Oregon (Oregon State University) Annual Report - FY2021

Report Status: Approved as of 07/08/2022

Contributing Organizations

Oregon State University

Executive Summary

Overview

OSU AES utilizes institutional collaborative projects in addition to multi-state projects for directing the expenditure of Hatch funds and state matching funds. These collaborative projects are multi-disciplinary five year projects that involve faculty across the College of Agricultural Sciences and these projects are grouped according to the critical issue being addressed. Currently, there are eight projects that encompass all five critical issues: 1) Agricultural Competitiveness and Resilience; 2) Animal Diseases and Animal Production Systems; 3) Food Innovation and Market Access; 4) Marine Food Systems; and 5) Working and Natural Landscapes.

To further contributions by faculty in these areas, AES holds a competitive process to fund up to four new projects annually around the critical issues. The approach is to create seed funding provided over two years for large groups of faculty to propose innovative and new approaches to old problems. The seed funding provides support to the teams to prepare large grant proposals to a host of private and federal funding sources and to create strategic advantages for AES in these research areas.

Critical Issue: Agricultural Competitiveness and Resilience

Forage Based Systems

The goal of one project is to design and conduct forage/livestock systems research where we aim to systematically evaluate forage production, herbage chemical composition, animal production and health, greenhouse gas (GHG) emissions and ecosystem services from pastures and develop adaptive and novel management strategies for sustainable, economically efficient, low carbon pasture-based livestock farming across Oregon. In particular, this project will have a specific emphasis on sustainable dairy systems. We will employ a unique approach of designing phytochemically diverse pastures containing chemoscapes to improve the health and reduce the environmental footprint of pastured dairy cattle. Our goal is to create a sustainable and more resilient dairy production systems where performance and animal health are maintained at high levels with enhanced ecosystem. Through replicated pasture grazing, indoor winter-feeding and in vitro screening studies, we will investigate the effects of carefully designed chemoscapes on milk yield, animal health, N utilization and methane emissions of dairy systems in the northwestern US. We will also develop optimized dual-purpose (e.g.
pollinator friendly, agrivoltaics) pasture-based livestock production systems. We will also investigate the agronomic and nutritional options to improve resource use efficiency (e.g. water productivity) in low input pastoral farming in dry areas of Oregon.

Sustainable livestock systems, cleaner environment and healthier communities:

- Novel forage species such as birdsfoot trefoil, plantain, and chicory in Oregon grazing pastures lower methane emission and urine leaching to the groundwater, while increase atmospheric nitrogen fixation potential to lower the nitrogen fertilizer demand.
- Agrivoltaics system where livestock and energy production are performed on the same land can increase the land use efficiency. Spent hemp biomass can be fed to livestock without any detrimental performance and health effects on livestock.

Implementation of solutions or adoption of recommendations developed:

- Match the right forage species with irrigation water rights or producers' specific objectives to achieve agricultural sustainability while conserving salmon habitat.
- Selenium fertilization practices to safely and efficiently solve selenium deficiency caused white mussel syndrome in livestock production system.
- Use of chicory silage can improve milk quality and feed efficiency

OPeNS

We support the broader application of wirelessly connected distributed sensing systems in agricultural and earth sciences. We bring together novel sensor technology, high-performance microelectronic data systems, 3-D rapid prototyping, and wireless communication to address a diverse set of objectives for clients.

