

New Mexico (New Mexico State University Main Campus) Annual Report - FY2025

Report Status: Approved as of 06/22/2026

Contributing Organizations

New Mexico State University Main Campus

Executive Summary

Overview

New Mexico State University's College of Agricultural, Consumer, and Environmental Sciences (ACES) has a mission to improve the well-being of New Mexican's and beyond through research, teaching, and Extension programs. In addition, the College serves as an engine for economic and community development in New Mexico. Over the past year, NMSU's College of ACES research and Extension efforts have pivoted to meet the necessary changes required by the federal government, while continuing to keep the priorities of New Mexico agricultural producers at the forefront. Researchers and Extension professionals have continued to pursue emerging challenges and to focus on the four critical issues that broadly define the various areas of concern regarding agriculture in New Mexico. These four issues include: Food & Fiber Production and Marketing, Water Use and Conservation, Family Development and Health of New Mexicans, and Environmental Stewardship, and are grounded by our dedication to educating and training skilled professionals in the field of agriculture.

The Agricultural Experiment Station (AES) advances science-based solutions that strengthen agriculture, natural resource stewardship, and community resilience across New Mexico. As the research arm of the College of ACES, the experiment station is fundamental in serving the land-grant mission. The AES system includes a network of scientists based at the main campus and 12 agricultural science and research centers throughout the state. These centers serve as outdoor research facilities that reflect New Mexico's vast geography and environment. The wide range of growing zones and environmental conditions varies significantly across New Mexico; therefore, research centers are strategically located throughout the state to address these differences. The NMSU AES advances research that addresses real-world challenges and is central to the university's mission to improve the lives of people in New Mexico and around the world.

Current figures show that modern agriculture must increase productivity to feed 9 billion people in the 21st century, while simultaneously addressing sustainability. Over the past year, AES researchers have made significant progress towards advancing sustainable agricultural practices, improving soil health, addressing food supply chain solutions, and collectively working to support a resilient agricultural system.

The multidisciplinary collaborative projects that were initiated in 2023 have completed their second year of research. The 14 project areas are guided by the four identified critical issues and include animal health and welfare, genetic enhancements in crop systems, sustainable management of water resources, agricultural literacy and education, as examples.

This year, the selected project highlights provide an insight into how these projects have developed and have responded to the challenges in New Mexico. Researchers will continue to enhance their collaborations and expand the areas of research to meet local community needs.

Complementing AES research, the Cooperative Extension Service (CES) translates science-based findings into community-centered education and applied solutions that directly benefit New Mexicans. The Cooperative Extension Service (CES) advances statewide economic, educational, and community development through research-based programming that responds directly to the needs of New Mexicans. With a presence in all 33 counties and Tribal communities, CES collaborates with more than 1,000 partner organizations and engages approximately 10,000 volunteers to extend its reach. In 2025, Extension faculty served over 750,000 residents through programs focused on agriculture and natural resources, youth development, community capacity building, and family health and well-being.

CES programs demonstrated measurable outcomes in knowledge gain, behavior change, and adoption of best practices across critical issue areas. Through integrated partnerships with schools, healthcare systems, producers, and community organizations, CES translates research into practical application, strengthening individual capacity, supporting economic resilience, and improving quality of life in communities across New Mexico. Collectively, CES programs demonstrate measurable impacts in behavior change, economic stability, environmental stewardship, and community resilience across New Mexico.

AES and CES continue to prioritize stakeholder engagement by working closely with producers, industry partners, government officials, and community members. This coordinated approach ensures that research is responsive to real-world needs and that findings are effectively translated into practical applications. Researchers and Extension professionals work together to meet the needs of New Mexicans.

Critical Issue: Environmental Stewardship

Increasing extreme heat, drought, water scarcity, and invasive species are some of the challenges that threaten ecosystem structure and function, as well as the physical and mental health of New Mexicans. AES and CES are addressing these complex issues with forward-thinking and collaboration.

In 2025, AES researchers worked on a project aimed at improving the understanding of soil health across varying agricultural systems, enhancing water use and conservation efficiency, and increasing agricultural literacy among stakeholders and the public. Using six of the NMSU Agricultural Science Centers that were chosen to represent this study, soil samples are being collected to measure soil organic matter and its relationship with food production, water dynamics, and energy use. Preliminary observations of the project have been shared with farmers, ranchers, and local stakeholders.

Another example of research related to environmental stewardship includes a group of researchers who are conducting a horizon scan that will synthesize current issues and identify emerging issues that

affect the health, environmental quality, and economic well-being of the southwestern United States. Researchers are developing a survey that will be deployed in early 2026 and disseminated to scientists, policymakers, and practitioners to help identify emerging challenges before they escalate. This work supports forward thinking and informed decision-making, while engaging stakeholders from across the natural resources spectrum.

CES advances environmental stewardship through science-based education and innovative programming that supports drought management, sustainable land management, and resource conservation. Across the state, Extension initiatives are addressing the impacts of drought, extreme weather variability, and ecological stress through applied education and community engagement.

Programming in soil health, biochar production, and sustainable landscaping has increased stakeholder knowledge and adoption of practices that improve soil organic matter, reduce open burning, and enhance water retention in arid systems. Water-efficient landscaping and irrigation education have led to documented shifts toward drought-tolerant plantings and improved irrigation practices among homeowners and land managers.

CES also strengthens community resilience through coordinated efforts in disaster preparedness, land stewardship, and post-event recovery. Statewide initiatives, including soil health conferences and land access programs, have expanded stakeholder capacity to support long-term environmental sustainability. Through these efforts, CES is contributing to improved ecosystem health, reduced environmental risk, and increased resilience of both agricultural and urban systems. These efforts have resulted in increased adoption of soil health practices, reduced reliance on open burning of agricultural waste, and improved water conservation behaviors among landowners and communities. AES and CES are also collaborating with other state and federal agencies to monitor and educate on the importance of New World Screwworm.

Critical Issue: Family Development and Health of New Mexicans

Throughout the past year, AES researchers have increased research efforts in the area of Family Development and Health of New Mexicans with projects related to New Mexico Rural Economic Development, Agricultural Literacy and Education and Pathways to Human Health and Wellness. Each of these projects includes a multi-disciplinary research team that is working towards supporting New Mexico communities through education, economic development and mental health awareness.

Some examples of this work include a project that is encouraging collaboration among various stakeholders while studying economic impacts from tourism on rural economic businesses and encouraging sustainable employment. One researcher has joined a non-profit work group to gain more insight into tourism and has submitted a proposal for a detailed study of the economic impact of tourism in two New Mexico counties. Another researcher involved with this project is focused on other areas related to hospitality training, including how to enhance the use of technology in hospitality. Lastly, this project also includes faculty representation from the New Mexico dairy industry, which brings the perspective of how to bridge dairy stakeholders with rural economic development.

Another project related to the ongoing challenges of family stressors in New Mexico put a focus on mental well-being and emotional awareness with high school students. Researchers engaged 40 high

school students in interactive activities focused on understanding emotions, recognizing burnout, and creating personal wellness plans. The results demonstrated positive outcomes, both quantitatively and qualitatively. Participants left with practical tools they could use immediately to manage stress and regulate emotions.

CES delivers comprehensive, research-based programming that improves health outcomes, strengthens family systems, and builds individual capacity across the lifespan. Programs addressing chronic disease prevention, nutrition education, financial literacy, and mental wellness are producing measurable improvements in knowledge, behavior, and quality of life among New Mexicans.

Statewide nutrition and health programs have demonstrated significant outcomes, including increased fruit and vegetable consumption, improved diet quality, and enhanced self-efficacy in healthy meal preparation. Participants in diabetes and chronic disease education programs reported measurable health improvements, including reductions in blood glucose levels and increased adoption of disease management behaviors. Across multiple programs, over 90% of participants reported increased knowledge and intent to adopt healthier lifestyle practices. In addition, participants in targeted programs reported measurable improvements in health indicators, including improved diet quality and reductions in blood glucose levels.

CES also addresses financial well-being through targeted education that improves financial literacy, debt management, and long-term economic decision-making. Participants reported increased confidence in managing personal finances and intent to implement budgeting and debt reduction strategies.

Family and community wellness initiatives further support mental health, stress management, and life skills development. Through partnerships with schools, healthcare providers, and community organizations, CES programming strengthens resilience, promotes healthy behaviors, and expands access to critical health education in both rural and urban communities.

Critical Issue: Food & Fiber Production and Marketing

Agriculture continues to be one of the most important industries in New Mexico, with three crops (chile, pecans and onions) being in the top five rankings nationwide in 2024 (New Mexico Annual Bulletin, 2024). The entire food and fiber supply chain has an economic impact of over \$21 billion in direct output and \$45 billion in total output. AES and CES continue to support production agriculture across the state by advancing the growth, quality, and overall improvement of New Mexico's agricultural products.

AES has several projects that support this critical issue in New Mexico. One is a project that addresses the food and fiber supply chain by conducting a series of studies that address the shortcomings in the production, processing, distribution, and consumption of food in the United States. Examples of their work include a study that analyzed metabolomic profiles of jujube fruit that grow in New Mexico and Texas, finding that the bioactive compounds can improve sleep, reduce anxiety, and reduce inflammation. Another example is a study that sought to determine small-scale producer and low-income consumer responses to the New Mexico Double Up Food Bucks (NM DUFB) program. This program matches Supplemental Nutrition Assistance Program spending on locally grown produce. Over the past year, researchers have taken on research efforts that address food and fiber supply

chain issues, as no single action can improve the entire food chain supply, but collective work can help provide decision makers with actionable information to increase economic returns for producers, improve nutritional quality of foods, reduce food insecurity, and promote more sustainable approaches to managing food waste in New Mexico, the border region, and the United States.

Other projects that focus on food and fiber production include a focus on animal health and wellness and crop production in New Mexico's arid lands through genetics. Researchers in the animal health and wellness project focus on advancing progress toward understanding how nutrition influences animal health, reproduction, and production efficiency, particularly in challenging environments. This study benefits the public through improvements in food security, food safety, environmental stewardship, and animal welfare. By identifying how animal health and nutrition influence fertility and productivity, this research helps livestock producers maintain stable and efficient meat production, supporting a reliable and affordable food supply.

The project focused on improving crop production in New Mexico's arid lands through genetics, including researchers who have specific crop focuses on some of New Mexico's largest crops. These crops include pecans, valencia peanuts, short-day onions, chile peppers, and alfalfa. Researchers are focusing on developing new genetic resources and cultivars that focus on increased drought, heat, and disease resistance, which are needed by New Mexican producers to increase crop production and maximize productivity and profitability on their farms.

