly describe how the broader public benefited from your project's activities.

A simulation of the virtual boundary and alert system was conducted with students attending the HLRM 201 Range Management Techniques course at the University of Alaska Fairbanks Northwest Campus, Nome. The beta testing of the system and student feedback was used to improve the system. A simulation of the project was presented to Alaska Reindeer Council (ARC) which is composed of reindeer producers, state and federal agencies that are associated with the reindeer industry. A marine mammal researcher participated in the ARC presentation to explore possible adaptations of this project to an on-going Beluga whale GPS satellite collar study.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

We had planned to place radio-collars on reindeer and for training sessions to be conducted with collaborating producers during this reporting period, but because of widespread outbreaks of Covid-19 in Alaska all of the rural Alaskan villages associated with reindeer went into lockdown and prohibited entry of any non-residents. We have tentatively scheduled radio-collar placement and training sessions for the next reporting period contingent upon Covid-19 rates, village travel protocols and weather.

Resource Optimization in Controlled Environment Agriculture

Project Director	Organization	Accession Number
M Karlsson	University of Alaska Fairbanks	1025487

NE1835-Resource Optimization in Controlled Environment Agriculture

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Objective 1. To evaluate and develop strategies to improve energy efficiency in controlled environment agriculture.

Objective 3. To train growers and students to utilize emerging controlled environment agriculture technologies.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Spinach is a popular leafy green with a public perception of providing higher nutritional quality than many other salad greens. Flower initiation and bolting occur under long day conditions resulting in limited or discontinued leaf formation. Cultivar selections of spinach with less tendency for flower initiation under long days or warm growing conditions are available. Field production can nevertheless be limited, as many cultivars still tend to form flowers under less than optimal temperature or photoperiodic conditions. To meet year round requests for locally grown high quality spinach, shifting from field production to greenhouses and other controlled environments is an option.

The impact of light quality on soluble solids content (°Brix), yield, dry matter accumulation and mineral nutrient content in fresh spinach were evaluated. Spinach was grown under panels of LEDs and compared to greenhouse growing conditions with natural or supplemented light. The cultivar Seaside was selected as it has a more limited tendency to initiate flowers and bolt. The light quality treatments included blue LEDs (peak emission at 450 nm), red LEDs (50:50, peaks at 625 and 660 nm), blue/red LEDs (20:40:40, peaks at 450, 625 and 660 nm), and white LEDs (5000K). In addition, T5 fluorescent (4100 K) and natural greenhouse light supplemented with high-pressure sodium (HPS) irradiance were evaluated in a greenhouse covered with the acrylic material DEGLAS®. The growing areas of LEDs and fluorescent lamps were separated and shielded from natural and greenhouse light using an opaque blackout material. Plants were grown at a constant 21 ± 2°C with a 16 hour photoperiod of approximately 150 µmol·m-2s-1.

The fresh- and dry weights were considerably smaller for plants grown in the greenhouse environment under natural and HPS lighting. Flowers formed quickly in the greenhouse grown spinach that resulted in limited leaf- and overall growth. Some spinach grown under blue LEDs also formed flowers with overall smaller fresh weights. The largest fresh weights were in the blue/red LEDs at 125.67 ± 9.16 grams per plant. The white LEDs also supported good growth (112.06 ± 4.86 g) while the red and fluorescent environments produced similar sized spinach. The proportion dry weight varied between 7.5 to 8.5 percent. The only exception was in the blue environment were the ratio of dry weight per plant was closer to 10 percent of the fresh weight.

There was a trend for higher °Brix under blue LEDs with a value of 8.6 ± 0.65. To further evaluate the use and significance of LED light spectrums for growing spinach, the mineral nutrient content and quality were also determined. The content on a dry weight basis of nitrogen, calcium, iron or zinc was not significantly different among growing conditions. For potassium and magnesium, the highest content was recorded in the control treatment (natural light with HPS). For phosphorous, sulfur and boron on the other hand, the control treatment resulted in the least amounts.

The 16 hour day length was used to ensure appropriate levels of daily light were provided for overall growth. Although Seaside is considered slow bolting, there was a tendency for bolting and flowering in the greenhouse environment throughout the year. The relationship between natural and HPS light is seasonally synchronized for adequate greenhouse irradiance and may influence the bolting response. The proportion for instance, of red to far-red wavelengths in the spectrum may activate flower initiation. In general, the LED environments countered or delayed flowering under the 16 hour day length to allow growth for satisfactory harvest. The only exception was the exclusively blue growing environment where flowering was observed.

Briefly describe how your target audience benefited from your project's activities.

Presentations are provided at local, regional, national and international meetings, conferences and workshops on crop production in various environments including greenhouses and other indoor growing approaches, high tunnels, season extension techniques, and field conditions. In the fall of 2019 and early 2020 prior to the pandemic, activities and conferences were conducted on schedule. As in-person events were reduced or canceled in 2020, online opportunities increased. Several conferences, workshops and meetings went online with opportunities for participation, presentations and the display of research findings and information.

Briefly describe how the broader public benefited from your project's activities.

Various communication channels are used to reach and meet the needs for information, education and training to various groups throughout the state. We are continuously communicating with producers and individuals interested in pursuing or already engaged in the use of various production systems such as fields, high tunnels, greenhouses and indoor controlled environments. Training opportunities in topics related to horticultural production are regularly offered and presented to students at secondary and post-secondary levels. Presentations are also provided at local, regional, national and international meetings, conferences and workshops on crop production in various environments including greenhouses, high tunnels, season extension techniques and field conditions. The limited in-person contacts and meetings in 2020 changed and reduced the number of direct interactions. As communities and the university are able to resume activities and events, traditional interactions along with online tools for training and development are likely to continue and increase.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

We are continuing the initiated studies and are adapting research protocols based on earlier findings to more effectively use the available greenhouse research facility. The setup for the LED research is updated for improved efficiency. Our outreach efforts are anticipated to go back to events similar to those provided prior to March 2020 along with methods that worked well during the pandemic to provide information at grower gatherings, response to information requests, scientific and producer oriented publications, and formal instructional secondary and post-secondary activities.

INSECT PEST MANAGEMENT SOLUTIONS FOR ALASKAN AGRICULTURE

Project Director	Organization	Accession Number
Dennis Fielding	University of Alaska Fairbanks	1021624

INSECT PEST MANAGEMENT SOLUTIONS FOR ALASKAN AGRICULTURE

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Alaskans lack robust food security, being dependent to a large degree on imported commodities and limited in terms of types of crops that can be grown. Insect pests are also a threat to food production in Alaska. Potatoes are susceptible to viral plant pathogens transmitted by aphids. Brassica crops, such as cabbage, broccoli, turnips, rutabagas, grow very well in Alaska, but yields are limited by root maggots.