- OPEnS developed sensing systems and so ware for 14 projects over the reporting period.
- Continued collaboration with the Pacific Northwest National Laboratory (PNNL) to create river-sensing systems for their WHONDERS program. The focus has been on upgrading the probe to use 4-wire ceramic electrical conductivity sensors which should greatly improve the robustness and accuracy of the measurements, as well as a 16-ring electrical resistance tomography sensor system which will be used to characterize the layering and flow though hyporheic stream beds. The next generation of probes is to be delivered to PNNL June 2022.
- Continued collaboration with industrial partner Weyerhaeuser to develop a satellite reporting 1- cm resolution landslide monitoring system. The third generation of the system with multiple "rovers" (the nodes which monitor movement at particular locations) will go to the field in April of 2022.
- In a second continuing effort, Clean Water Services (CWS) of Hillsboro Oregon, wrote a second contract to support the CTEMPs-
- OPEnS lab to develop a COVID-specific sampling device to monitor COVID in sewage systems (https://github.com/OPEnSLabOSU/OPEnS-Lab-Home/wiki/COVIDSampler). The development process has been collaborative with the Utility District. The first sampler was delivered to CWS in August 2020, the second generation delivered in October, the third generation in January, 2021, and the fourth-generation samplers will be delivered at the end of March, 2022. These samplers provide previously unavailable precision in sample aggregation (drawing as many as 250 sub-samples per day), including passive cooling to 0C, and at a price about half of that of lower-performance products in the market. Together with the sampler, OPEnS developed a new inlet device allowing gathering of samples during the low, episodic flow found in many sewer systems.
- The OPEnS lab had its first commercial spinoff company launch, Helixon. This company, led by two OPEnS graduates, will produce the new eDNA sampler that grew out of the OPEnS lab efforts. This 24-sample device will automate eDNA collection at a price about 10% of the current technology. The demand for the device is remarkable, with first deliveries expected in the 4th quarter of 2022.
- Dendrometer patent. Our first patent application was submitted December 2, 2021 presenting our major improvement in
- Dendrometer design. The novel approach completely eliminated thermal artifacts, and eliminated mechanical hysteresis, together improving the accuracy of this measurement by about an order of magnitude over current technology. These radio-telemetry enhanced devices cost under $370 when built one-by-one, allowing researchers and growers to precisely track the water stress of their water stress. The dendrometer team has applied for $15,000 in funding from Oregon State university to commence commercialization of the device. As of March 10 they had passed all evaluations, and completed their final interviews for funding. This would be the second spin-off company coming out of the lab, with potentially significant commercial and water saving potential for farmers of woody species of plants (e.g., in Oregon, blueberries, grapes, apples and other tree fruit, hazelnuts).

Critical Issue: Animal Diseases and Animal Production Systems

Global food security represents access to food at many levels. Worldwide, millions of people live hungry due to poverty or lack food security intermittently. As the global population grows, the need to develop better ways of providing enhanced food quality and production and improving land use while preventing food degradation, as well as distributing the food efficiently and without spoiling, will became key research foci. The health of the animal food sources, as well as plant sources, is important to maintain and expand the nutrition of populations. However, disease is still common in food sources. Many pathogens evolved to survive in the prevailing conditions existing during the course of food production and food conservation may be deficient even in the developed world. Further, if the source of the food is diseased, for example, Johne's disease and tuberculosis in cattle and other ruminants or Vibrio tubiashii in seafood or Clostridium perfringens infections in several meat animals (pork, poultry, etc), the security of food will be compromised. We propose objectives which address aspects associated with food

animal security, that is, developing diagnostic tests and vaccines and creating a better understanding of the mechanisms of pathogenesis of or immunity to many virulent bacteria, viruses and health conditions.

Major parts of the US, including Oregon, are deficient in Se. Regional differences are reflected in the Se content of forages and in wholeblood Se concentrations in cattle consuming these forages. In plants (and in yeast), Se is incorporated into methionine as selenomethionine, and when forage is consumed by cattle, Se from selenomethionine is incorporated into selenoproteins, whose functions range from antioxidant, anti-inflammatory, and detoxification to thyroid hormone activation. We supplemented pregnant beef cows with Se-yeast at different stages of pregnancy, i.e., fetal development, to enhance proliferation of myogenic precursor cells and improve the efficiency of lean growth and pre-weaning calf performance. In conclusion, we identified dietary Se-biofortified alfalfa hay as a potential promoter of nasal microbiome genome and microbiota diversity, which may explain in part high-Se benefits for prevention of bovine respiratory disease complex in beef calves.

Selenium (Se) concentrations in soils and plants are low in the Pacific Northwest, and consequently, in livestock consuming locally-grown forages. Applying sodium selenate with traditional nitrogen-phosphorus-potassium-sulfur (NPKS) fertilizers provides a cost-effective Se agronomic biofortification method for increasing forage Se concentrations and maintaining optimum health and productivity of livestock. In conclusion, springtime sodium selenate foliar application is an effective management strategy to increase forage total Se concentrations and highly bioavailable selenomethionine concentrations across Oregon, and should be implemented to meet local forage and livestock requirements.

Vibriosis is a key impediment to hatchery and nursery culture of bivalve mollusks. Certain Vibrio bacteria are recognized as significant shellfish pathogens and commercial production is plagued by the typically rapid onset of vibriosis and high bivalve mortality rates. As there is currently no effective treatment available, Vibrioinfections in shellfish in commercial hatcheries can be considered a critical disease impacting commercial aquaculture production. We previously demonstrated that the metalloprotease VcpA, released by the Vcor bacteria, is a highly efficient killer of shellfish seed and is the main secreted toxin produced by these bacteria. Our strategy is to utilize PPMOs to knock down expression levels of the Vcor metalloprotease. PPMOs are a class of DNA-like cell permeable antisense agents, which are currently in clinical development for certain genetic diseases in humans. Importantly, the PPMO technology has been successfully used to knock down essential bacterial genes, both in vitro and in vivo. Thus, utilizing PPMOs for reduction of virulence gene expression is a promising approach and will be assessed for its potential as a novel intervention against vibriosis that is seriously affecting the productivity of commercial oyster hatcheries. If successful, these data sets can then be used to attract further funding to support more extensive testing of this approach.