CES plays a critical role in strengthening New Mexico's agricultural systems by supporting producers, developing future workforce pipelines, and enhancing community-based food systems. Through research-based education, hands-on training, and strategic partnerships, CES contributes to increased productivity, sustainability, and economic viability across the food and fiber sector.

Extension programming has improved producer knowledge and adoption of best management practices in areas such as soil health, pest management, irrigation efficiency, and livestock production. Educational efforts have resulted in increased confidence among producers and documented intent to implement practices that enhance profitability and reduce production risk.

CES also expands agricultural literacy and workforce development through youth-focused programming and experiential learning opportunities. Thousands of youth engaged in agricultural education initiatives that increased awareness of food systems, strengthened STEM engagement, and promoted career pathways in agriculture and natural resources. Programs such as agricultural literacy events, youth camps, and school-based partnerships are building the next generation of agricultural leaders. These efforts contribute to strengthening agricultural workforce pipelines, increasing producer capacity, and supporting long-term sustainability of New Mexico's food and fiber systems.

In addition, CES strengthens local and regional food systems through community-based initiatives that support food access, home gardening, and nutrition education. Volunteer-driven programs, including the Extension Master Gardener network, significantly expand outreach capacity while contributing to food security, environmental stewardship, and community engagement. Collectively, these efforts support a resilient and economically vibrant agricultural sector in New Mexico.

Critical Issue: Water Use and Conservation

In New Mexico, water is increasingly a limited resource and the most complex challenge that all agricultural producers face. Drought, followed by periods of flooding, increases the risk of loss for New Mexico agricultural producers. AES and CES continue to expand research and programming efforts to manage water challenges throughout the state.

Due to water being such a critical resource in New Mexico, it is necessary to note that most AES research projects intersect with water use and conservation on some level, while the project examples below are those with a specific focus on water.

New Mexico and the southwestern United States are facing increasing water scarcity due to reduced surface water, declining aquifer levels, and rising demand from communities, agriculture and ecosystems. This scarcity threatens the way of life for almost all New Mexicans. This past year, researchers conducted an online survey of residents across New Mexico and Arizona to assess their attitudes toward water conservation and the actions they take to conserve water. The results provide a baseline understanding of residential water conservation perspectives in the semi-arid southwest, informing future strategic outreach, education, and policy initiatives.

Not only are New Mexico farmers and ranchers worried about the sustainability of water, but there is also a concern regarding water quality. One group of researchers has a goal to understand and document water quality issues and offer recommendations for sustainable productivity. Over the past year, several water, wastewater, and soil samples were collected and analyzed from various sources across New Mexico and the southwestern United States. These samples are tested and results are documented and shared with the public through fact sheets and community outreach. Researchers have published at least twelve journal articles and made several presentations to share the results of this project related to water quality throughout New Mexico. Findings and recommendations from researchers will enhance the water quality for all New Mexicans.

CES is a leader in advancing water conservation and resource efficiency in response to the increasing pressures of drought and water scarcity in New Mexico. Through innovative education, applied demonstrations, and technology-driven outreach, CES equips residents, producers, and communities with the tools needed to make informed water management decisions.

Programs focused on irrigation efficiency, drought-adaptive cropping systems, and water-smart technologies have resulted in increased knowledge and strong intent among participants to adopt water-saving practices. Demonstration projects, including agrivoltaics systems and subsurface drip irrigation, illustrate scalable solutions that reduce water use, improve crop resilience, and lower energy costs.

Innovative educational tools, such as interactive simulation games, have expanded public understanding of complex water management tradeoffs, engaging both youth and adult audiences in learning about sustainable resource use. CES programming also integrates water conservation into broader efforts in agriculture, landscaping, and community planning, reinforcing the interconnected nature of water systems.

Through these efforts, CES contributes to reduced water demand, increased adoption of conservation practices, and strengthened resilience of agricultural and community systems in water-limited

environments. Documented outcomes include increased intent to adopt water-saving technologies, improved understanding of water management tradeoffs, and expanded use of conservation practices across agricultural and urban systems. Together, these efforts highlight CES as a critical component of the land-grant mission, ensuring that research-based knowledge is accessible, actionable, and impactful for communities across New Mexico.

Merit and Scientific Peer Review Processes

Updates

AES continues to have PIs seeking a new project to write a proposal, seek peer-review, and then submit to the AES Director's Office before submission to NIFA.

Stakeholder Input

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

AES hosts advisory committee meetings at science centers that have an advisory committee. These meetings are open to the public and are posted throughout the community. Stakeholders are encouraged to attend and provide feedback regarding research projects. CES also hosted county advisory committee meetings throughout the year in all 33 county Extension offices

AES and CES have continued active involvement with agricultural commodity associations throughout the state to help stay connected with New Mexican agricultural producers and seek input on developing projects and programs to meet their needs.

Methods to identify individuals and groups and brief explanation

AES and CES will continue to utilize US Census data to broaden the scope of potential audiences to minimize gaps in demographic parities.

Staggered term limits have been set for advisory committee membership, which will allow new opportunities for community members every couple of years. This will help to keep new insights on the advisory committees, which help inform research practices.

Methods for collecting stakeholder input and brief explanation

AES and CES use a variety of methods to collect stakeholder input. Primarily, meetings of various stakeholder groups throughout the state, including virtual and in-person options. Additionally, surveys and interviews (both formal and informal) have continued to be used to collect input.

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

Stakeholder input is gathered throughout the year to assist in planning and developing projects and programs that will continue to support all citizens of New Mexico. State legislators continue to be a connection to the various regions of New Mexico, along with the presence of Extension in all 33 counties around the state and 12 Agricultural Science Centers located throughout the state.

CES and AES advisory committees represent agricultural producers and community members from their specific regions of the state and can present concerns or requests for community education and research throughout the year or at one of the bi-annual meetings that are offered.

Community members and members of the New Mexico legislature have requested an increase in student engagement in research programs. In response, the Los Lunas Agricultural Science Center has implemented a student outreach program, where high school students are introduced to concepts such as hypothesis testing, experimental design, data collection, and reporting results. In 2025, students joined staff and volunteers over the summer to learn about the work researchers do daily, develop knowledge of plants growing in New Mexico, and played a key role in conducting a research study. The request from stakeholders for student outreach and engagement within the community was heard, and this program is an example of the response.

Highlighted Results by Project or Program

Critical Issue

Environmental Stewardship

Current and Future Issues of Southwestern Ecosystem Structure and Function

Project Director

THERESA LAVERTY

Organization

New Mexico State University Main Campus

Accession Number

7006687



Current and Future Issues of Southwestern Ecosystem Structure and Function

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

Increasing extreme heat, drought, floods, haboobs, wildfires, and invasive species threaten ecosystem structure and function as well as the physical and mental health of residents in the southwestern United States. Addressing these complex issues requires a forward-thinking and collaborative team. The purpose of this study is to synthesize current issues and, through a horizon scan, identify emerging issues that affect the health, environmental quality, and economic well-being of the southwestern United States. We will highlight areas that can support the region's socio-ecological ecosystems through targeted interventions.

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.

We initially compiled a set of issues that are relatively unknown, but have the potential to occur, and if they do would severely threaten ecosystem structure and function (e.g., mismatches between predator-prey communities, emerging zoonotic diseases, etc.). In designing this list, we acknowledged that our horizon scan process would benefit from incorporating the ideas of external experts. We therefore sought approval and will deploy a survey in February 2026 to experts on issues related to southwestern ecosystem structure and function to broaden our initial list of potential issues. We will follow up in the next fiscal year by reorganizing the list of issues and ranking them in order of importance.

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

Horizon scanning brings together scientists, policymakers, and practitioners to identify and respond to emerging challenges before they escalate. This collaborative process supports forward-thinking solutions and informed decision-making. Our work engages natural resource agencies, researchers, nonprofits, policymakers, and communities across the southwestern United States, fostering partnerships that strengthen ecosystem resilience and sustainable resource management now and into the future.

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

Through this horizon scan, we aim to identify key issues that are often overlooked but critical to the future of the southwestern United States. This process will support the development of solutions that protect both human livelihoods and ecosystem health, while also strengthening resilience in arid and semi-arid systems. Although demanding, horizon scanning provides valuable foresight that enables proactive responses to emerging challenges.

Comments

Our survey of external experts was delayed in fall 2025 due to the government shutdown and winter holidays. We did not want to exclude the ideas of our federal colleagues.

Land Use and Environmental Function

Project Director

Erik Lehnhoff

Organization

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Accession Number

7006709



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

Modern agriculture must increase productivity to feed 9 billion people in the 21st century, while simultaneously addressing sustainability. Current agricultural practices have potential negative impacts including soil erosion, degraded soil health, increased populations of fungal, insect and weed pests, invasion by non-native plants, loss of plant, animal, and microbial diversity, and more. Research is needed to evaluate impacts of land use change and agricultural practices in both croplands and rangelands. Furthermore, researchers must develop new sustainable management practices to provide tools for land managers to confront the challenges of increasing yield and managing pests, while addressing issues such as increasing carbon sequestration, ensuring soil health, and preserving agroecosystem biodiversity.

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.

During this reporting period, our team made significant progress toward advancing sustainable agricultural practices, improving soil health, and enhancing pest management strategies across cropland and rangeland systems in New Mexico. Several key activities contributed to achieving these goals.

Soil Health and Crop Productivity: We leveraged Hatch funding to support ongoing projects in chile pepper production, integrating soil amendments, microbial formulations, and cover cropping to improve soil health and crop yield. Controlled environment and field studies evaluated nutrient dynamics, drought and salinity stress, and the impact of biological treatments on soilborne pathogens such as *Phytophthora capsici*, *Rhizoctonia solani*, and *Verticillium dahliae*. Results demonstrated that soil amendments and microbial treatments can reduce pathogen incidence, improve plant growth, and enhance soil microbial function. These activities directly support our objectives of promoting sustainable production while preserving soil health and ecosystem function.

Rangeland and Livestock Management: Studies at the USDA-ARS Jornada Experimental Range evaluated precision livestock grazing using virtual fencing combined with breed-specific grazing strategies. Cattle were successfully conditioned to virtual fencing systems, allowing targeted grazing in fragile pasture areas, thereby protecting plants and soil. Monitoring of animal behavior and forage selection revealed that virtual fencing can redistribute grazing pressure, reduce environmental impacts, and improve forage utilization without the need for costly physical fences. These studies provide a framework for integrating precision management with environmental stewardship in arid rangelands.