Effective and economical means of managing these pests would promote greater profitability for producers and more food security for all Alaskans.

It is essential for the management of insect pests to understand their basic life-history and biology, but much of this information is lacking in Alaska. In the case of root maggots, stakeholders have raised the question of whether a longer growing season resulting from climate change, may allow for a partial second-generation of root maggots to in Alaska. This is an important question, because late plantings of susceptible crops could be wiped out by a 2nd generation of root maggots. Root maggots were studied in Fairbanks and at Palmer to determine when adult flies emerge in the spring, when egg-laying begins and for how long crops are exposed to egg-laying flies, and to determine whether a second generation is possible. It seems very unlikely that root maggot flies could successfully complete a second generation with the current climate regime. Models of temperature and rates of insect development can predict how much warmer the climate would have to change before a second-generation is possible.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Objective 1) To be able to predict timing of major developmental stages in most common species of root maggots based on air and soil temperatures.

Emergence of adult flies in the spring, egg laying, and growth of maggots on radishes was monitored during the growing season. Soil temperatures were recorded and air temperatures were obtained from weather stations located at the experiment farms in Palmer and Fairbanks. The emergence of flies was spread out over several weeks from late May through June in both locations. Oviposition (egg production) continued from June through July. This long period limits options for control. Chemicals currently registered for control of root maggots have a short life in the environment, and maintaining control over several weeks would require several applications of the chemical. Similarly, cultural and mechanical methods would also have to be in place and effective over a long period.

Long-term historical records of daily maximum and minimum air temperature were available from the Experiment Farms in Palmer and Fairbanks. Season-long degree-day (base 4.3?) accumulation were calculated for the period of 1921 to 2020. The two locations had similar mean degree-day totals, 1296 (± 128 s.d.) vs. 1251 (± 135 s.d.) for Fairbanks and Palmer, respectively. Fairbanks tended to be warmer than Palmer in June and July, but cooler in late August and September. Regression of annual degree-day totals over time indicated that the average number of degree-days rose by about 149 degree-days over the past 100 years in Palmer, and the station in Fairbanks recorded an increase of about 176 degree-days over the same time period.

From observations made in 2021 in Palmer and Fairbanks, it required from 630 to 700 degree-days for the insect to complete one generation (from overwintering pupa to 1st generation pupa). The earliest 1st generation pupa appeared after 800 to 900 degree-days elapsed. Therefore, I estimate that it would require a season-length of at least 800 + 630 = 1430 degree-days to complete a 2nd generation. In Fairbanks, seasons this warm are not common, but are occurring more frequently. In Fairbanks, 15 years in the last 100 have had degree-day accumulations greater than 1450, 11 of those years occurred in the last 30 years. In Palmer, years with greater than 1450 degree-days occurred nine times, with six of those occurring in the last 30 years. Although the growing season is getting longer, the high variance in length of growing season suggests that it will be some time before growing season is consistently long enough to support a partial 2nd generation of root maggots. If any pupae develop directly to flies, rather than overwintering safely, early freezing of the soil would kill any larvae that did not have time to reach the pupal stage, thus eliminating those individuals from the population. Until summer degree-day accumulations consistently surpass about 1450, I do not expect to see a second-generation. The degree-day models will be tested and refined in 2022.

The use of trap crops to manage root maggots was explored. The objective of trap crops is to attract the insect pests to more desirable plants, concentrate the pests on the trap crop, then kill the pests or remove the trap crop along with the pests. Radishes were employed as the trap crop and rutabagas were the main crop. Radishes are faster growing than rutabagas and thus might be more attractive to root maggot flies than the initially smaller rutabagas. Although the radishes were highly attractive to the flies - two to 3 times as many eggs were laid on the radish trap crop than on the rutabagas - the presence of the trap crop did not reduce damage to the rutabagas. Rutabagas grown alone did not have more eggs, larvae, or damage than those grown in the presence of the radish trap crop. This experiment may be repeated in 2022 to refine the timing of planting and spatial arrangement of the trap and main crops in an attempt to increase the effectiveness of this strategy.

Objective 2) Determine life history attributes, such as overwintering sites and alternate hosts, based on which species of thrips, aphids, and leafhoppers are found in protected environments and potato fields.

Some species of aphids that attack greenhouse crops and carry potato viruses overwinter as eggs on certain woody plants. Species of Prunus, including chokecherries (P. virginiana) and bird cherries (P. padus) are known to be overwintering hosts for the green peach aphid (Myzus persicae) and the Oat-Bird Cherry aphid (Rhopalosiphum padi), which are vectors of diseases of potatoes and small grains, respectively. Five different species and varieties of Prunus were surveyed in the Fairbanks area for the presence of aphid eggs in the late winter of 2021. Most eggs were found on chokecherries (P. virginiana), and bird cherries (P. padi). Fewer were found on the red variety of Chokecherry (P. virginiana var. Schubert). None were found on Amur chokecherry (P. maackii) or on Pin cherries (P. pennsylvanica). The species of aphid encountered was R. padi. No specimens of M. persicae were found on the Prunus, suggesting this species does not overwinter in the Fairbanks area, but infestations arise from imported plants or immigrating aphids. This information may also indicate which trees to eliminate or to not plant in the vicinity of susceptible crops.

Objective 3) Develop thrips population management recommendations in Alaskan protected environments based knowledge of their biology.

A system for fumigation of plants and cut flowers using ozone (O3) was designed and specifications developed. The system will be a small, research-scale unit, consisting of O3 generator, fumigation chamber, O3 monitor and controller. The components were ordered. This system will allow for testing of levels of O3 needed to kill insect pests, thrips in particular, while not harming the plants. This technology could potentially lead to increased exports of peony cut flowers and reduce thrips and other pest populations in greenhouse settings.

Briefly describe how your target audience benefited from your project's activities.

One-on-one consultations with peony growers.

One-on-one consultations with agricultural researchers.

The knowledge gained from these studies will inform work of extension personnel, pest scouts, and researchers; reduce crop losses to insects while preserving beneficial arthropods and the ecosystem services they provide; encourage growth of agricultural industry in Alaska and ultimately lead to increased food security for the state.

Briefly describe how the broader public benefited from your project's activities.