The central goal of our research is to understand the molecular mechanism of germination and inactivation of spores of C. perfringens. To attain our long-term goal, we performed a study entitled “Inhibition of Clostridium perfringens spore growth in meat products by synergistic effects of different antimicrobials”. Collectively, our current study demonstrated that combination of nisin with AITC or chitosan could be a potential strategy to control C. perfringens spores and vegetative cells in laboratory condition and chicken meat model system. The antimicrobial agents (nisin, AITC or chitosan) used in this study are generally recognized as a safe (GRAS) agents to food formulation.

Critical Issue: Food Innovation and Market Access

Sustainability

Food systems must change to sustainably and equitably feed the global population anticipated by 2050. Many factors impact the ability to be successful including the global climate crisis, policy barriers, a complex supply chain, issues related to waste, water and energy and consumer perspectives. These issues are starkly visible in the Western US which is a significant food producer and exporter. The challenges and solutions involve many diverse stakeholders as well as transdisciplinary solutions and universities, particularly land grant institutions must play a leadership role in accelerating positive change. The ability to coordinate in an interdisciplinary manner across research, outreach and education is complex but necessary.

Our Sustainable Food Manufacturing efforts span commodity areas (e.g. dairy, brewing, wine, produce), particularly targeting emerging, small and medium-sized processors who face significant gaps to create opportunities and address barriers via education, research and outreach. Workforce development efforts provide essential technical training in areas like food safety or food production that contribute to a safe food supply and profitability to stakeholders, research creates opportunities such as how small and medium-sized cheese processors can drive product purchase due to COVID challenges and our outreach efforts bring statewide stakeholders together to create common ground for accelerating change in the region related to sustainability. Our undergraduate curriculum now fully integrates Sustainability starting in 2022.

COVID posed challenges to research efforts due to mandates impacting in person activities as well as supply chain issues related to supplies and equipment. Our curriculum is, by design, highly hands on so courses with labs had to adapt to ensure delivery of learning outcomes via adapted methods. The inaugural Sustainable Food Manufacturing (SFM) Forum which is designed as an in person event was delayed six months to spring 2022. Despite that, remote meeting platforms enable a greater than normal productivity of network expansion to communicate the new SFM programs. This resulted in many benefits including increased audience diversity in attendees and speakers for the monthly Farm 2 Fork webinar and engagement in the postponed SFM Forum. Capacity is being sought through grants to formally establish the Innovation Hub for SFM including a website and a communication strategy.

Food Safety

The long-term goal of this multi-state project is to perform comprehensive and integrative risk-based research, education, and outreach to improve food safety and advance public health. The project establishes multi- and trans-disciplinary teams of academics, food producers/processors, retailers, consumers, and local, state, and federal agriculture and health officials. The research conducted under this project contributes to the understanding of foodborne pathogen ecology and transmission—including the emergence and spread of antimicrobial resistant bacteria--in fresh and processed foods so that more effective mitigation strategies can be designed and applied at various stages of the farm-to-table continuum.

Since 2000, a multidisciplinary team of researchers and Extension educators from 39 institutions across the U.S. have worked together to address Food safety concerns. These efforts have expanded knowledge and set the foundation for future work on food safety. Collaboration has led to inventive strategies that can help prevent food safety threats before they become dangerous and costly. The primary objectives for this project are:

Risk Assessment: Characterize food safety risks in food systems

Risk Management: Develop, validate, and apply science-based interventions to prevent and mitigate food safety threats

Risk Communication: Convey science-based messages to stakeholders to improve food safety behaviors and practices

We have numerous active research projects that are focused on the first two objectives of this project and continue to propose and receive funding for these projects each year. Many of these have resulted in their presentation and/or publication (listed later in this report). We are also very active in the translation of these research findings and food safety messaging to various stakeholder groups, mostly focused on growers and processors, but we also work with consumers on a less frequent basis.

Many of our research projects are performed in close communication and conjunction with the food industry. They are kept informed of our research progress through regular communication – email, phone calls, and interim reporting. We also share our formal publications and other outputs with them as appropriate to the project and the stakeholders. Research and extension/outreach outcomes broadly support improved food safety practices and compliance with relevant federal and state laws.

Improvements in food safety practices by the food industry support public health, sustainability, and social efforts to provide jobs and access to affordable, nutritious foods. Our efforts broadly support the food system and the broader public benefits from the implementation of practices that improve food safety. A subset of research and outreach materials also support food security issues, particularly involving home food preservation.