Harvester Ants Impact on Rangeland Restoration: Harvester ants are common in arid rangelands and play an important role in shaping plant communities by collecting and dispersing seeds. While they are sometimes viewed as a challenge for rangeland restoration because they remove seeds, these ants are actually keystone species whose behavior can influence the success of restoration efforts. Our research examined how rough harvester ants select and collect seeds across two contrasting ecosystems in New

Mexico: Chihuahuan Desert shrubland near Las Cruces, NM and grassland–juniper woodland near Corona, NM. Experiments tested seed removal near ant colonies and across the surrounding landscape using native plant species. Results showed that ants removed more seeds near their nests and that foraging activity was highest in late summer, but they did not prefer any particular plant species. These findings highlight that ant foraging is strongly influenced by space and season, and suggest that understanding ant behavior can improve restoration strategies.

Integrated Pest Management: Insect pest research focused on developing alternatives to broad-spectrum insecticides and Bt crops, emphasizing biological control and adaptive field management in semi-arid systems. Studies demonstrated that plant architecture, row orientation, plant density, and crop variety (okra-leaf cotton) can significantly reduce insect survival while maintaining predation by natural enemies. These findings guide practical management strategies that reduce dependence on chemical inputs and delay resistance development in pest populations, directly supporting our goals of sustainable pest management and environmental protection.

Capacity Building and Knowledge Dissemination: Across all projects, students and early-career researchers received hands-on training in field techniques, data collection, and scientific communication. Research findings were shared with scientific and stakeholder communities through conferences, workshops, extension presentations, and outreach events. In total, our team contributed to over 30 presentations, multiple journal submissions, and reports to industry partners, enhancing knowledge transfer and supporting future adoption of sustainable practices.

Collectively, these activities advanced our project objectives by demonstrating the effectiveness of innovative soil management, precision grazing, and integrated pest management strategies in real-world agricultural systems while building human and scientific capacity to sustain these practices.

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

Our project's activities directly benefitted New Mexico agricultural producers, extension agents, consultants, and other professionals involved in crop and rangeland management.

Soil and Crop Management: Research on soil amendments, microbial formulations, and cover cropping provided producers with actionable strategies to improve soil health, nutrient availability, and crop productivity, particularly in chile pepper systems. By evaluating the frequency and combination of biological inputs, producers now have evidence-based guidance for controlling soilborne pathogens and enhancing yield under drought and salinity stress. Findings were communicated through state and national conferences, extension workshops, and farmer-friendly reports.

Rangeland and Livestock Management: Rangeland studies provided producers and land managers with data on breed-specific grazing behaviors, forage utilization, and

environmental outcomes from virtual fencing systems. This research informs decisions that optimize livestock performance, reduce soil and vegetation degradation, and enable more efficient, low-cost management strategies for extensive pastures. Presentations at scientific meetings and producer-focused workshops demonstrated the practical feasibility and economic benefits of virtual fencing technologies.

Harvester Ants and Rangeland Restoration: Our research on harvester ant foraging behavior provided important insights for rangeland restoration. Producers and land managers often view harvester ants as a challenge because they remove seeds, but our work showed that ant activity is strongly influenced by the location of their colonies and by seasonal patterns. Understanding these behaviors allows land managers to account for ants in restoration planning, improving the establishment of native plants while minimizing unintended seed loss.

Integrated Pest Management: Growers benefited from recommendations that leverage natural pest suppression and crop management strategies, reducing reliance on chemical insecticides and delaying resistance in key pest populations. Through extension programs, pesticide applicator trainings, and commodity group presentations, producers gained practical, economically viable approaches for managing pests in cotton, forage, and other crops, ultimately saving costs and protecting the environment.

Education and Workforce Development: Graduate and undergraduate students gained direct experience in experimental research, field trials, and professional communication. Training activities helped prepare the next generation of agricultural scientists, consultants, and extension personnel to implement sustainable practices and support agricultural resilience in semi-arid systems.

Overall, our project provided the target audience with evidence-based tools, technical knowledge, and practical strategies to improve agricultural productivity, soil health, pest management, and rangeland restoration, while promoting environmental stewardship and sustainable land management.

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

Beyond the direct target audience, our research provides substantial benefits to the broader public by supporting sustainable agriculture, environmental stewardship, and community engagement.

Food Security and Sustainable Agriculture: By improving soil health, crop productivity, and pest management in key agricultural systems, our work supports long-term food production in New Mexico and similar semi-arid regions. Research on chile pepper and other crops helps stabilize yields under drought and salinity stress, contributing to regional and national food security. Biological control strategies for insects and fungal pathogens, and optimized management practices, reduce losses and enhance the reliability of agricultural systems.

Environmental Protection and Climate Resilience: Rangeland studies—including precision grazing with virtual fencing, breed-specific livestock management, and harvester ant ecology—demonstrate ways to improve forage utilization, reduce soil and vegetation

degradation, and maintain ecosystem balance. Understanding harvester ant behavior allows for more effective native plant restoration, enhancing biodiversity and ecosystem function. These approaches also contribute to carbon sequestration, reduced greenhouse gas emissions, and improved resilience of arid ecosystems under climate variability.

Community Education and Engagement: Our outreach programs, including extension workshops, 4-H and FFA youth activities, STEM nights, and public presentations, engaged students, educators, and community members. Participants gained hands-on experience in sustainable agriculture, pest ecology, and rangeland management. These activities increase agricultural literacy, promote environmental awareness, and inspire the next generation of farmers, scientists, and natural resource managers.

Scientific Contribution and Knowledge Sharing: Findings from our research are disseminated through peer-reviewed publications, conference presentations, extension reports, and technical guides. By sharing evidence-based practices for crop production, pest management, and rangeland restoration, we extend the impact of our work nationally and internationally. This knowledge informs policies and management strategies that benefit society at large, supporting sustainable food systems, resilient ecosystems, and informed environmental stewardship.

Collectively, our project enhances public understanding of sustainable agriculture, promotes ecosystem health, supports climate resilience, and strengthens local and regional communities, providing tangible benefits that extend well beyond immediate participants.

Comments

No major problems were encountered during the reporting period.

Training and Professional Development

Our project provided extensive opportunities for training and professional development for students, early-career researchers, and agricultural professionals. Graduate and undergraduate students gained hands-on experience in field research, laboratory techniques, data collection, and statistical analysis across diverse agricultural and rangeland systems. For example, students involved in chile pepper soil health experiments learned to design field plots, implement soil amendment treatments, and evaluate plant growth under abiotic stress conditions, and also prepared results for poster and oral presentations at regional and national scientific conferences.

Under the precision rangeland and livestock management component, students and staff were trained in novel livestock monitoring technologies, including virtual fencing systems, and in measuring environmental parameters such as forage utilization, spatial grazing patterns, and greenhouse gas emissions. These experiences exposed trainees to interdisciplinary approaches integrating animal science, ecology, and rangeland management, providing skills relevant for careers in sustainable livestock production and natural resource management.

In entomology and integrated pest management, students, extension personnel, and industry stakeholders were trained in biological control methods, insect identification, field

sampling, and pest management decision-making under semi-arid conditions. Extension workshops, pesticide applicator training sessions, and youth programs such as 4-H and FFA entomology judging practices provided additional professional development, reinforcing both technical knowledge and science communication skills.

Our research also supported professional growth through manuscript preparation, conference presentations, and collaborative projects, including interdisciplinary proposals involving soil microbiology, crop production, and rangeland ecology. These activities strengthened participants' competencies in experimental design, scientific writing, data interpretation, and public outreach, fostering the next generation of agricultural scientists and natural resource professionals.

Overall, the project integrated experiential learning, mentorship, and professional skill-building across multiple agricultural and ecological disciplines, providing trainees with the tools and experiences necessary to pursue careers in research, extension, and sustainable land management.

Dissemination of Results

The following references highlight results that were disseminated.

Conference Presentations

1. Sharma, R.; Santos, I.; Ortega-Carranza, J.; Hunter, B.; Coon, D.; Guzman, I.; Idowu, J.; Ghimire, R.; Ulery, A.; Walker, S.; Li, X. *Effects of Soil Amendments on Nutrient Dynamics and Chile Pepper Yield*. Annual ASA-SSSA-CSA Meeting, Salt Lake City, UT, Nov 9–12, 2025.
2. Santos, I.; Sharma, R.; Ortega-Carranza, J.; Hunter, B.; Coon, D.; Guzman, I.; Idowu, J.; Ghimire, R.; Ulery, A.; Walker, S.; Li, X. *Effects of Drought and Salinity Stress on Chile Growth and Yield*. 30th Annual NMSU Undergraduate Research & Creative Arts Symposium (URCAS), Las Cruces, NM, April 25, 2025.
3. Sharma, R.; Santos, I.; Ortega-Carranza, J.; Hunter, B.; Coon, D.; Guzman, I.; Idowu, J.; Ghimire, R.; Ulery, A.; Walker, S.; Li, X. *Soil Amendments and Abiotic Stresses Impact Chile Germination, Growth, and Soil Microbial Functions*. New Mexico Chile Conference, Las Cruces, NM, Feb 3–4, 2025.
4. Fechner, J.; Sanogo, S. *Efficacy of Combined Biological Fungicides and Biostimulants Against Three Major Chile Pepper Pathogens*. New Mexico Chile Conference, Las Cruces, NM, Feb 2–3, 2026.
5. Fechner, J.; Sanogo, S. *Activity of Extracts from *Chlorophyllum molybdites* and Spent Substrate of *Pleurotus djamor* var. *roseus* on Sporangia Production by *Phytophthora capsici**. APS Plant Health 2025 Conference, Honolulu, HI, Aug 2–5, 2025.
6. Sanogo, S.; Lujan, P.; Fechner, J.; Dobey, Q.; Barraza, J.; Consford, J. *Enhancing Microbial Recruitment and Persistence in Cover Crop Mixtures for Control of Soilborne Pathogens in Chile Pepper*. APS Plant Health 2025 Conference, Honolulu, HI, Aug 2–5, 2025.