The knowledge gained from these studies will inform work of extension personnel, pest scouts, and researchers; reduce crop losses to insects while preserving beneficial arthropods and the ecosystem services they provide; encourage growth of agricultural industry in Alaska and ultimately lead to increased food security for the state.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

In the next reporting period, we will do presentations at the Alaska Entomological Society, Alaska Peony Growers, and Sustainable Agriculture Conference in Alaska.

[Increasing knowledge and adoption of agriculture and horticulture best practices for northern climates]	Project Director	Organization	Accession Number
	Alda Norris	University of Alaska Fairbanks	7000199

Alaska Extension Supports Women in Agriculture

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Women are a traditionally underserved group among farmers and ranchers. According to USDA's state agriculture overview for Alaska, women represent 47% of the farmers and farm operators in Alaska, a significantly higher number than the national average. This represents a significant need for support and mentorship in the farming community. It's important for all producers to get to know people from their communities as well as their industry. Farmers in general benefit from information on everything from mental health care to grant opportunities. The pandemic delayed the regular Women in Agriculture event held by Washington State, so Alaska Extension organized a virtual event to maintain connections. Alaska Extension is well-networked and is able to facilitate conversations among female farmers to experience connection, networking, information exchange and fun.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

MEFEC and the Trust partnered with Homer Soil & Water Conservation District, the Farm Bureau, and Extension's Anchorage district to hold the free virtual event in March 2021. The response for the event, themed "Strong Then, Strong Now" was overwhelming and registration closed two weeks early as the 300-participant maximum was reached. Content included a video from four generations of the Kenley Family, who have farmed in Palmer for generations. Presentations featured four women individually representing their agricultural regions across the state. Participants brought experience in everything from sheep husbandry and peony production to tractor mechanics and oyster farming. Two breakout sessions included approximately 40 rooms with a facilitator to allow for networking in various topic or regional groups.

Briefly describe how your target audience benefited from your project's activities.

The Matanuska Experiment Farm and Extension Center (MEFEC) director was interviewed about the conference by the Alaska Farmland Trust on a show called Ag Matters. Both describe the relationships forged through the annual event as "powerful." Alaska has hosted Women in Agriculture events for several years, and the number of participants has consistently increased. Offering the content for free improved accessiblity to the conference. The event also boosted awareness of Alaskan agricultural efforts at the legislative level. Sen. Lisa Murkowski, R-Alaska, recorded a video highlighting the things women in Alaska are doing in agriculture.Throughout the conference, engagement activities included Zoom polls and questions in chats provided interaction with participants. Feedback from participants was largely positive. Many respondents in a wrap-up session mentioned they found the experience inspirational. The majority reported they either have or plan to reach out to people they met during the event.. The conference achieved its goal of providing a networking platform and expanding capacity for peer support.

Briefly describe how the broader public benefited from your project's activities.

A statewide event offered by Extension offered continuity in mentoring and networking for women in agriculture, who compose almost half of the farmers in the state.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The organizers look forward to reconnecting the event with Washington State next year, as the Women in Agriculture network is a significant opportunity for multi-state collaboration as well.

Alaska Extension teaches Integrated Pest Management

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Alaska hosts thousands of visitors every year. The state also imports most of its food and many horticultural products, so it remains vulnerable to imported pests. Retail sales of plant materials contaminated with a variety of pests continue to challenge the state. Invasive weed infestation can reduce land values and agricultural productivity. Ecologically disruptive plants and insects can also negatively impact recreation, tourism and subsistence harvesting. Improving citizen, farmer and land manager ability to assess pest management practices is critical to protecting cold-climate agriculture, foraging and other Alaskan interests.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Seasonal IPM technicians and permanent staff, with support from faculty, provided community education and technical assistance. Agents and IPM staff had over 2,000 consultations with Alaskans regarding agricultural questions, many of which were requests for plant and insect identification. IPM technicians maintained a reporting web portal where the public submitted digital photos. They also assisted with community weed pulls, camps, Master Gardener classes and Certified Pesticide Applicator trainings. Mediated outreach included "Bug of the Week" posts on Facebook. The public showed continued interest in a series of IPM videos on YouTube with information on invasive species like bird cherry and chokecherry trees, and native species like spruce beetles that have caused widespread damage. Two agents collaborated to host a 3-day Pesticide Safety Education Programs (PSEP) workshop twice, and a two-day-long Certified Pesticide Applicators Workshop. The workshops had an online option and provided continuing education for pesticide applicators in the state of Alaska. These education events were developed in partnership with the Alaska Department of Environmental Conservation (DEC) and Alaska Division of Agriculture.

Briefly describe how your target audience benefited from your project's activities.

Responses from 60 attendees of the Alaska Invasive Species Workshop indicated a high level of satisfaction with the information provided by Extension and its collaborators. Forty-eight people rated the amount they learned as either a 4 or 5 on a 5-point scale. Ninety-eight percent agreed they would attend the workshop again in the future. Regarding intent-to-change, 75 percent of respondents agreed they plan to use information gained from the workshop in their invasive management practices. Another 23 percent responded "maybe," indicating in total, 98 percent of attendees are considering applying the information. Examples provided of intent to use the information included: for outreach and community engagement; to teach students and garden clubs; to modify terminology used to communicate about invasive species; and to inform sampling methods and herbicide use. Almost 40 percent of returning attendees said they made changes to their practices as a result of attending past workshops. Examples of behavior changes included improving the timing of chemical application to reduce secondary effects; procuring a better spill kit; and informing invasive management plans. Respondents also provided valuable recommendations regarding information needs and desired speakers for future workshops.

Briefly describe how the broader public benefited from your project's activities.

Alaskan communities and landscapes benefit from better pest management practices. Expert consultations, identification services, and collaborative workshops all help to improve knowledge and behaviors applied to reducing the harmful effects of invasive species. Agents maintained partnerships across the state with garden clubs, municipalities, tribal administrators, soil and water conservation districts, school leaders, Natural Resources Conservation Service (NRCS) personnel, and others to leverage knowledge and resources for improving Alaska's communities.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Alaskans are able to gain knowledge and contribute to statewide tracking by using Extension's IPM portal: https://pestreporter.alaska.edu/ or by downloading the Alaska Weeds ID app: https://apps.bugwood.org/apps/alaska/

To combat public confusion over which platforms to submit to, the Alaska Invasive Species Partnership (AKISP) asked local groups to prioritize the existing invasive species reporting platforms from UAF Cooperative Extension Service (insects, weeds and plant diseases) and the Alaska Department of Fish and Game (terrestrial and aquatic fauna). The group consolidated information at alaskainvasives.org, which redirects to a website that an Extension agent helped build as a "one stop shop for invasive species information." This will improve public recall of where to report an invasive species; the reporting page gives instructions separated out by taxa. Future plans are to expand to an incentivized “First Detector” program with a suite of certification courses.