The team was effective at making significant progress on research and extension/outreach goals for the 2020-21 fiscal year. We were successful in spite of challenges and interruptions related to the COVID-19 pandemic. Many conferences and workshops effectively pivoted to virtual, remote formats and we found success in keeping many of these synchronous. We continued to offer PSA and FSPCA trainings through virtual formats and offered several webinars/presentations; however, we delayed the delivery of several of our popular and effective in-person workshops (i.e., Pathogen Environmental Monitoring) until a er the pandemic has subsided.

Critical Issue: Marine Food Systems

Vibriosis is a key impediment to hatchery and nursery culture of bivalve mollusks. Certain Vibrio bacteria are recognized as significant shellfish pathogens and commercial production is plagued by the typically rapid onset of vibriosis and high bivalve mortality rates. As there is currently no effective treatment available, Vibrioinfections in shellfish in commercial hatcheries can be considered a critical disease impacting commercial aquaculture production. We previously demonstrated that the

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Critical Issue: Public access to healthy and nutritional foods

- OSU Extension trains volunteers to provide information to those accessing food through emergency food pantries about how to use unfamiliar ingredients, how to store food for maximum use, and provides healthy recipes to use the ingredients. Program staff work with local food banks and pantry sites to align recipes to stocked ingredients to make it easy for clients to obtain meal kits that are intended to help them make the most of the ingredients provided. Efforts are also focused on working with pantry sites to display foods according to behavioral economics theories of food selection so that customers are more likely to select healthier options.
- OSU Extension partners with organizations who are working to increase access to farmers' markets and local food for low-income individuals, including the Oregon Farm Direct Nutrition Program through WIC, which provides vouchers to WIC families and income-eligible seniors. OSU Extension staff complement these programs by co-locating booths next to these partners and providing activities, recipe demonstrations, farmers' market tours, and other information about how to use fresh produce to shoppers.
- Summer Food Service Program sites provide important access to nutritious food for youth during the summer months when schools are not in session. OSU Extension researchers conducted focus groups and surveys with summer meals participants and sponsors to understand barriers and strengths to increasing participation. About half of the parents answering the survey reported that offering an activity was at least "somewhat important" to their decision to participate in summer meals. In addition, the promotion of activities may reduce the stigma associated with going to the site to receive a free meal. OSU Extension partners with summer meals sites in communities to provide activities for youth including hands-on nutrition and physical activities to encourage families and youth to access these sites and increase food security.
- OSU Extension works with schools to increase appeal for school breakfast and lunch options through the provision of kid-tested, kid-approved quantified and credited food service recipes. During the COVID-19 pandemic, OSU partnered with schools offering grab and go meals for students to provide innovative interactive meal kits that engaged students in optional food preparation tasks and connected families with nutrition resources and activities to do together at home. Efforts to encourage access to school meals are supported year-round through school partnerships providing nutrition-based direct education in the classroom, a er school programs, and school gardens. Social marketing focused on increasing consumption of fruits and vegetables, and policy, systems, and environmental strategies targeted at increasing access and appeal for healthy eating and food choices for youth and their families is a focus for OSU Extension.
- OSU Extension intensified its efforts to reach new gardeners and low-income families during the pandemic to offer free seed packets and gardening resources designed to foster gardening for food. Seeds were distributed to households and school and community groups, with an overall reach of 53,000 Oregonians. This is an important method to increase access and use of fruits and vegetables in households and community sites.

Critical Issue: Resilient Communities and Economies

OSU Extension (OSUES) partners with local communities to provide trusted expertise and science-based knowledge to address critical issues and help every Oregonian thrive. Through our programs, partnerships, and volunteers we have traditionally invested in healthy communities and economies and resilient and productive forests and natural ecosystems. New programs that address poverty and underemployment, health and nutrition, food insecurity, and the growing opioid and mental health challenges in rural communities will be an essential focus of OSUES faculty. OSUES acknowledges that urban and rural communities not only offer unique programming contexts and population needs, but allow for innovative opportunities to serve Oregonians. Similarly, Oregon is bestowed with diverse and unique geographies. From rugged coastal shores to the highly agriculturally productive Willamette Valley to the high deserts and mountainous east to the low basin complex of Southern Oregon. Each region and subregion have unique natural resources and natural hazards.