7. Perea, A.R.; Macon, L.K.; Spetter, M.J.; Funk, M.P.; Bakir, M.E.; Estel, R.E.; Bestelmeyer, B.T.; Cibils, A.F.; Utsumi, S.A. *Differential Response of Angus-Hereford and Rarámuri Criollo Cattle to a Dynamic Feeding Challenge During Training to an Autonomous Virtual Fencing Collar*. Journal of Animal Science, In Press, 2026.
8. Spetter, M.J.; Utsumi, S.A.; Perea, A.R.; Funk, M.; Macon, L.; Bestelmeyer, B.T.; Spiegel, S.; Cibils, A.; Estell, R.E. *Gas Flux Quantification of Angus x Hereford and Rarámuri Criollo Cows Grazing Extensive Arid Rangelands*. Society for Range Management, 78th Annual Meeting, Monterrey, CA, Feb 7–11, 2026.
9. Pierce, J.B.; Monk, P.; Tellez, I. *Impact of Microclimate and Okra-leaf Cotton on Helicoverpa zea Egg Hatch and Predation Under Semi-Arid Conditions*. CANVAS - ASA, CSSA, and SSSA Annual Meeting, Salt Lake City, UT, Nov 10, 2025.
10. King, J. (Presenter); Lehnhoff, E.A.; Uhey, D.; Velasco-Cruz, C. *Investigating Harvester Ant Seed Foraging for Improving Rangeland Restoration*. Entomological Society of America, Portland, OR, Nov 11, 2025.
11. DuBois, J. (Presenter); Lehnhoff, E.A.; King, J. *Pitfall Trap Bycatch Data in the Southwestern United States Highlights Terrestrial Arthropod Biodiversity in Arid and Semiarid Communities*. Entomological Society of America, Portland, OR, Nov 11, 2025.
12. Lehnhoff, E.A. (Presenter); King, J.; Velasco-Cruz, C.; Uhey, D. *Investigating Harvester Ant Seed Foraging for Improving Rangeland Restoration*. Society for Range Management, Spokane, WA, Feb 11, 2025.

Extension and Outreach Presentations

1. Pierce, J.B. *Integrated Pest Management in New Mexico*. IPM Symposium, San Diego, CA, Mar 4, 2025.
2. Pierce, J.B. *IPM of Insects in Forage Crops*. Forage Grower's Workshop, NMSU, Los Lunas, NM, Dec 4, 2025.
3. Pierce, J.B. *Biological Control of Insect Pests in New Mexico*. SENM Urban Horticulture Symposium, NMSU, Roswell, NM, Nov 19, 2025.
4. Pierce, J.B. *Insect Identification and Sampling Techniques*. Loving Elementary STEM Night, NMSU ASC, Artesia, NM, Feb 27, 2025.
5. Pierce, J.B.; L. Patton. *Pink Bollworm Eradication in New Mexico*. National Cotton Council, Phoenix, AZ, Sept 8–9, 2025.
6. Pierce, J.B.; L. Patton. *Boll Weevil Eradication in New Mexico*. National Cotton Council, Dallas, TX, Sept 23–24, 2025.
7. Pierce, J.B.; Tellez, I. *Integrated Pest Management Workshop*. La Semilla Ag Fellows, NMSU ASC, Anthony, NM, Jun 27, 2025.
8. Pierce, J.B. *Mosquito Control in New Mexico*. Lea County Vector Control Training, NMSU, Lovington, NM, Nov 5, 2025.

9. Pierce, J.B. *Pesticide Applicator Training – Insect Update 2025*. NMSU, Ft Sumner, NM, Dec 11, 2025.

10. Pierce, J.B. *Pesticide Applicator Training – Screwworm*. NMSU, Ft Sumner, NM, Dec 11, 2025.

Community Engagement

1. Pierce, J.B. *Entomology Judging Practice*. Eddy County 4-H, NMSU CES, Artesia, NM, multiple sessions, 2025.

2. Pierce, J.B. *Careers in Entomology*. Agriculture Career Day, Artesia Municipal Schools, Park Jr. High, Artesia, NM, May 9, 2025.

3. Pierce, J.B. *NMSU Research Group Brings Science and Community Together During Solar Eclipse*. NMSU News, Las Cruces, NM, 2025.

4. Pierce, J.B. *Biological Control in New Mexico*. NMSU Online Pesticide CEU Training, 2025.

All of the projects discussed above are ongoing and will continue for the 2026 reporting period.

Carbon-Food-Energy-Water in New Mexico Agricultural Systems

Project Director

RAJAN GHIMIRE

Organization

New Mexico State University Main Campus

Accession Number

7006674



Carbon-Food-Energy-Water in New Mexico Agricultural Systems

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

Water scarcity, soil degradation, and environmental warming are the most challenging issues facing sustainable agriculture and food security in recent years. These issues are more severe in arid and semi-arid regions, as drought and heat waves are adding pressure on marginalized communities and vulnerable ecosystems. This project aimed to improve understanding of soil organic matter storage and soil health across diverse agricultural systems, enhance water use efficiency and soil water conservation, and increase agricultural literacy among stakeholders and the public.

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.

Six NMSU Agricultural Science Centers are represented in this study (Artesia, Clovis, Clayton, Corona Ranch, Farmington, and Los Lunas). The research projects include annual and perennial grain and forage crop production fields, livestock-grazed sites, and rangeland sites with diverse management practices. Soil samples are collected from selected sites to measure soil carbon and its relationship with food production, water dynamics, and energy use. These soil samples are analyzed for nutrient content, soil organic carbon, and microbial community structure. Data on annual and perennial crop yields, forage quality, production input, and energy equivalents were collected from selected sites. The ASC Farmington began monitoring in 20-year-old agroforestry plots. ASC Artesia's new faculty member plans to establish a site for demonstrating soil health and water management practices, and their linkages with food production and environmental quality. Preliminary observations of the project have been shared with farmers, ranchers, and local stakeholders. Several research and extension articles were published, and presentations were delivered.

Peer-reviewed Scientific Publications related to the project

2. Singh, A., D.R. Aryal, M. Omer, A.D. Adhikari, O.J. Idowu, R. Herema, **R. Ghimire**. 2025. Soil carbon and biological health under pecan orchards of varying ages. Soil Science Society of America Journal. <https://doi.org/10.1002/saj2.70089>.
3. Rotz, C.A., K. Briggs, A.N. Hristov, A. Leytem, E. Young, **R. Hagevoort**, D. Mullinax. 2025. Strategies for mitigating gas emissions from US dairy farms toward a net-zero goal. J. Dairy Sci. <https://doi.org/10.3168/jds.2025-26392>.
4. Hsiao C.J., M. Cloutier, D. Liptzin, N. Looker, C. Molling, M. Cope, R.D. Jackson, G.R. Sanford, M.D. Ruark, D. Busch, K. Czymmek, Q.M. Ketterings, R. Afshar, J. Bell, **R. Hagevoort**, C. Morgan. 2025. Management practices and soil health: Insights from dairy farms in the United States. Agriculture, Ecosystems and Environment. <https://doi.org/10.1016/j.agee.2025.109969>.
5. Bista, D., J. Mamkhezri, R.N. Acharya, and M. Regmi. "Spice Meets Sustainability: Consumer Willingness to Pay for Water-Efficient Green Chili Peppers." Submitted to the Journal of Agricultural and Resource Economics.

Meeting Abstracts/Presentations

1. Frene, J.P., N. Kasera, D.P. Jaisi, S. Sapkota, S. Adhikari, and **R. Ghimire**. 2025. Modified biochar improves sorghum growth by increasing phosphorus use efficiency in semi-arid environments. Ecological Society of America Annual Meeting, Baltimore, MD.
2. Singh, A. and R. Ghimire. 2025. Evaluating winter crop effects on soil gas emissions and soil water dynamics in forage corn production under semi-arid regions. CANVAS 2025, Salt Lake City, UT.
3. Sapkota, S. and **R. Ghimire**. 2025. Understanding the dynamics and drivers of trace gas emissions in cropland and natural rangeland systems. CANVAS 2025, Salt Lake City, UT.

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

Farmers and ranchers in New Mexico are seeking scientifically tested information on agricultural strategies that increase soil organic carbon (SOC) storage, improve water conservation, and sustain crop production in low-fertility soils and water-limited environments. The establishment of systematic research on management strategies to strengthen carbon-food-energy-water systems across New Mexico's diverse agricultural systems is expected to provide information on best management practices for farmers, ranchers, and land managers in the region. Specifically, the economy of marginal and vulnerable communities will be supported.

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

Developing adaptable soil and crop management strategies to improve soil carbon storage and water conservation in arid and semi-arid agroecosystems by evaluating various best management practices will strengthen carbon-food-energy-water systems across the landscape and benefit the economy of marginal and vulnerable communities in the western United States. We are also training graduate and undergraduate students on these projects. It is noteworthy that the project is also training undergraduate students from underrepresented communities on the Navajo Nation.

Comments

Due to the retirement of a project team member, a new faculty member has joined the project and will establish new projects at ASC Artesia. He aims to start a field trial at the Artesia Agricultural Science Center to evaluate the efficiency of different regenerative agricultural practices, including cover crops, no tillage, and organic amendments, in sequestering soil carbon.

Discovering Environmental Impacts and Adaptation Strategies in Arid and Semi-Arid Regions

Project Director

Madhav Regmi

Organization

New Mexico State University Main Campus

Accession Number

7006696



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

This project addresses the challenges posed by environmental change in agriculture, with a focus on arid and semi-arid regions. It has two objectives: one is to examine the impacts of environmental change on agriculture and assess the role of water policies in climate adaptation, and the other is to examine the impacts of crop improvement and pest management on climate adaptation.

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 project explored an innovative cropping system that reintroduces native perennial grasses into a center-pivot irrigated production system as 'Circular Buffer Strips' to enhance multiple ecosystem services, developed in Clovis, NM. The aim is to address major challenges facing irrigated agriculture in New Mexico and nearby states, including declining water resources, increased climate variability, strong winds, loss of natural resources, deteriorating soil health, carbon sequestration, and biodiversity. The system is expected to enhance water-cycle efficiency by conserving more precipitation and optimizing water use. It is also predicted to improve crop microclimate, reduce crop stress, increase productivity, promote soil health, boost biodiversity, strengthen climate resilience, and cut greenhouse gas emissions. Additionally, it offers management benefits for farmers, such as improved water pressure control and easier center-pivot maintenance. In 2025, the system was tested on cotton, an important, low-water-use crop in the High Plains. Another research work examined how limited water resources interact with economic systems and human institutions, especially under stress from climate variability, drought, population growth, agricultural demand, and transboundary water competition.

The project also examined regional differences in how conservation program payments influence the adoption of conservation practices. Specifically, it estimated a cover crop adoption rate using USDA-NASS data and analyzed how this rate responds to changes in two major working-land conservation program payments. The analysis included weather variables collected at the grid-daily level and interpolated to the county-season level. The study shows regional differences in program effectiveness across two regions (the Southwest and the Corn Belt). Preliminary findings, also presented at a regional conference, suggest stronger adoption responses in areas experiencing greater climatic stress and lower baseline adoption rates.