Alaska Extension continues vegetable variety trials

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Variety trials are time-consuming. Seed companies tend to develop their products for the market at-large in the Lower 48. Though varieties described as cold-tolerant may be offered, they are rarely tested in growing seasons as extreme as Alaska's. As a result, Alaskan growers struggle with identifying viable crop varieties in their growing zones, and some tried-and-true varieties are no longer available. Alaska’s experiment farms, with their established test plots and tours for the public, are excellent venues for researching adapted crops and sharing results with local stakeholders, saving growers the time and money of individual trial and error.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Alaska’s experiment stations have conducted vegetable variety trials since the early 1900s. After an eight-year break, trials resumed at the Fairbanks Experiment Farm in 2017 and expanded to the Matanuska Experiment Farm and Extension Center. Sixty-six varieties of vegetables were planted in 2020 in Fairbanks, including corn, carrots, beets, beans, fennel, winter squash and spinach. All trials except the corn were replicated in Mat-Su. Because of disruptions in the 2020 data, the Mat-Su results from the prior year are also included in the 2021 report. The trials usually continue over several years because of variability in weather. In comparison to 2020, the 2021 Palmer growing season started with a cooler May, with larger amounts of precipitation in the summer. This may have contributed to reduced germination rates.

Each cultivar was evaluated at least once in terms of plant vigor, bolting sensitivity (or susceptibility to bolt), uniformity, pest resistance and disease resistance. These traits were evaluated on a scale from 1 to 9, with 1 being very poor and 9 being excellent. Celery was added for a vegetable trial for the first time at Mat-Su in 2021. Taste tests were conducted by IANRE staff due to the pandemic making public tasting events infeasible.

Briefly describe how your target audience benefited from your project's activities.

Publicly funded variety trials reduce the expense, time and effort gardeners and farmers need to put in to figure out which cultivars will be successful. FY21 trial results have been disseminated widely to help growers make informed choices. Results are also shared as part of the Master Gardener program. The majority of 36 respondents to a survey of the 2021 Alaska Master Gardener Online course indicated a positive change in knowledge regarding which crops and varieities will grow well where they live.

Briefly describe how the broader public benefited from your project's activities.

In addition to the public presentations offered, Alaskans can access information on the variety trial results at any time by visiting the results website: https://uaf.edu/afes/research/variety-trials/index.php

The variety trials are one part of multi-faceted efforts across the state to increase Alaska's food security.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

A YouTube series on specific vegetables is also getting the word out through the AFES playlist, at www.youtube.com/user/UAFExtension. Once vegetables have been trialed sufficiently, Extension publications on recommended varieties for Interior and Southcentral will be updated.

The Fairbanks-based agent overseeing the variety trials writes regular articles for *The Fairbanks Daily Newsminer;* a blog, *It Grows in Alaska*; and the Tanana Chiefs Conference's newsletter. In the Summer of 2021, *Alaska Home magazine* reprinted two of these articles and has shown interest in printing more.

Critical Issue

Healthy Individuals, Families & Communities

Supporting wellness, safe food handling and use of food preservation best practices in Alaskan communities

Project Director	Organization	Accession Number
Alda Norris	University of Alaska Fairbanks	7000201

★ Alaska Extension improves food safety in remote areas

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

In Southeast Alaska, the communities are spread over hundreds of miles of islands and inlets, with no roads connecting them. Traveling by plane is impractical, due to high costs and the amount of gear needed for COVID-safe workshops. With the Alaska Marine Highway ferry system's budget slashed, the Juneau-based Home, Health and Family Development faculty member started looking for ways to reach the communities.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

In July of 2021, the Juneau agent launched (literally) the first Maritime Extension Project at the helm of her family's 36-foot cruising trawler, the JunieBell. COVID-19 mitigation practices required tents, a portable kitchen, and propane cooking equipment to hold classes outdoors. She pulled cartloads of gear up low-tide harbor ramps and biked around each community pulling a trailer to transport gear and ingredients for the tent-covered classes. She met with existing and future community partners in Kake, Sitka, Angoon, Tenakee Springs, Haines and Skagway and taught 10 food preservation workshops, three food entrepreneurship/Cottage Foods classes, and two 4-H/youth local food focused classes. The agent also made six food preservation demonstrations at the Southeast Alaska State Fair in Haines and tested more than 50 canner dial gauges for accuracy.

Briefly describe how your target audience benefited from your project's activities.

Extension's efforts improved food safety. The agent noted that some of the gauges hadn't been tested in more than a decade and several needed to be replaced. The agent also visited a Haines farm to complete a complementary produce safety assessment with another member of the statewide produce safety team. "That was an awesome bonus," she said. This program will also continue to reach diverse audiences and increase community capacity for food preservation. The agent plans more maritime trips in 2022, with tentative routes to Kake-Petersburg-Wrangell, and Hoonah-Gustavus-Pelican. She also hopes to repeat the Haines-Skagway route to coincide with the Southeast Alaska State Fair.

In addition to the highlighted activity in Juneau, the Palmer-based agent offered multiple educational opportunities for Alaskans to learn about food safety and proper preservation methods. Alaska Extension built food industry capacity through offering Certified Food Protection Manager (CFPM) Training; Alaska regulations require food establishiments to have at least one CFPM on staff. A survey of participants in the agent's FY21 "Preserving Food Safely" course showed that Alaskans use a variety of preservation methods, and there is a continued demand for dial gauge testing and research-based guidance on canning local foods like homegrown vegetables, foraged berries, wild game and fish.

Briefly describe how the broader public benefited from your project's activities.

Extension improved food safety knowledge and practices at a regional level by employing creative means to reach remote audiences.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The Juneau agent built relationships with communities throughout the Southeast and is planning return trips to continue meeting needs for food safety information and training.