Healthy Oregonians are resilient Oregonians. OSUES SNAP-Education and Family Community Health programs contribute significantly in this area. In Central Oregon SNAP-Ed staff a er programming in schools saw double digit increases in healthier food choice and food intake and nearly a one-third increase in physical activity. Although COVID-19 highlighted societal challenges, it also brought out selfsufficiency in Oregonians. Home food preservation is among these areas which saw a

renaissance. While OSUES has long had a food preservation program and strong core of volunteers, the uptick in interest was noticeable. Food preservation education went virtual in the Preserve-Along and Preserve @ Home Oregon programs. Eighty-three percent of the participants completed the course. In addition to increasing their access to fruits and vegetables throughou the year, o en from their own gardens, the average estimated savings by participants was suggested to be $1030 per year.

Vaccine access during COVID has not been evenly distributed either geographically or across each of our demographic populations. Communities of color have historically, and likewise during the COVID pandemic, experienced lower access to vaccines and evidencebased health information. Juntos en Colaboracion is a partnership between OSU Extension Service (FCH, SNAP-Ed, Small Farms), OSU Center for Health Innovation, Lincoln County Health and Human Services, community non-profit partners and community members. This collaborative team was established to respond to COVID but has evolved to be working toward broader community resilience. In responding to the need to increase access to vaccinations, they used evidence-based public health data and culturally-relevant approaches to tailor vaccination clinics to the Latino and Hispanic communities along the Central Oregon Coast. There work initially resulted in over 700 vaccinations in eight months and a long-term commitment to increasing culturally tailored public health outreach.

The Forestry and Natural Resources (FNR) Program has been critical in supporting healthy forests, resilient communities, and a critical sector of the Oregon economy. Recent and significant fires across the state have stressed resources and communities. The FNR program not only provided critical support during the fires, they stepped-up significantly during the post-fire recovery. FNR staff connected with impacted landowners supporting their needs for recovery loggers and tree planting landowners. They also formed broad groups of partners to advise, educate, and consult with landowners on the way to recovery. Well-planned recovery sets the conditions for more resilient communities and natural systems. Their efforts resulted in available funding, reforestation materials, and informational town halls.

Juntos and Open Campus helps Oregonians increase their resilience through college and career readiness, degree completion, economic and community development. In Grant County, one of Oregon’s least populous, Open Campus staff convened community meetings, wrote grant requests and managed the project with community partners to increase high-speed internet access. This project, called Cybermill, raised over $400 in funding and opened locations in three different communities. Their work has positively impacted businesses, education, and outreach to communities, especially seniors.

Critical Issue: Thriving Youth, Individuals, and Families

Open Campus and Juntos helps Oregonians increase their resilience through college and career readiness, degree completion, economic and community development by serving 1,912 bi-lingual families in 41 workshop cohort across 28 communities in 17 counties.

According to the National Center for Education Statistics (NCES), students with some college and no degree will made $21,410 less per year than students who completed a bachelor’s degree, and are twice as likely to live in poverty. Open Campus college access programming reports that 86% of college access participants said they were likely to attend college a er attending Open Campus Extension events.

The Open Campus Hangouts program has created an opportunity for over 100 peer mentorships within Extension. Eighty percent of students reported the program helped motivate them to complete high school, 70% reported the curriculum motivates them to go to college, 50% stated it has created conversations with their parents about college, and 87% said they were better able to find answers to questions concerning college.

Open Campus first brought Tech Trek camps includes week-long core classes, hands-on workshops, field trips, and a professional night with women in STEM careers. In Summer 2021, the camp pivoted to a 3-day, day camp format to safely offer an in-person experience to 18 girls from Tillamook and Lincoln Counties. The impacts of Tech Trek have been documented in two Journal of Extension articles and shows that 89% of campers have gone on to attend college and 47% went on to major in STEM.

Juntos Afuera is a 10-week summer camp in Tillamook County with the goal of showing Latinx students that the outdoors is an inclusive and safe space where they can learn about and celebrate Latinx identity and culture. Although the Latinx community is the fastest growing in the US, making up more than 18% of the population, only 11.6% of outdoor recreation participants identify as Latinx. The program was piloted in Summer 2021 with 12 students and with the support of a wide array of partners. The campers went kayaking, bird watching, and zip lining while also exploring Latinx identity, learning about career opportunities from Latinx natural resources professionals, and sharing their experience with a presentation to the county

commissioners. Juntos Afuera is growing an active local group of Latinx explorers and environmental stewards with plans for future outdoor experiences and another year of camp.

Outdoor School Program:

Whether organized by a school district, an Educational Services District (ESD), a non-profit organization, or a partnership with natural resource professionals, outdoor school is an important common thread for Oregon students. As outdoor school programs grow in participation, the OSU Extension Service Outdoor School program aims to help school districts and outdoor school providers develop culturally responsive and inclusive curriculum. To do this, outdoor school providers statewide lean into questions such as:

- How do we meet the needs of all students?
- How do we ensure diverse representation on the teaching staff?
- How do we ensure access for all abilities, languages, and identities?