Progress has also been made in studying how the pecan microbiome changed from growing in a greenhouse to two years after transplanting at the NMSU experimental orchard. The research used next-generation sequencing and subsequent analysis to identify differences in microbiome structure due to pecan genetics and/or environment. The findings directly address the knowledge gap by providing the first genotype-specific

and environment-dependent characterization of pecan clonal rootstock microbiomes. This work highlights the importance of management strategies for improving rootstock performance across various growing conditions.

Progress was also made in leafhopper research. The project collected data on leafhopper population movement using yellow sticky traps and sweep nets. Combined with data from the past six years, these numbers show the extent of population changes during late fall and early winter.

Over the past year, the project collaborator developed learning tools for high school and undergraduate students, including interactive modules across various fields. These include modules on Chile with hybrid activities, a scientific analysis of traditional New Mexico foods, and an animated video sharing Roy Nakayama's story. An additional YouTube video featuring Dr. Fabian Garcia was added, along with three videos showcasing modern researchers inspired by historical figures. The website is now fully operational at AgInnovators.nmsu.edu.

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

Research on innovative cropping systems is the first to evaluate circular buffer strips of native perennial grasses worldwide. For the first time, the study attempted to apply this system to cotton. Cotton emergence and establishment benefited from circular buffer strips, and preliminary data analysis indicates benefits to cotton growth and productivity. Researchers are engaging with farmers in New Mexico regarding these findings. The project collaborator's work on hydro-economic modeling has helped bridge the gap between hydrology and economics, which scientists and policymakers may find useful. Similarly, research on conservation program payments suggests that aligning incentives with regional climatic conditions can enhance overall effectiveness, carrying important implications for researchers and policymakers.

Understanding how host genotype and environment influence the rhizosphere and root microbiome is essential for improving crop production and sustainability. Pecan (*Carya illinoensis*) is a long-lived perennial crop whose productivity and resilience rely on beneficial interactions between plants and microbes that enhance nutrient uptake, stress tolerance, and root health. Yet, despite their importance, the assembly and shifts of microbial communities across different environments, especially during the transition from greenhouse propagation to field establishment, remain poorly understood. This knowledge gap matters to growers, breeders, and researchers because pecan rootstocks vary genetically, and these differences affect how each rootstock genotype attracts its associated microbiomes under different environmental conditions. The study offers insights into how pecan rootstocks interact with their rhizosphere and root microbiomes, showing that both host genotype and environment significantly shape microbial community structure. Its potential to enhance pecan production systems lies in enabling more informed rootstock selection, better transplant success, and increasing resilience to environmental stress. By determining which microbial groups persist or shift following the transition from greenhouse propagation to field planting, this work helps growers and breeders understand how soil biology influences tree performance.

Prediction of beet leafhopper movements and virus infection of chile in southern New Mexico is based on leafhopper interaction with key weed hosts. Previous prediction models are not accurate because of changes in temperature, host plants, and leafhopper survival. We are defining the problem. The target audience (chile growers/extension personnel) is aware of the problem and recognizes that the disease prediction model will not work as well as it did in the past.

The initial focus of the Ag Innovators initiative is to assess participants' perceptions of jobs. The initiative helps undergraduate students develop their identities as individuals considering agricultural careers and fosters greater interest in pursuing them.

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

The concept and initial results on corn attracted the attention of the Soil and Water Conservation Society of Colorado. In 2025, they invited the project collaborator to visit various locations in Colorado and give seminars about the concept to farmers, graduate students, extension personnel, and researchers. Likewise, the dean of the oldest agriculture college in the United Kingdom organized an online seminar for their faculty, showing interest in the concept beyond the United States. Additionally, research on the effectiveness of cover crop adoption was recently presented at the Southern Agricultural Economics Association conference.

The work on pecans has been submitted for peer-reviewed publication in *Frontiers in Microbiome*. The study related to leafhoppers may not be widely known to the public yet, but it can serve as another example of how climate change impacts agriculture. The Ag Innovation Initiative will conduct another round of testing soon and plans to market and share its findings with the public afterward.

Enhancing Soil Fertility for Sustainable Agriculture

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7007045



Using Biochar from Wood Waste to Improve Soil Health in Arid Agroecosystems

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

New Mexico is the second-largest pecan-producing state in the U.S., with approximately 50,000 acres in production. Annual orchard pruning generates an estimated 300 tons of

woody biomass. Many producers burn this material, contributing to carbon dioxide emissions and particulate pollution. In arid agroecosystems, soil organic carbon is limited, reducing soil health and water-holding capacity. Converting pecan wood waste into biochar provides an alternative management strategy that reduces open burning, stabilizes soil carbon, and supports long-term soil productivity in water-limited cropping systems.

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.

Target audiences included pecan producers and other agricultural producers generating woody biomass, Cooperative Extension agents, Certified Crop Advisors, agricultural support professionals, NGOs, and governmental agency personnel. Programming focused on stakeholders interested in low-technology biochar production methods and the application of biochar to improve soil health and crop performance in arid systems.

Extension programming included statewide presentations, a biochar and soil health workshop, targeted hands-on demonstrations using a low-technology kiln, and the development and distribution of fact sheets and Extension publications. Educational sessions addressed biochar production techniques, soil carbon stabilization, and the impacts of biochar application on soil health and crop productivity in arid environments.

Outputs

- Educational outreach reached at least 500 stakeholders statewide
- Biochar and soil health workshop conducted
- Hands-on kiln demonstrations delivered
- Extension fact sheets and publications released

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

- Over 90% of participants reported increased knowledge of biochar production and soil application.
- More than 60% of hands-on workshop participants indicated intent to produce biochar using demonstrated kiln methods.
- Increased awareness of alternatives to open burning of woody biomass.

These outcomes indicate strengthened producer capacity to adopt biochar practices that improve soil carbon and support sustainable production systems.

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

Converting approximately 300 tons of pecan wood waste into biochar reduces open burning and associated emissions while stabilizing carbon in soil systems. Biochar application can improve soil structure and moisture-holding capacity in arid agroecosystems, contributing to reduced irrigation demand in water-limited systems and

enhancing long-term soil productivity. By promoting resource recycling and climate-smart soil management practices, this program advances both and long-term agricultural resilience.

Wildlife Wisdom: Fostering Coexistence and Sustainability in New Mexico

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7007047



Building Coordinated Pest Surveillance and Response Capacity for Emerging Invasive Species

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

The 2024 detection of the Coconut Rhinoceros Beetle (CRB) on Hawai'i Island created immediate economic, ecological, and regulatory risks to agriculture and natural resources. Before response efforts, pest surveillance data, diagnostics, and agency activities were siloed, limiting coordinated action, slowing decision-making, and increasing the risk of duplication. Early detection and rapid response (EDRR) require centralized infrastructure, aligned workflows, and strengthened diagnostic capacity to prevent the establishment and spread of invasive pests.

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.

Through the PestMAP Hawai'i program, Extension developed a coordinated systems-based response focused on:

- Designing a centralized pest observation and diagnostic database
- Aligning software with Extension and diagnostic workflows
- Coordinating interagency communication and surveillance activities
- Strengthening the Agricultural Diagnostic Service Center (ADSC) capacity through equipment upgrades
- Organizing statewide technical trainings for Extension agents

This work emphasized infrastructure development and capacity building rather than direct county-level outreach.

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

- Established a centralized reporting system for pest surveillance
- Improved interagency communication and reduced duplication
- Increased diagnostic throughput and improved CRB sample processing timelines
- Enhanced Extension agent readiness to deliver consistent messaging to growers and communities
- Developed structured field data suitable for predictive modeling and future risk assessment tools

Collectively, these efforts strengthened institutional readiness for invasive pest detection and response and established permanent surveillance infrastructure for future threats.

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

Invasive pests threaten agricultural commodities, urban landscapes, and fragile ecosystems. By improving coordination, data integration, and diagnostic capacity, this project enhanced early detection and rapid response capabilities, reducing the risk of economic loss and ecological damage. The infrastructure developed provides a scalable model for responding to future invasive pest introductions while improving accountability and efficiency in the use of public resources.



San Juan County Predator Control Program

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

Coyotes pose ongoing predation risks to livestock in San Juan County due to high populations, adaptable behavior, and proximity to rangelands and rural residential areas. Nearly 1,000 livestock are lost annually to coyote predation statewide. Seasonal food shortages and reduced trapping access on public lands increase predator pressure. Producers face economic losses, particularly among sheep, goats, poultry, and newborn calves.

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.

Participants

- Approximately 700 livestock producers in San Juan County

- 20 qualified hunters and trappers participate annually
- Urban residents and animal control officers receiving educational outreach

Response

In partnership with the San Juan County Farm and Livestock Board, Extension administers an annual predator control incentive program funded by Taylor Grazing Act fees.

Key components include:

- \$25 incentive per coyote submitted
- Annual education and regulatory updates for hunters and trappers
- Ag Notes Newsletter articles on predator behavior and seasonal trends
- Producer consultations on livestock protection strategies
- Coordination with local animal control and wildlife agencies

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

2024–2025 season results:

- 210 coyotes removed
- \$5,250 distributed through incentive payments

Reported impacts:

- Increased young livestock survival rates
- Strengthened working relationships between producers and trappers
- Improved coordinated response to predator pressure
- Greater awareness of safe, legal predator management practices

Sheep and lamb operations on the Navajo Nation reported improved survival rates for young livestock, reducing preventable economic losses. Coordinated predator management strengthened producer-trapper partnerships and improved rapid response to seasonal predation pressure.

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

Reducing preventable livestock losses strengthens producer profitability, protects rural livelihoods, and supports local food production systems. By combining education, coordination, and incentive-based management, the program promotes responsible

wildlife management while enhancing the economic resilience of San Juan County's agricultural sector.

Mitigating Wildfire Risks in New Mexico: Community Education & Preparedness

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7002277



Growing Resilience: Yellowhorn as a Water-Smart Economic Alternative for New Mexico Agriculture

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

Severe drought conditions continue to threaten agricultural sustainability in southern New Mexico. Elephant Butte Reservoir, the primary irrigation source for Doña Ana County, fell to 3.8% capacity in August 2025. Producers increasingly seek crops that can be grown with less than one acre-foot of water annually. Traditional crops such as pecans, cotton, alfalfa, and vegetables require significantly higher water inputs, placing pressure on limited groundwater and surface water resources. Identifying profitable, drought-tolerant alternatives is critical to protecting farm viability and regional economic stability.