Alaska Extension advocates for indoor air quality as part of wellness

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

To manage costs, Alaskans want to keep winter heat loss to a minimum in their homes. This is a challenge, particularly in rural areas where some Alaskans rely on diesel generators. Natural gas is not yet available statewide, and wood burning has caused concerns about air quality. Many look for ways to make their home "tighter," which can be more energy efficient. But tight buildings allow for less clean air circulation and higher concentrations of radon, a rare radioactive gas that can cause lung cancer over time. Thus, homeowners, landlords and building managers should be educated about proper firewood use and radon's effects on air quality in conjunction with building efficiency.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Extension maintained a wood energy website that covers topics like BTUs and stove choice and offers an online heating cost calculator. Two agents held workshops on radon, wood stove use, and general indoor air quality attended by hundreds of Alaskans statewide. Awareness of radon was also raised through outreach at local fairs, shows and other booths. The Bethel agent had ongoing meetings with a radon workgroup, and presented to groups like the Institute for Tribal Environmental Professionals. Extension offices continued to offer publications on radon. The energy specialist also contributed newsletter articles on healthy homes, and authored newspaper articles on preparing wood stoves for winter, the importance of radon testing, and recommendations for projects to make homes safer. Extension collaborated with entities like the Department of Environmental Conservation (DEC), Environmental Protection Agency (EPA), and Alaska Division of Geological & Geophysical Surveys.

Briefly describe how your target audience benefited from your project's activities.

Participants learned about what potential sources of energy they might use to lower heating costs and how to balance those choices with protecting their health. The Alaska wood energy website continued to receive thousands of hits per month. The energy specialist provided consultations to 40 individual contacts regarding home testing and mitigation technical assistance. The specialist also met with groups including the Alaska Native Tribal Health Consortium and the Alaska Tribal Conference on Environmental Management regarding healthy homes topics. Clients performed tests in their homes, and for any concerning results shared, they received valuable mitigation advice. This made Alaskans better equipped to improve the indoor air quality of their homes.

Briefly describe how the broader public benefited from your project's activities.

Expanding awareness of radon dangers and testing opportunities has helped multiple organizations work together to map hot spots in Alaska and work on mitigation plans to improve public health.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Art Nash, the energy specialist, co-authored two documents for Alaska: one on understanding radon test results and the second on mitigating radon. These research-based publications are freely available online and through the state library:

Knapp, S.P., Athey, J.E., and Nash, A.L., Jr., 2020, Understanding your radon test results: Alaska Division of Geological & Geophysical Surveys Information Circular 89, 6 p. http://doi.org/10.14509/30467

Knapp, S.P., Athey, J.E., and Nash, A.L., Jr., 2020, Mitigating radon levels at home: Alaska Division of Geological & Geophysical Surveys Information Circular 90. doi.org/10.14509/30474

Alaska Extension supports wellness through chronic disease management

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Alaska, per capita, has one of the fastest-growing population of seniors in the nation, and the state expects the number of seniors to double in the next 30 years. Alaska has more Baby Boomers as a percent of the population than any of the contiguous states, according to a 2015 News-Miner article. All of Alaska is considered medically underserved, and costs to individuals for medical care are higher than the national average. Alaska's senior population faces challenges remaining active and healthy in a remote environment. It is imperative that Alaskans focus on health strategies to maintain health and independence throughout life.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

StrongWomen, Chronic Disease Self-Management and Diabetes Self-Management are high demand, evidence-based programs that have increased community capacity through train-the-trainer opportunities. Volunteer leaders received support from Extension across the state. The Tanana District agent solicted stakeholder input from school districts, senior centers in multiple cities, health fairs, food banks, tribal associations and consortiums, medical centers and hospitals, Parks & Recreation, Alaska Housing and Finance Corporation, local legislators and class participants. Overall, stakeholders expressed continued health-related concerns about obesity and disease prevention, limited access to care, food insecurity, and inadequate nutrition knowledge and skills. Although the pandemic presented challenges, the Fairbanks-based agent was able to provide StrongWomen meetings by Zoom, with attendance sometimes reaching 50 individuals. The agent also arranged for a volunteer leader to hold in-person meetings with safety protocols. Hundreds of volunteer leaders have been trained over the years; in FY21, the agent added to the talent pool by training 17 new leaders from five different organizations. The recent trainees led chronic disease and diabetes management programs in Kenai and Wasilla, with plans for another organization to launch a six week series.

Briefly describe how your target audience benefited from your project's activities.

StrongWomen groups have provided continuity in access to physical activity instruction and support, with many participants continuing to be active for at least one year. The Kenaitze Indian Tribe group has been meeting since 2004, the Kenai Senior Center group since 2009, and the Homer Senior Center group since 2010. Positive outcomes reported by Interior participants included feeling stronger and happier, reaching a desired weight loss, and increasing bone density. The diabetes management programming provided support otherwise unavailable to participants on Medicaid, who have no reimbursed diabetes education. Because of Extension's efforts, 60 individuals enrolled in a telephone-delivered version of the diabetes prevention program provided by the Centers for Disease Control and Prevention. More than 20 years of national-level research show that the chronic disease and diabetes management curricula used by Extension leads to better quality of life, improved health behaviors and reduced medical care expenses.

Briefly describe how the broader public benefited from your project's activities.

Alaska Extension supports programs that improve community engagement in wellness and can eventually reduce health care costs. The agent reported that if 90 fewer Alaskans develop diabetes, there will be potential savings of $864,000 for each year that they remain diabetes-free. There is also a tremendous amount of value added by the volunteer hours contributed by Extension-trained community volunteer leaders. Independent Sector reports that for 2021, in Alaska an hour of volunteer time is worth $31.34, an increase over the prior year, and slightly above the national average of $29.95.

Critical Issue

Natural Resources, Ecosystems & Sustainable Energy

	Project Director	Organization	Accession Number
Research, Capacity Building, and Training for Meeting the Climate Change Challenges in Wildfire Management and Indigenous Communities in Alaska	Sarah Trainor	University of Alaska Fairbanks	1018914

Research, Capacity Building, and Training for Meeting the Climate Change Challenges in Wildfire Management and Indigenous Communities in Alaska

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project takes a three-pronged approach including research, community development, and education.

1. Research: This research aims to advance the theoretical and practical knowledge of sustainability science, use-inspired research, and stakeholder engagement.

2. Community Development: Build capacity and advance rural community development in Alaska that is fully informed by changing climate, ecosystems, and natural resources

3. Education: Promote and develop integrated undergraduate and graduate research conducted in partnership with stakeholders.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Earth System Science (ESS) graduate program and curriculum development. Salary for S. Trainor has supported her efforts as an active member in the working group that is developing an interdisciplinary Earth System Science (ESS) graduate program at the University of Alaska Fairbanks. Her role was to lead and design a new graduate degree option in boundary spanning, engagement, and research co-

production within this ESS program. This program is designed to train graduate students in actionable, interdisciplinary research that is conducted in partnership with stakeholders to meet present day needs in sustainability and community development. Trainor formed a working group and networked extensively across the UAF campus with other programs and departments to discuss their input and involvement in the proposed program. She submitted program and course proposals to the University Curriculum committee in November 2021.