And most importantly, outdoor school providers must continue to ask:

- Who is missing from the conversation?

In response to these critical questions, the OSU Extension Service Outdoor School program team created three self-evaluation tools to help support outdoor school providers in the creation of more equitable and inclusive outdoor school experiences for all youth. They include the:

- Instructional Resource Self-Evaluation Tool (IRSET)
- Cultural Responsiveness Self-Evaluation Tool (CRSET)
- Special Education and Accessibility Self-Evaluation Tool (SEASET)

These self-evaluation tools are designed to support outdoor school providers in moving through the program evaluation cycle:

1) evaluating current policies, practices, and resources,

2) reflecting, learning, and planning for change, and

3) implementing changes that make outdoor school more equitable, accessible, and culturally responsive.

To further facilitate outdoor school program accessibility and support self-evaluation and implementation of outdoor school program improvement planning, in 2021 the OSU Extension Service Outdoor School program sought grant applications from outdoor school providers and sites who wished to engage in projects that further the values of equity, diversity, and inclusion. The two grant programs focused on:

1. Building instructional resource responsiveness around EDI, or moving outdoor school staff and programming toward an improved understanding/expression of EDI during the 2020-2021 academic year.

These improvements could include, but were not limited to:

- curriculum creation, review or revision, such as generating curriculum that is:
    - responsive to and reflective of the background and cultures of all students attending outdoor school.
    - accessible and inclusive for students with cognitive disabilities.
- programming review, revision, and/or EDI strategic planning.
- mission, vision, and values statement creation, review, or revision through an EDI lens.
  outdoor school staff professional development related to EDI.

1. Improving site and programming accessibility for outdoor school students (e.g. students with exceptional physical or cognitive needs).

These improvements could include, but were not limited to:

- Site accessibility audits that would lead to physical improvements

- Physical site improvements focused on ADA (Americans with Disabilities Act) accessibility, which may include support for inprogress projects only if the original project start date was July 1, 2020, or later
- Training for appropriate use of accessibility features at the site
- Modification or conversion of existing restroom facilities to gender inclusive restrooms
- Inclusive signage or culturally responsive visual aids
- Installation of broadband, Wi-Fi or power to remote instructional sites to permit students with disabilities to use necessary communication, instructional or mobility equipment
- Safety-related improvements (guard rails, fencing, path improvements, etc.)

In addition, the OSU Extension Service Outdoor School program strove to equitably distribute these grant awards to outdoor school community members across the state of Oregon with the aim of helping Oregon's outdoor school programs emerge from the pandemic as stronger, more equitable and more accessible programs for the youth of our state with culturally responsive, inclusive and accessible instructional resources, taking place at culturally responsive, safe, inclusive and accessible sites.

Critical Issue: Working and Natural Landscapes

Rangeland Management

Cattle distribution, nutritional status, and management on extensive landscapes is a challenge faced by land managers in the Western U.S. Consequently, we are working on research and outreach programs that optimize ruminant livestock production on rangelands to improve the sustainability of beef cattle operations and associated rural communities.

In 2021 we had significant progress toward the objectives of our project. A 3-state group (NE, MT, and OR; USDA-ARS and associated land grant institutions) received federal funding related to Precision Livestock Management Systems for Western Rangelands ($3 million per year for 5 years). This funding will assist with this project for both research and outreach programming. Active projects in 2021 were associated with virtual fence technology, riparian grazing strategies, and wildlife/livestock grazing effects on ecosystem function and wildlife habitat. This project will add to the available science associated with land management, grazing behavior, wildlife/livestock habitat, restoration practices, and rangeland ecology. Findings from the project will lead to the development of publications and new tools that will assist livestock producers and land managers in making informed decisions regarding the use of management practices that support the viability of livestock production- improves the condition and health of rangelands, and improves the economic viability of rural communities.

This project is developing and evaluating tools to manage western rangelands for optimization of plant/soil biological processes that are critical to the long-term economic outlook of the rural west as well as the multiple ecosystem services contained within the public and private rangelands of the Western US. Therefore, this project is critical in maintaining and enhancing the livestock industries that are the foundation of the Western US agricultural economy and critical to future success of rural communities, economies, and ecosystems. Recent specific benefits include working with state and federal agencies to incorporate evolving land management practices for multiple management objectives and popular press articles highlighting results, impact, and implications of research and outreach programs.