Participants

- Small- and medium-scale producers in Doña Ana County
- Farmers statewide are exploring drought-tolerant crop options
- NMSU Specialists and Science Centers
- Rural communities dependent on irrigated agriculture

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.

NMSU-ACES and Doña Ana County Extension delivered three educational sessions serving approximately 25 producers on Yellowhorn (*Xanthoceras sorbifolium*) production and management.

Key activities included:

- Establishment of a 56-tree demonstration orchard at the New Mexico Farm & Ranch Museum (January 2025)
- Release of Guide A-103: *Exploring Yellowhorn – A Drought-Tolerant Crop for New Mexico's Future* (July 2025)
- Technical assistance and on-farm demonstrations
- Grant applications submitted to support expanded research and additional demonstration orchards at Farmington and Leyendecker Science Centers

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

Adoption and Acreage:

- 10 local producers began cultivating Yellowhorn
- Approximately 3 acres established in Doña Ana County
- Over 400 trees planted
- Additional statewide interest for 2026 planting

Water Conservation:

- Yellowhorn requires ~1 acre-foot of water annually
- Saves 2–4 acre-feet per acre compared to traditional crops
- 67%–80% water savings
- Equivalent to 651,702–1,303,404 gallons saved per acre annually
- Replacing 40,000 acres of pecans could conserve an estimated 52.1 billion gallons annually

Economic Potential:

- Specialty oil valued at \$8.50 per ounce (\$1,088 per gallon)
- An estimated 242 trees per acre
- Potential 242 gallons of oil per acre
- Estimated gross revenue potential: ~\$263,296 per acre

Producers identified drought tolerance, reduced irrigation requirements, and specialty oil market value as primary drivers of adoption.

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

Yellowhorn offers a viable drought-adaptive crop option that significantly reduces agricultural water demand while offering high-value specialty-market potential. By supporting research-based adoption of water-efficient crops, Extension strengthens farm resilience, reduces financial risk, and contributes to long-term water conservation in one of the nation's most water-limited agricultural regions.

Critical Issue

Family Development and Health of New Mexicans

Pathways to Human Health and Wellness

Project Director

MERRANDA MARIN

Organization

New Mexico State University Main Campus

Accession Number

7006697



Mental Wellbeing & Emotional Awareness High School Camp

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

The purpose of of this project is to to enhance the lives of New Mexico Residents, in particular the youth of New Mexico. In the United States, youth are encountering an abundance of stressors including mental health challenges, food insecurity as well as educational systems that may not be meeting their needs. The overall goal of this project is to connect youth: to teaching tools such as VR; to mental health wellbeing; and to foods to enhance their life in New Mexico.

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.

To address the needs, as outlined in Objective 1, a summer camp was designed to build emotional awareness, coping skills, and resilience which are foundations for long-term wellbeing and academic success.

The Mental Wellbeing & Emotional Awareness Camp held June 30–July 3, 2025, at NMSU, engaged 40 high school students in interactive activities focused on understanding emotions, recognizing burnout, and creating personal wellness plans. The Human Development and Family Science faculty partnered with TRIO Upward Bound to bring

students from Hatch, Las Cruces, Gadsden, and Santa Teresa. Facilitators taught emotional labeling, identifying personal needs, grounding strategies, and the importance of mental health. Activities included “Name It to Tame It,” the 5-4-3-2-1 grounding technique, and daily reflection cards for monitoring stress.

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

Overall, the camp demonstrated positive outcomes, both quantitatively and qualitatively. Participants left the camp with practical tools they could immediately use to manage stress, regulate emotions, and strengthen their personal wellbeing.

Quantitative ratings (0 = Not at all, 4 = Extremely) show strong positive outcomes:

- ***Increased confidence recognizing emotions:*** Mean **3.38**
- ***Greater understanding of mental wellbeing:*** Mean **3.41**
- ***High engagement in camp activities:*** Mean **3.36**
- ***Likelihood to recommend the camp:*** Mean **3.69**

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

This camp strengthens youth mental health by equipping students with practical tools to manage stress, regulate emotions, and support their wellbeing. Developing these skills promotes healthier relationships, improved academic outcomes, and reduce long-term mental health concern. In doing so, this program supports families, schools, and communities while advancing NMSU’s land grant mission of improving the quality of life across New Mexico.

Comments

This approach worked well in connecting with youth to gain their insights into what is effective when it comes to mental health for their population. The information from the camp has been disseminated via impact statements and the next step will be looking at how to disseminate further.

The Mental Wellbeing & Emotional Awareness High School Camp addressed rising mental health needs among New Mexico youth by equipping 40 students from Hatch, Las Cruces, Gadsden, and Santa Teresa with essential emotional regulation and coping skills. Over four days, participants engaged in evidence-informed activities—including emotional labeling, grounding strategies, burnout recognition, and personalized wellness planning—led by NMSU Human Development and Family Science faculty in partnership with TRIO Upward Bound. Quantitative outcomes reflected strong gains: students reported increased confidence identifying emotions ($M = 3.38$), greater understanding of mental wellbeing ($M = 3.41$), high engagement ($M = 3.36$), and strong likelihood of recommending the camp ($M = 3.69$). Qualitative themes highlighted improved emotional awareness, practical stress-management skills, enhanced self-confidence, meaningful personal insight, and high

satisfaction. By strengthening youth resilience and supporting healthier developmental outcomes, the camp contributes meaningful public value and advances NMSU's land-grant mission across New Mexico.



Testing of Virtual Reality Simulation

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

The purpose of the Pathways to Human Health and Well-being project is to enhance the lives of New Mexico residents. In particular, the youth of New Mexico and the United States are encountering an abundance of stressors including mental health challenges, food insecurity, as well as educational systems needing to tap into newer learning tools to maximize learning.

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.

To work towards objective 2: Enhance nutrition assessment virtual reality/simulation teaching tools in order to deliver effective dietetics programs, a VR simulation was tested and the results of the testing was documented in a journal article. This simulation was also published in the International Journal of Environmental Research and Public Health. The citation is as follows: Quick, V., Chamberlin, B., Golem, D., Panchal, P., Phillips, S.G., and Byrd-Bredbenner C. (2025). iENDEAVORS:Development and Testing of Virtual Reality Simulations for Nutrition and Dietetics. International Journal of Environmental Research and Public Health, 22, 1389. <https://doi.org/10.3390/ijerph22091389>.

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

The results of this suggested that VR simulations were well received by dietetic students and were found to have meaningful improvements in nutrition counseling self-efficacy and comfort using nutrition counseling skills. It appears the VR simulations offered a realistic, flexible, and psychologically safe learning environment for students.

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

This can provided other program areas a model to teach and train students.

New Mexico Sustainable Rural Economic Development

Project Director

Keith Mandabach

Organization

New Mexico State University Main Campus

Accession Number

7006578



New Mexico Sustainable Rural Economic Development

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

This project is designed to study, assist, and support sustainable rural business expansion and economic development in New Mexico. The focus is to link our rural community agricultural stakeholders with the growing demand for rural tourism and rural lifestyles. Rural tourism plays a pivotal role in promoting economic growth and preserving cultural heritage while fostering sustainable business practices.

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 project continues to encourage collaboration among various stakeholders while studying economic impacts from tourism on the rural economic businesses. Forging partners between rural tourism, lodging establishments, agricultural tourism and artisanal, cultural and culinary sectors this initiative is working to create a vibrant ecosystem for rural tourism and economic development. The project encourages sustainable employment by studying and developing solutions for technology skills gaps. The seven participating researchers and practitioners' collective interests all focus on economic development, training and supporting stakeholders in their specific areas.

The major activities that helped our project make progress began with planning and outreach. Each member of the team interacted and planned their activities for the year to deliver needed support for their stakeholders. In the tourism area, Dr. Mandabach joined the Western Region Outdoor Recreation Work Group and participated in a study focused on evaluating states efforts to support tourism development in this area through outreach to key individuals throughout the region. He also shared the information with New Mexico Stakeholders and extension staff. He submitted a proposal for a detailed study of the economic impact of tourism in Luna and Hidalgo county which included all tourism segments with a focus on rural tourism as well as the impact of cross-border tourism on the counties. This proposal was accepted in December and will be completed this year. His presentation on this project was well received at the West CHRIE Conference in Frisco, Texas and he also discussed the project at the American Culinary Federation Conference.

Dr. Stringam completed a study of hospitality technology training effectiveness and is continuing this work this year. She presented Working Together: Algorithmic Management and Peer Relationships in the Hospitality Industry. She also published a book titled Navigating Technology and Employee Well Being, and an article, Adoption of semiautonomous food delivery robot. Dr. Hertzman planned activities and outreach to the NM Wine Association, the New Mexico Restaurant Association, the El Paso Lodging Association, the American Hotel and Lodging Association, and the New Mexico and Albuquerque Hospitality Associations. She and Dr. Mandabach started a needs assessment study assessment survey to determine if New Mexico wineries are interested in research on customer demographics and motivations, and wine labeling and packaging, or in staff training. She also planned and facilitated the training of high school hospitality and tourism teachers in structured online on-demand classes and hosted a boot camp on campus.

Dr. Hagevort planned training and outreach with his dairy stakeholders including the U.S. Dairy Education and Training Consortium, New Mexico AgrAbility, Dairy Workforce Development and the U.S. Indonesian Dairy Partnership. Dr. Torell supported the project by planning outreach efforts to cattle ranchers and farmers. Dr. Ahn led the development and submission of three collaborative research proposals focused on applying the SSR framework to community thrift and resale environments which aims to connect sustainable consumer behavior research with educational and community engagement outcomes. She also researched sustainable fashion manufacturing. Food safety training continued in the Family and Consumer department but no faculty are associated with this grant yet. Dr. Robinson and Dr. Torell completed and published a study on succession and transition planning for rural business owners. Dr. Robinson working with the Center of Excellence in Sustainable Food and Agriculture Systems completed a study of New Mexico's mid-level supply chain conducted with New Mexico value-added agricultural producers.