Briefly describe how your target audience benefited from your project's activities.

Tribal governments and rural Indigenous communities throughout Alaska (workforce development project)

Organized Village of Kake (Tribal Government), City of Kake, Kake Local Corporation (Kake Climate Partnership)

The wildfire and land management community in Alaska is targeted through existing relationships with the AFSC. Specific agencies involved include federal (BLM Alaska Fire Service, National Park Service, US Fish and Wildlife Service, BLM Lands, Bureau of Indian Affairs, US Forest Service, US Geological Survey) and state (Department of Natural Resource, Division of Forestry, Alaska Department of Fish & Game). Native Non-Profit Organizations including Chugatchmiut, the Association of Village Council Presidents, and Tanana Chiefs Conference are also key wildland fire constituents, as is the Alaska Wildland Fire Coordinating Group and their sub-committees such as the Research Development and Application Committee and the Fire Behavior and Modeling Group.

UAF graduate and undergraduate students

Briefly describe how the broader public benefited from your project's activities.

Build capacity and advance rural community development in Alaska that is fully informed by changing climate, ecosystems, and natural resources

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Professional development and training:

Postdoctoral fellow has mentored and provided information on research and job placement for young adults in rural Alaska Native communities in the Bristol Bay region.

The field projects in the Kake Climate Partnership emphasize mentorship, training, and paid work opportunities for local residents and Tribal members. 25 local residents worked as paid members of our research team during the reporting period October 1, 2020 - September 30, 2021. In addition to providing part-time work opportunities for local adults in Kake, postdoctoral researcher co-supervised 9 students from Kake High School, who worked as paid research assistants on the project. For more than half of these students, working on our team was their first professional job. Postdoctoral researcher coordinated ocean monitoring training (water and shellfish data collections methods) for all 25 team members, including local high school students. During this reporting period, also guest lectured at the Kake High School and hosted local students on a field trip, further mentored one undergraduate research assistant/senior thesis project and three undergraduate student interns, and presented with partners and students at three national science conferences.

Professional development provided for postdoctoral fellow includes supporting attendance at the American Indian/Alaska Native Tourism Association (AIANTA) American Indian Tourism Conference (AITC) and at the Alaska Travel Industry Association's (AITA) yearly conference virtually where federal land managers gave their perspective of future tourism opportunities and innovative models. These conferences provided opportunities for networking, relationships building, and developing a vision of how Geotourism as economic development can intersect with public education of climate impacts, adaptation, and mitigation in rural Alaska Native communities.

Postdoctoral fellow has also presented at multiple professional conferences together with research partners from Kake. PhD Student has also presented her research at multiple scientific conferences.

Dissemination to communities of interest:

The Kake Climate Partnership includes community participation at every stage. The community partners lead the effort in identifying research priorities, building research that contributes to long-term community goals, and identifying community members to work as research assistants.

Research relevant to wildfire management is vetted and reviewed by members of the Alaska wildfire management community and presented to the Alaska wildfire managers at semi-annual workshops hosted by the Alaska Fire Science Consortium.

When at a stage that is ripe for dissemination, other research will be disseminated through the creation of research reports targeting the intended audiences. Presentations will also be made to the National Congress of American Indians and the American Indian/Alaska Native Tourism Association and at national scientific conferences.

In the next reporting period:

Postdoctoral fellow will complete analysis and create guidebooks accessible to Tribes as well as a peer-reviewed publication. Next steps on the Geotourism project include creating an inventory of existing Geotourism and Cultural Heritage programs throughout Alaska as well as an inventory of existing curriculum on developing Geotourism as part of community economic development. In the up-coming year, additional work will be done to outline the intersection of climate impacts, adaptation, and mitigation with Geotourism as economic development opportunities, including creating a guidebook and outreach materials.

Ph.D. student Rudolf will be continuing her research and has three peer-reviewed publications planned. Postdoctoral fellow Figus will continue her work in Kake. We are planning to support public interpretation signage related to wildfire, climate change, suppression and risk at the site of a 2021 fire that occurred in the wildland urban interface in Fairbanks, Alaska.

19-06 Hatch Regular: Understanding Human and Community Benefits and Mechanisms	Project Director	Organization	Accession Number
	Peter Fix	University of Alaska Fairbanks	1019421

Understanding Human and Community Benefits and Mechanisms

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project addresses several objectives regarding recreation management and health and wellness issues.

- Contribute to the understanding of how recreation management can facilitate the production of benefits
- Report findings in a manner relevant to a broad audience with practical applications clearly highlighted
- Improve efficiency in the BLM's application of Outcomes-Focused Management (OFM)
- Further develop the capacity of the Matanuska Experiment Farm (MEF) to fulfill the surrounding communities' health and wellness needs
- Investigate how recreation on the MEF contributes to the well-being of the surrounding community
- Provide data to assist in the management of the MEF.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

With regard to the goals related to the MEF, a report was produced that provided information for management of the Matanuska Greenbelt Trail system (MGT) (e.g., assessment of problems on the trail system, assessment of signs, facilities needing improvement). Those results will allow for more informed management decisions, allowing the area to better meet the community's needs. The report also presented the quantity (i.e., hours per typical week) of vigorous and moderate physical activity occurring on the MGT trail system in relationship to other settings of physical activity (although the sample was limited to people who visited the MGT), providing one measure of the MGT's contribution to the well-being of the surrounding community.

With regard to understanding how recreation management can facilitate the production of benefits, Kimberly Diamond's Master's thesis work increased knowledge of the relationship between management actions (e.g., level of development, types of amount of use, etc.) and outcomes recreational users attain (e.g., restoration from stress, better relations with family/friends, improved outlook on life, etc.).

With regard to improving efficiency in the BLM's application of Outcomes-Focused Management, project personnel continued to refine procedures to streamline the process of assessing recreation-related outcomes. That refinement resulted in increased knowledge (i.e., it allowed for data to be gathered across a wider range of sites) and economic efficiency (i.e., the assessments require fewer financial resources).

Finally project personnel participated in the Equity in Conservation and Outdoor Recreation conference (August 13). In addition, one project team member has continued to participate in diversity and equity workshops. Participation in those conferences/workshops has increased project personnel's awareness of diversity and equity issues, allowing for more inclusive assessments of outdoor recreation outcomes.

Briefly describe how your target audience benefited from your project's activities.