Water Resources

Increasing global shrinkage of freshwater resources compels policymakers, stakeholders, and farm producers into expansion of alternative irrigation water resources. Processed industrial water is an emerging alternative resource for irrigation water with a remarkable climate adaptation potential in semi-arid agriculture. However, local reuse water sources o en contain nitrate, ammonium, and occasionally trace metals that may accumulate in soil or leach to the aquifers. Thus, the sustainable expansion of reuse irrigation water requires an in-depth knowledge about the terrestrial dynamics of water and nutrient, water chemistry, and remediation practices.

Our research concerns the regional characterization of water and solute dynamics in the alluvial agroecosystems of the Lower Umatilla Basin Groundwater Management Area (LUBGWMA) and developing land-use practices that permit sustainable expansion of reuse-water irrigation. In a multi-phase approach, we address the effect of land use, terrain, and hydro-pedology on water and nitrogen dynamics on a regional scale. We characterize the spatiotemporal landscape control on soil-water-plant relations and their subsequent effect on water and nutrient transport and availability. This information is used as a basis to design and examine local management strategies that are suited for local challenges. These strategies are expected to complement the reuse water nitrogen input through symbiotic N fixation, intensify carbon storage, reduce evaporation, and improve water holding capacity to reduce the risk of nitrate leaching and enhance the agroecosystem resilience to drought and off-season aeolian soil losses.

To achieve this goal, we have been conducting extensive measurements of saturated and unsaturated water and solute fluxes, water retention characteristics, and hydro-pedological characterizations of LUBGWMA agroecosystems.

As a team, we have collaboratively been very successful in disseminating our information to a wide-ranging audience. This is evident in the previous sections which highlight outcomes presented in many regional, national, and international events. In addition to presentations, we have produced printed materials as extension publications, magazine articles, and a best stewardship plan.
Specifically, in 2021 we have produced 14 peer refereed journal publications, 2 published datasets, 1 magazine article, 20 presentations, and 1 best stewardship plan.

Our research and outreach efforts involved training both undergraduate and graduate students in multiple departments, and colleges and universities. We trained students through both formal and informal training programs. Formal training programs for undergraduate students included the OSU Branch Experiment Station Experiential Learning Experience Internship Program and the OSU FWCS Vanguarding an Inclusive Ecological Workforce Internship Program. Formal training programs for graduate students working on the project included a training grant from the USDA National Institute of Food and Agriculture National Needs Graduate and Postgraduate Fellowships (NNF) Program entitled “Enhancing professional quality of future leaders in agriculture and natural resources: New strategies for graduate student training.” The USDA NNF grant indicated above was awarded $246,000 in 2021 to PI Lukas, with co-pi’s DeBano, Wooster, and Qin.

Merit and Scientific Peer Review Processes

Updates

None

Stakeholder Input

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

Use of media to announce public meetings and listening sessions
Targeted invitation to traditional stakeholder groups
Targeted invitation to non-traditional stakeholder groups
Targeted invitation to traditional stakeholder individuals
Targeted invitation to non-traditional stakeholder individuals
Targeted invitation to selected individuals from general public
Survey of traditional stakeholder groups
Survey of traditional stakeholder individuals
Survey of the general public
Survey specifically with non-traditional groups
Survey specifically with non-traditional groups
Survey of selected individuals of the general public
The Director, as well as Associate Directors, Assistant Director and the External Relations Director, travel throughout the state to interact at formal and informal stakeholder events. Events included field days, special commodity events, County and State fairs, faculty organized conferences and workshops. They also attended events organized by various industry, public and nonprofit entities to interact with stakeholders. Faculty also attended all events.
Reviews of unit leaders and faculty are conducted periodically to assure that personnel are responding appropriately to relevant stakeholders, industry, and consumers. Each unit also has an advisory council of important stakeholders and the public at large that assist with setting strategic direction and allocation of resources.

Methods to identify individuals and groups and brief explanation

During the reporting period, OAES and OSUES reassess all programs used to address its internal strategic planning, which was formulated with input from internal and external stakeholders. As mentioned previously, CAS has undertaken a new strategic planning exercise that will change the focus of future scientific and extension activities around four areas of distinction.

OAES faculty at the eleven branch stations (situated in 15 agro-ecozone locations) ensure that local stakeholder input is transmitted to OAES administrators and that feedback is generated. Each station is highly integrated into the surrounding industries, communities and governing bodies, as well as land management bodies. Representative stakeholders generally hold positions on the station advisory bodies and directly provide guidance on programming and issues and needs. Many of our stations are not only research locations but are integrated research and extension centers. Programming is based on stakeholder input and developed and delivered by the four colleges receiving Hatch/Multistate funds (Forestry, Agricultural Sciences, Public Health and Human Sciences, and Veterinary Medicine).