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

An initial report examining the economic impact of tourism and hospitality businesses in Luna and Hidalgo Counties, New Mexico, from 2018 through 2026 showed that both counties, located in the southwestern region of New Mexico along the U.S.-Mexico border, have experienced significant economic fluctuations driven by their strategic positions along Interstate 10, their proximity to international ports of entry, and their unique tourism attractions. The analysis reveals that while both counties face economic challenges, tourism and hospitality sectors remain critical components of their economic infrastructure, contributing substantially to employment, tax revenues, and overall economic activity. An interesting note was that cross-border tourism through the Columbus-Puerto Palomas Port of Entry represents a significant economic driver for Luna County, facilitating cultural exchange, shopping, medical tourism, and recreational travel[6]. The 28.2% increase in cross-border visitors arriving by car or on foot in 2025 demonstrates the vitality of this tourism segment. This report lead to submission and approval of a study that will be completed this year and will provide ideas for growing tourism in the two counties.

Dr. Robinson working with the Center of Excellence in Sustainable Food and Agriculture Systems studied New Mexico's mid-level supply chain through interviews were collected

assessing current challenges through 47 interviews conducted with New Mexico value-added agricultural producers. In general, companies are experiencing high input costs which are contributing to inflation and the state of the economy. Some sectors are experiencing growth such as food hubs and meat processing, while others are experiencing little to no growth, such as beef producers. Many participants utilize word of mouth and social media to promote their businesses. Many of the individuals recognized issues with cold storage, labor and transportation being of significant importance. New Mexico's value-added sectors within the mid-level of the supply chain need assistance. These producers are struggling to get products to the final stage of the supply chain. With significant limitations in available cold storage, labor and cost effective transportation being the most common topics. New Mexico's value-added agricultural sectors face critical supply chain challenges, particularly among mid-level participants responsible for processing and distribution. While producers and retailers perform effectively, gaps in cold storage, labor availability, and cost-efficient transportation hinder the movement of products to market. In Summer 2025, a database of 206 mid-level companies was compiled. From this 47 interviews were conducted to identify barriers and opportunities in the supply chain. Findings reveal high input costs driving inflation, uneven sector growth, and reliance on informal marketing channels. This work provides actionable insights to strengthen infrastructure and support innovation, ensuring New Mexico's agricultural economy remains competitive and resilient.

Dr. Hagevort training and outreach with his dairy stakeholders provides the support stakeholders need to improve their operations. The New Mexico AgrAblit presentation at the Farm and Ranch Museum provided outreach supporting improved mental health for dairy operators and workers. The Dairy Workforce Development has trained 7700 employees in multiple languages and the U.S. Indonesian Dairy Partnership provided 2 trainer trainings for 80 individuals that lead to 1400 farm visits. Dr. Torell water research and outreach efforts supported our cattle ranchers and farmers. Dr. Ahn's leadership in developing and submitting three collaborative research proposals focused on applying the SSR framework to community thrift and resale environments connected sustainable consumer behavior research with educational and community engagement. Her research and outreach on sustainable fashion manufacturing provided valuable information to stakeholders. Food safety training online and on campus is essential for value added products. Dr. Robinson and Dr. Torell completed and published a study on succession and transition planning for rural business owners which provides valuable information for stakeholders. Dr. Robinson working with the Center of Excellence in Sustainable Food and Agriculture Systems completed a study of New Mexico's mid-level supply chain conducted with New Mexico value-added agricultural producers.

Dr. Hertzman coordinated all activities for two Immersive Workshops at NMSU in June 2025 attended by 34 teachers providing valuable training designed to connect hospitality and culinary educators to agricultural systems. She also connected with stakeholders at the Fabian Garcia and Alcade field days along with Dr. Mandabach, She also served on the New Mexico Restaurant Association Board and Winer Growers Board provided outreach and needs assessments of our stakeholders. Dr. Hertzman also attended and spoke at the El Paso Lodging Association, the New Mexico Hospitality Association, the New Mexico Tourism Department and Visit Las Cruces as well as supporting each groups activity.

In summary, our work continues on tourism's economic impact in New Mexico. Outreach initiatives included collaborations with the tourism industry, professional development for hospitality educators, and digital literacy training for hotel staff, as well as efforts to connect agriculture and tourism through training hospitality and culinary teachers, and partnerships with other hospitality and tourism industry associations. Additional programs focused on food safety, dairy industry training, rural succession planning, supply chain issues, sustainable fashion research and rural economic development.

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

This project holds significant public value as it fosters sustainable rural economic development in New Mexico by connecting agriculture, tourism, and technology. By supporting rural businesses, promoting eco-friendly practices, and enhancing workforce skills, it strengthens the economic vitality of rural communities while preserving cultural heritage. The initiative has positively impacted local stakeholders, including farmers, hospitality workers, educators, and artisans, by providing training, professional development, and partnerships that create job opportunities and improve business sustainability. By addressing critical issues like succession planning, technological skills gaps, and sustainable practices, the project ensures long-term prosperity and resilience for New Mexico's rural economy, serving as a model for other regions in the Southwest.

Comments

We hope to continue our diverse efforts to build sustainable rural economic development.

Agricultural Literacy and Education

Project Director

William Norris

Organization

New Mexico State University Main Campus

Accession Number

7006748



Agricultural Literacy and Education

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

The purpose of our research is to provide effective tools and strategies to inform and educate constituents on critical concepts related to agriculture. Specifically, we want to provide agricultural content and concepts to the public, students, and educators in using research-based methods to help change behaviors/perceptions related to agriculture. We also wish to use these concepts to increase student interest in science careers in agriculturally related disciplines.

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: Conduct research on agricultural literacy and educational practice and application

Members of our group conducted research on a wide range of topics related to agricultural education and literacy. Research topics included assessment of the curricular and content needs of SBAE teachers in New Mexico, impact of agricultural education on students with adverse childhood experiences, assessment of the Agricultural Science Teacher's Industry-Aligned Education and Development Program (AGRI-TED), etc.

Objective 2: Apply research towards the development of formal and informal learning opportunities

to include development of learning curricula and tools

Our group has taken the results of their research as well as incorporating the expertise of researchers in a wide range of agricultural disciplines such as agricultural education, entomology, animal science, food safety, crop production, horticulture, etc. to develop a variety of learning opportunities. We are developing and evaluating learning curricula and innovative teaching methods to better engage students and educators in agricultural instruction and literacy, as well as training the general public on these topics. For example, some members of our group are evaluating the specific technical skills taught within agricultural education and the needs of skill development of both school-based agricultural education teachers and pre-service teachers being taught at New Mexico State University. Other members are evaluating the AGRI-TED program, which provides a year-long cohort of agricultural educators with professional development in specific agricultural topics each year. The researchers evaluated the educators to assess changes in their ability to teach national standards on the topic and found a substantial increase in their ability to teach the material.

Numerous educational products also were generated by researchers in this group. Approximately 16 research articles, 63 social media campaigns, 17 apps, 36 videos (many in Spanish), 10 animations, 4 games, and 5 interactive programs. Numerous presentations were given at professional meetings, and 100s of presentations to approximately 15,000 stakeholders in New Mexico.

Objective 3: Establish new partnerships for research and development of learning opportunities

Members of our group have worked to generate numerous grant proposals and research and educational collaborations with a wide range of cooperators related to agricultural literacy and education.

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

Our target audience includes researchers in agricultural literacy, developers of learning curricula, and tools, educators, and learning stakeholders (including students, agricultural producers, and the general public). Approximately 16 research articles, 63 social media campaigns, 17 apps, 36 videos (many in Spanish), 10 animations, 4 games, and 5

interactive programs. Numerous presentations were given at professional meetings, and 100s of presentations to approximately 15,000 stakeholders in New Mexico.

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

Effectively communicating important concepts on topics related to agricultural disciplines is the primary focus of this group. Therefore, the majority of the many educational products created, and the presentations that were given, specifically targeted the public. For example the games, videos, animations, etc. are available for use by the general public and target many different age groups. The numerous educational presentations given on topics from insect science to horticultural concepts specifically targeted the general public (pre-K through adult).

Breaking the Cycle: Battling Substance Abuse Across Generations in New Mexico

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7007085



Reducing Risky Driving Behaviors Through Experiential Prevention Education

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

Motor vehicle crashes remain a leading cause of death among teenagers in New Mexico. Risk behaviors, including impaired driving, distracted driving, and failure to use seat belts, continue to threaten youth safety statewide. Preventing these behaviors requires early, research-informed education that increases awareness of consequences and strengthens decision-making skills. The Shattered Lives of Doña Ana County program was developed as a collaborative, countywide prevention initiative to reduce risky driving behaviors and promote responsible choices among high school students through experiential education.

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 2025 Shattered Lives event was held at Gadsden High School, reaching more than 1,220 students, faculty, and community members. Participants included students in grades 9–12, school staff, law enforcement, emergency responders, health professionals, and community volunteers representing safety and prevention agencies.

Coordinated by the Doña Ana County Cooperative Extension Service, the two-day program integrates simulation, structured reflection, and professional engagement.

Key components included:

- Pre-event informational session for students and parents outlining program goals and expectations.
- A staged impaired-driving crash simulation involving a selected “Living Dead” cohort of 32 students. Participants were symbolically removed from class at 15-minute intervals, accompanied by mock obituaries read by law enforcement to illustrate the long-term consequences of impaired driving.
- Educational retreat and funeral home visit focused on real-life testimonials from individuals impacted by alcohol-related crashes.
- Parent retreat to facilitate family dialogue about teen driving safety.
- School-wide mock funeral featuring speakers from law enforcement, emergency services, and community agencies.
- Classroom debrief sessions led by professionals who discussed legal, medical, and emotional consequences of impaired and distracted driving.

The program combines emotional engagement with factual education to reinforce accountability, peer influence awareness, and safe decision-making.

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

- 32 students actively participated in the “Living Dead” cohort.
- 1,189 additional students were indirectly engaged school-wide.
- 24 cohort students participated in restorative circle reflection sessions.
- 75% reported they are less likely to ride with someone under the influence.
- 85% reported they would encourage peers to make safer driving decisions.
- Participants indicated greater understanding of the consequences of impaired and distracted driving.
- Teachers reported that classroom discussions about peer pressure, leadership, and personal responsibility were strengthened following the event.

Interagency collaboration strengthened community-wide prevention messaging and reinforced shared responsibility for youth safety.

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

Shattered Lives advances public safety by reducing risky driving behaviors among adolescents through experiential, community-based prevention education. By increasing youth awareness, strengthening peer accountability, and promoting responsible decision-making, the program reduces crash risk and promotes long-term community well-being. Cooperative Extension’s leadership in convening schools, law enforcement, emergency responders, and families strengthens cross-sector collaboration to protect the health and safety of New Mexico’s youth.