Recreation managers and researchers, which includes not only managers and researchers in Alaska, but nationwide as well, and managers in local, state, and federal agencies, and researchers within agencies as well as private research firms, and non-profits such as the Mat-Su Health Foundation

The report prepared for MEF changed the state of knowledge regarding the health outcomes associated with the MGT. Results will eventually help inform other efforts such as the Matanuska Health Foundation's Health Needs Assessment.

The thesis work completed, presented, and published by Kimberly Diamond (UAF) provides recreation managers improved ability to refine management models to more effectively plan for outcomes. Also procedures and processes of assessing recreation-related outcomes have been refined for efficiency for BLM's applications and management.

Other products specifically to benefit recreation managers include:

Database: added variables to the database described in depth in the FY 20 report. As a short descriptor, the database will contain data related to outcomes associated with recreation and variables that might predict attainment of outcomes. The database will contain datasets from 26 different locations, with other 7,000 cases. The variables added related to outcome desirability and attainment, previous experience with the site, and demographics.

Instruments or Equipment: A focus group script to assess the relationships of traditionally "underserved" community members to public lands was developed. "Underserved" community members does not have a particular definition, but could include a variety of socioeconomic groups. The focus group script focuses on constraints to visiting public lands, and the desired activities if the participants

were to visit. The focus group script was designed for the Bureau of Land Management, to use in their Resource Management Plan development process, but it could be applied to other contexts.

And Other Instruments or Equipment: Refinements were made to a survey developed for the Bureau of Land Management. The survey is intended to by used across all BLM-managed areas, and assess outcomes associated with recreation at those areas.

Other: A proposal for research to examine recreation outcomes of residents in the Palmer/Wasilla area of Alaska was developed. The research would assess randomly selected resident's weekly amount of physical activity, the settings in which they conduct that physical activity (if any), and the availability of recreation settings within specified distances of the residents. The purpose of the research is to examine if relationships between neighborhood recreational setting characteristics and the amount of physical activity are evident.

Briefly describe how the broader public benefited from your project's activities.

Research team members' participation in conferences/workshops such as the Equity in Conservation and Outdoor Recreation conference, has increased project personnel's awareness of diversity and equity issues, allowing for more inclusive assessments of outdoor recreation outcomes.the public that enjoy multiple uses of public lands will benefit.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

Opportunities for training and professional development:

Graduate students receive professional development through engaging in literature reviews, study design, analysis, report generation, and public speaking. Research technicians receive professional development through engaging in literature reviews, study design, analysis, report generation, public speaking, professional meetings, and workshops.

Dissemination of results through presentations and publications as follows:

Presentation to the Matanuska Greenbelt Trails Advocacy Group (2021)

Casey, T. T., Virden, R., Diamond, K., Garcia, R. A., & Fix, P. J. (2021). BLM Kingman Field Office Outcomes-Focused Management (OFM) Recreation Focus Group Study, 2021. Project report for the BLM Kingman, AZ Field Office. BLM PLRRP Report #13. Grand Junction, Colorado: Colorado Mesa University, Natural Resource Center, Department of Social and Behavioral Science.

Diamond, K. (2021). Understanding the outcomes focused management production process: meta-analysis of the relationship between activities, settings, and the benefits of recreation participation. Unpublished Master's Thesis, Department of Natural Resources and Environment, University of Alaska Fairbanks.

Fix, P. J., Garcia, R. A., Kelley, M., Virden, R. J., & Casey, T. T. (2021). Northeast Wyoming BLM Lands Outcomes-Focused Management Recreation Study, Spring 2021. Project report for the BLM Newcastle Field Office. BLM PLRRP Report #12. Fairbanks, Alaska: University of Alaska Fairbanks, Institute of Agriculture, Natural Resources and Extension, Department of Natural Resources and Environment.

Garcia, R. A. & Fix, P. J. (2021). Indian Creek 2020-21 Outcomes-Focused Management Survey Preliminary Summary Report. Fairbanks, Alaska: University of Alaska Fairbanks, Institute of Agriculture, Natural Resources and Extension, Department of Natural Resources and Environment.

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Project plans during next reporting period:

Finalize and administer the survey designed to assess the relationship between recreation settings and physical activity in the Palmer/Wasilla area. Be sure results are disseminated to the Matsu Health Foundation.

Continue to refine methods to assess divesity and equity with regard to recreation on public lands. Analyze demographic data in the recreational outcomes database to assess current diversity and equity at BLM-managed sites.

Conduct additional meta-analysis on the recreational outcomes database to understand the production of recreational benefits.

	Project Director	Organization	Accession Number
Outdoor Recreation, Parks and Other Green Environments: Understanding Human and Community Benefits and Mechanisms	Peter Fix	University of Alaska Fairbanks	1025572

Outdoor Recreation, Parks and Other Green Environments: Understanding Human and Community Benefits and Mechanisms

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

This project seeks to examine the relationship between attainment of benefits and recreation area site characteristics. The goal is to expand the evidence for the role of park and outdoor recreation services in promoting physical activity and associated preventative health benefits, particularly among youth.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

An edited text is being produced; I am the co-managing editor. During the review period 45 chapter submissions were recieved and sent out for review, with most reviews being completed and returned to the editorial team during the review period.

The UAF Hatch research team produced and submitted a chapter.

When completed, the book will provide evidence for the role of park and outdoor recreation services in promoting physical activity and associated preventative health benefits. The book is targeted towards a more general management and policy maker audience.

Briefly describe how your target audience benefited from your project's activities.

The production of the UAF Hatch team's chapter included graduate students and research technicians, providing training in professional technical writing.

Several book chapter authors are not academics and the book has provided them the opportunity for development of their professional writing skills.

Briefly describe how the broader public benefited from your project's activities.

Upon publication of the book (the goal is to have a final draft of the book to the publisher by fall of 2022), the public will benefit as parks and outdoor recreation services are improved as managers apply the concepts to their projects. The expected impacts of this project are: 1) increased effectiveness of recreation managers to provide benefits to the public, and 2) healthier individuals, and 3) increased community vibrancy.

Control of invasive plants at high latitudes using persistent herbicides

Project Director	Organization	Accession Number
Gino Graziano	University of Alaska Fairbanks	1021463

Control of invasive plants at high latitudes using persistent herbicides

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Invasive plants are a growing problem in Alaska, and the most effective methods including persistent herbicides are needed to manage the species. Some of the most effective persistent herbicides have proven to persist beyond the time frame they are needed for control leading to non-target impacts in wildlands, and preventing rotation of crops to sensitive species. This project seeks to understand the persistence of picolinic acid herbicides in Alaska to benefit invasive plant management in agricultural and wildland settings.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

Invasive Chokecherry Management- Wildland plots in forests of Anchorage and Fairbanks were set up and invasive chokecherry (*Prunus padus*) received basal bark treatments with a persistent and non-persistent herbicide. Evaluation of these wildland plots will occur during the summer of 2022.