OSUES faculty work closely with local stakeholders, including farmers and ranchers, foresters, agency personnel, elected leaders, educators health professionals, environmental organizations, and a myriad of other public and private entities to establish need and design appropriate programming. In many cases, stakeholders are directly involved in the programming as volunteers or by permitting demonstrations and applied research trials on their properties. Additionally, faculty members utilize critical demographic and economic date, and examine current research findings to identify societal needs and opportunities for significant social, environmental and economic impacts. Programming is then planned based upon this input with each of the four academic colleges with Extension programs (Forestry, Agricultural Sciences, Public Health and Human Sciences, and Sea Grant). OSUES provides funding to these colleges on the basis of planned outcomes outlined in a biennial plan submitted by each college. All Extension FTE must be accounted for in these plans.
The plans are reviewed annually and span a two-year timeframe. Annual evaluations are conducted by the OSUES Director to determine how effectively each planned program is addressing key needs and delivering the anticipated outcomes and impacts described in each plan.

Methods for collecting stakeholder input and brief explanation

Use of Advisory Committees
Use of Internal Focus Groups
Use of External Focus Groups
Open Listening Sessions
Legislative Hearings and Requests for Information
Meetings with State and Local Elected Officials
Meet with agency representatives
Meeting with Congressional members and staff
Meetings with commodity groups
Meetings with industry suppliers
Meetings with consumer groups
Needs Assessments
User Surveys
Other (blogs, fairs, social media, websites,)
Extension, Station, and departmental faculty, as well as unit leadership provide information on critical stakeholders and groups. The deans and the External Relations Director also identify important clientele through their many contacts. The Director's advisory group is composed of industry and community leaders. They meet regularly to update the Station administrators about critical issues and developments around the state or in their industry. Every branch station enlists stakeholders to serve as an advisory council for station work planning and research emphasis.

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

Determining OAES and OSUES strategic direction is an on-going, shared responsibility, especially in entities as diverse as these partners at OSU. The power of our planning derives from the process. As noted above, that process includes our continuing dialog with Oregonians and the inevitable distillation of their needs. It also includes matching of faculty strengths with opportunities for outside funding, consistent with our mission. Much of the critical decision-making is at the unit level. Because responsibility is shared between OAES and OSUES administrations and their units, our strategic planning documents are best seen as a reference for subsequent and continuing conversations between the administrations and the individual units. Such conversations will be a regular part of how we operate. In addition, budgets reduced by declining state revenues starting in 2002 and exacerbated by the nation's deep recession starting in 2008 only began to slightly recover in the 2015-2016 state fiscal year. Current budgets suggested a very modest increase of above continuing service levels but recent economic impacts of the pandemic, inflation, increasing cost of salary and benefits, and the need to replace aging infrastructure and equipment suggest declining budgets for the immediate future.

At stakeholder workshops administrators pose questions and listen to what attendees have to say, and then compile these stakeholders' comments, observations, and suggestions. The summaries are posted on the College and OSUES website and points are incorporated into the annual Action Plans.

OAES and OSUES have and continue to solicit and receive thoughtful critiques and sometimes views that differ from its own. Responses are prepared in a timely fashion and posted either to the particular individual or on webpages or in newsletters maintained by the administration or their units.

In 2009, Oregon State University instructed its colleges to develop plans that would implement structural and programmatic change throughout the university to better position it for a future with a predicted small state-supported "footprint." This mandate included restructuring of units, programs, and curricula. Stakeholders, both inside and outside the College and OSUES, contributed ideas and suggestions that were used to shape new plans. Discussions throughout 2014 and 2015 among internal and external stakeholders continue to refine the design. While most of our stakeholders have said they understand the need for us to be creative at addressing our budget challenges, they also hope that we will be creative in meeting their local needs as well.

Beginning in 2013, the College of Agriculture Sciences initiated a Strategic Intent process that focused faculty and leadership attention on student success, international presence, communications, faculty success, research emphases, diversity, equity, and inclusion, outreach and engagement, graduate education, resources/business plan, our role in STEM education and infrastructure/facilities. That document was replaced in 2019 in an ongoing process to describe key areas distinction where we demonstrate unique leadership that is recognized as an area of strength and opportunity.

Stakeholder input is widely used by OAES and OSUES to set priorities at all levels of the organization. This influences budgetary outlays for various programs and subsequently affects program delivery. Stakeholders serve on virtually all faculty search committees and thus directly affect hiring decisions. The process of involving stakeholders in the hiring process works well, with stakeholders feeling a greater commitment to helping new hires be successful in their assignments. Stakeholders who have a vested interest in the program and/or community are the most effective.

Highlighted Results by Project or Program

Type	Projects / Programs
Projects / Programs without a Critical Issue	**0**

Not Provided