Certified Weed Free Straw - In 2021 plots treated in a fallow season (2020) had soil samples taken to determine the quantity of herbicide present. Barley was planted to harvest straw and determine if the crop could be certified weed free according to standards set by Alaska and the North American Invasive Species Management Association.

Sorption experiments- Additional laboratory bench work is underway to determine the soil processes driving the affinity of two herbicides, aminopyralid and clopyralid, for soils in Alaska.

Briefly describe how your target audience benefited from your project's activities.

Presentations of the current results were prepared and given to the target audience at the Alaska Invasive Species Workshop, Western Society of Weed Science, and Western Region Integrated Pest Management webinar series. These presentations outlined the difficulties of invasive plant management in Alaska and the utility of persistent herbicides. Further, we highlighted how our research will help manage the use of persistent herbicides to prevent non-target impacts and problems with rotating crops to sensitive species.

Briefly describe how the broader public benefited from your project's activities.

The broader public will benefit from this project by increased efficacy of the invasive plant control in both agricultural and forested settings. The agricultural settings are aimed to increase the availability of certified weed free straw products that are used as animal bedding, and in the local manufacturing of erosion control materials. The forested settings are aimed at increased efficacy and management of persistent herbicides in the control of invasive chokecherry trees (*Prunus padus*). As we continue the research to understand the soil properties that drive affinity for aminopyralid and clopyralid to soils we can form additional hypotheses about the potential period of control, and remediation of treated sites with plant material or adjusting soil chemical properties such as pH.

Partnering to promote sustainable energies and responsible natural resources stewardship for Alaska

Project Director	Organization	Accession Number
Alda Norris	University of Alaska Fairbanks	7000200

Alaska Extension Promotes Energy Efficiency

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Sustainable energy is an increasingly popular issue in Alaska where transportation and heating costs are prohibitive. In the face of declining oil prices and production, there is a need for Alaska to invest in alternative energies. A fundamental shift in the state's energy focus requires constituent support to gain momentum. Community-level change begins with improving knowledge and awareness at the individual level. IANRE has the research capabilities, content experts, and partnerships to help communities assess emerging options for energy efficiency and alternative energy use in Alaska.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

The energy specialist traveled to multiple locations in Alaska to either instruct or help facilitate panels on energy efficiency topics, with 124 contacts. The specialist covered everything from weatherization and energy storage to using gasification to produce biomass heat. Attendees learned skills like how to reduce energy usage, choose a generator, extend the growing season, and use products like biochar. The energy specialist also produced two relevant new extension publications. The first was on generator selection, sizing and operation. The second covered design considerations for dry cabins. The specialist also co-authored an article on powering Native communities while preserving forest health.

Briefly describe how your target audience benefited from your project's activities.

Results of sustainable energy outreach efforts came primarily in the form of capacity building, as connections were made with multiple community organizations that can help further the awareness of biomass potential in the state. There are also positive individual-level knowledge and behavior changes expected as participants and readers implement the best practices suggested in the workshops and publications.

Briefly describe how the broader public benefited from your project's activities.

Alaska's energy specialist continues to help build community capacity for understanding and utilizing biomass and other alternatives to petroleum-based fuels.

Alaska Extension Promotes Sustainable Forest Products

In 2-3 sentences, briefly describe the issue or problem that your project addresses.

Buy-in from communities is critical to ensuring non-timber forest products are harvested properly and processed safely. Improving awareness and knowledge of good forest stewardship practices is key to ensuring our forest products remain sustainable. Various species of trees and the forest products that can be derived from them are just some of the many renewable natural resources that Alaska has to offer. The faculty and staff of IANRE work together to blend research and outreach to assure stakeholders understand best practices when gathering and preserving locally foraged foods. Helping Alaskans learn to harvest wild foods safely can also improve local food security.

Briefly describe in non-technical terms how your major activities helped you achieve, or make significant progress toward, the goals and objectives described in your non-technical summary.

OneTree Alaska, part of IANRE, is an Alaska Center for Energy and Power (ACEP) partner for science, technology, engineering, art and math programs sponsored by the Office of Naval Research. The state-certified OneTree Alaska kitchen is a production space for local forest products, including birch syrup, caramels and birch sticks made from sap collected by a volunteer cooperative of local families and classrooms. A goal of the program is to use all parts ot the tree, and the lab recently started a project on turning birch wood scraps into artist's charcoal. While the integrated team at OneTree conducts outreach primarily in the Interior, an Extension agent in the Southcentral region also provides outreach for foragers and landowners further south. The agent offered birch tapping and sap processing classes to 172 individual, and also continued to sponsor a free online publication about backyard birch tapping and syrup making which saw 3,799 downloads in FY21.

Briefly describe how your target audience benefited from your project's activities.

Research at the OneTree lab continued to target greater predictability for when the birch sap season will start, peak and end. The lab collected and contributed seasonal data to researchers working on predictive algorithms. This has the potential to provide greater certainty for producers to know when to set and pull taps. Regarding the Extension educational events, participants reported positive changes in knowledge and behavior. Changes in knowledge included stated improvements in understanding of proper techniques including how to boil sap. In post-workshp surveys 71.4% of 28 respondents went on to tap a birch tree that season. The sap collected was predominately drunk fresh, with a few using it to make tea or coffee. Some condensed their sap for making a marinade, using in cooking or baking, and seven made their sap into birch syrup.

Briefly describe how the broader public benefited from your project's activities.

The data collected by the OneTree lab is shared across units at the university and contributes to broader knowledge about green-up trends. Natural resources programming helps youth develop a connection with nature. The inclusion of community members as citizen scientists inspires the next generation of forest stewards. The publication on birch tapping has been shared widely, and helps increase awareness and knowledge of Alaska's forest products.

Describe and explain any major changes or problems encountered in approach. Additionally, note opportunities for training and professional development provided, how results have been disseminated to communities of interest, and any new details regarding what the project or program plans to do during the next reporting period to accomplish the goals.

The agent learned from survey results that some respondents did not tap a tree due to deep snow or lack of equipment at home. This insight will be used to help participants navigate potential barriers in future iterations of the classes. The public continues to show interest in the free guidance offered in this online publication: https://cespubs.uaf.edu/index.php/download_file/1434

Appendix

Research Projects

Extension Programs

Other Projects / Programs