Financial Wellness

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7004851

★ Expanding Financial Literacy Capacity in New Mexico: Statewide Education for Youth, Families, and Extension Professionals

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

New Mexico ranks 48th in financial planning and habits and 36th in financial knowledge and education (WalletHub, 2024). Financial literacy is essential for breaking cycles of poverty and promoting long-term economic stability. In Rio Arriba County, where 20.1% of residents live in poverty, strengthening financial literacy skills among youth, families, and Extension professionals is critical. In 2024, New Mexico passed House Bill 171, requiring financial literacy coursework for high school graduation, creating increased demand for accessible, research-based financial education statewide.

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.

To address this need, the agent partnered with a multi-county team and the NMSU Family Resource Management Specialist to develop and deliver *Finance and Friends*, a statewide financial literacy book club launched in 2024 and continuing through 2025. Delivered virtually via Zoom, the four-part series engaged participants across multiple counties in guided discussions of selected financial education texts. The agent developed three original instructional presentations, led three sessions, and facilitated the fourth session.

To strengthen youth financial education capacity, the agent also co-presented at the 2025 New Mexico 4-H In-Service with fellow agents and the state specialist. An updated national 4-H financial literacy curriculum was identified to replace outdated materials, and a training presentation was developed to introduce agents to the new curriculum and implementation strategies.

Outputs

- Four-part statewide financial literacy series delivered in 2024–2025
- Nine counties engaged in 2025, reaching 76 participants
- Thirteen counties are involved in 2024, reaching 30 participants
- 4-H financial literacy curriculum training delivered at statewide In-Service

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

Short-Term Outcomes:

- 99% of participants reported satisfaction with program content and delivery.
- 88% reported an increased understanding of the financial resources available to 4-H members.
- 100% correctly identified what a credit score primarily reflects following the 4-H Smart Cents presentation.

Intermediate Outcomes:

- 80% of 4-H agents reported increased confidence in teaching financial literacy.
- Participants reported intent to apply financial management practices, including establishing savings accounts and setting SMART financial goals.

Participation increased by 153% from 2024 to 2025, demonstrating expanding statewide reach and engagement.

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

Financial instability contributes to stress, limited access to healthcare, reduced food security, and restricted housing options. By equipping youth, families, and Extension professionals with practical financial knowledge and resources, this program supports improved financial decision-making, greater economic stability, and strengthened community well-being in a high-poverty state.



Feeling Free by Eliminating Debt Quickly

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

Financial hardship continues to affect New Mexico families. Nationally, total household debt reached \$18.59 trillion in 2025, with credit card balances exceeding \$1.23 trillion and delinquency rates rising. In New Mexico, the poverty rate is 18.4%, among the highest in the nation, and median household income remains below the national average. Average credit card debt per household exceeds \$9,900, and nearly one in five residents report using payday or title loans. High-interest debt contributes to financial stress, strained relationships, and reduced long-term economic stability.

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.

To address this need, NMSU Extension delivered “Feeling Free by Eliminating Debt Quickly!” in 2025. Developed by Dr. Bryce Jorgensen, this research-based, interactive workshop integrates financial education, mindfulness, and principles of behavioral economics. Participants examined types and costs of debt, calculated lifetime interest expenses, and compared debt snowball and avalanche repayment strategies. Sessions also addressed emotional drivers of spending and practical behavior-change techniques. Workshops were offered in-person and virtually across urban and rural counties, serving adults, young adults, and high school students. A retrospective pre-post evaluation assessed changes in knowledge, attitudes, confidence, and behavioral intent.

Outputs

- 163 participants attended in-person and virtual sessions statewide
- Workshops delivered across multiple counties
- Retrospective pre-post evaluation administered

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

Participants demonstrated increased knowledge, confidence, and commitment to debt reduction:

- 97% reported increased knowledge of debt management strategies
- 97% reported improved attitudes toward managing debt
- 100% reported an increased desire to eliminate debt
- 97% learned specific tools and strategies to accelerate repayment
- 94% indicated they were likely or very likely to apply concepts within three months
- 95% intended to pay off debt as soon as possible
- 88% planned to create a formal debt-elimination plan

Participants also reported increased communication with family members regarding financial planning.

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

By strengthening financial knowledge and repayment planning skills, this program supports reduced reliance on high-interest debt and predatory lending. Increased participant confidence and planned behavior change contribute to improved household financial stability, reduced financial stress, and stronger economic resilience among New Mexico families.



Game-Based Financial Literacy Program: Knowledge Gain and Behavior Change Among Young Adults

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

Financial literacy is essential for long-term economic stability. Credit knowledge significantly influences access to housing, education, and other major financial decisions. Many young adults do not receive adequate personal finance education in high school or early college, leaving them unprepared to manage debt and build credit responsibly. Extension systems also face challenges in delivering engaging, accessible financial education. To address this gap, a multistate collaboration between New Mexico State University (NMSU) and the University of Idaho developed an interactive, game-based Extension program designed to increase financial literacy knowledge and promote responsible credit behaviors among young adults.

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 *Night of the Living Debt* program was designed primarily for young adults, including high school students and first-year college students, but can be adapted for middle school or adult audiences. Among 127 study participants, 83% (n=101) were young adults ages 18–29, and 12% (n=15) were youth under 18. The program was implemented through face-to-face Extension programming, classroom integration, and online sessions, expanding reach across multiple educational settings.

Night of the Living Debt is a web-based, game-centered financial literacy program developed collaboratively by NMSU and the University of Idaho. The platform includes an interactive game, supplemental instructional videos, and educator support materials. In 2025, Dr. Luke Erickson delivered the program through face-to-face and online Extension sessions in Idaho, reaching approximately 200 young adults. At NMSU, Dr. Bryce Jorgensen incorporated the program into Financial Fitness coursework. In 2025, the game was played 5,373 times and served as the focus of a research study examining knowledge gain and behavioral intentions.

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

Survey data (n=127) indicate significant perceived knowledge gains. Agreement with the statement, “I know the best way to build credit is by wisely using a credit card and paying off the balance regularly,” increased from 33% pre-program to nearly 90% post-program. Most participants (83%, n=101) rated the program as highly enjoyable. Participant feedback highlighted increased confidence and reduced fear of debt, with one noting the program explained debt “in a memorable, easy, and fun way,” and another stating it provided clarity on how to improve a credit score.

The program was developed through collaboration between the NMSU Innovative Media Research & Extension team and Dr. Luke Erickson, Personal Finance Extension Specialist at the University of Idaho. Dr. Erickson integrates the program into Extension and outreach efforts in Idaho and online. Dr. Bryce Jorgensen at NMSU incorporated the

program into Financial Fitness coursework, expanding its reach among New Mexico students.

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

Night of the Living Debt addresses a critical gap in engaging financial literacy education for young adults. This game-based Extension program increases understanding of credit management and debt decision-making through interactive learning. With 5,373 game plays in 2025 and documented knowledge gains, the program demonstrates strong engagement and measurable impact. By equipping young adults with foundational credit knowledge and confidence, the program supports responsible financial behaviors that contribute to long-term financial stability and economic resilience. A peer-reviewed article summarizing research findings is planned for 2026.

Health Equity Initiatives: Tackling Chronic Diseases in New Mexico

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7004850



Aging in Rural New Mexico: Aging in Place and Succession Planning

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

Approximately 29.5% of New Mexicans age 65 and older live in rural areas. Rural seniors face limited access to medical and legal services; several counties are classified as “legal deserts” with few or no practicing attorneys. Residential care can exceed \$3,500 per month, underscoring the importance of aging-in-place planning. Agricultural producers also face succession planning challenges as the average age of farm operators continues to rise.

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.

Seniors in rural New Mexico and members of the New Mexico Cattle Growers Association.

Family and Consumer Sciences Agents partnered with the New Mexico Cattle Growers Association and New Mexico CowBelles to deliver educational sessions during the NMCGA Midyear Board meetings. Topics included:

- Mental and physical health in aging
- Retirement financial planning
- Home modification for aging in place
- Estate and succession planning

Post-session evaluations informed the development of a follow-up workshop and an Aging in Place Checklist developed with NMSU specialists and graduate students.

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

- 75% found the information extremely helpful
- 84% would recommend the program
- Participants reported intent to initiate estate planning, retirement preparation, and home modification strategies. Proactive planning reduces costly emergency legal interventions and long-term residential care expenses.
- Follow-up workshop and checklist developed in response to participant requests

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

Supporting rural seniors in aging in place reduces financial strain and supports independence. Succession planning strengthens the sustainability of family farms and ranches, preserves generational assets, and supports rural economic stability.



Cooking for Your Health

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

Residents in Doña Ana and Otero counties experience high rates of diet-related chronic disease and barriers to preparing healthy meals, including limited cooking confidence and reliance on processed foods. Many adults report limited experience preparing vegetables, whole grains, and lean proteins, which can contribute to poor diet quality and increased chronic disease risk. To address these challenges, NMSU Cooperative Extension partnered with the Fred Hutchinson Cancer Center to deliver a hands-on nutrition education program focused on building practical cooking skills, improving diet quality, and strengthening confidence in preparing affordable, healthy meals.

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.

Thirty-three adults in Doña Ana and Otero counties participated in the six-week program. Participants were primarily female (66.7%), with a mean age of 49, and included both White and Hispanic residents. The program targeted adults seeking to improve their

cooking skills, increase their fruit and vegetable intake, and reduce their chronic disease risk.

Educational Activities

Cooking for Your Health was delivered as a six-week, hands-on cooking and nutrition education series in Alamogordo and Las Cruces. Weekly sessions included food demonstrations, guided meal preparation, and nutrition instruction provided by Extension Family and Consumer Sciences Agents and a Registered Dietitian. Participants practiced knife skills, roasting and sautéing techniques, seafood preparation, meal planning, label reading, and cost-effective grocery shopping strategies. The evaluation included pre-/post-surveys, analyses of the Healthy Eating Index (HEI-2020), self-efficacy measures, and focus groups to assess dietary behavior change and confidence.

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

Dietary Improvements:

- Fruit intake increased by 0.32 servings/day.
- Vegetable intake increased by 0.38 servings/day.
- Total fruit and vegetable intake increased by 0.69 servings/day.
- Overall HEI-2020 score increased by 6.34 points, reflecting improved alignment with national dietary guidelines.

Knowledge and Confidence Gains:

- Improved understanding of recommended fruit and vegetable intake.
- Increased self-efficacy across healthy snacking, resisting unhealthy foods, and choosing healthy meals when fatigued.

Behavioral and Social Impacts:

Participants reported increased home meal preparation, reduced reliance on processed foods, improved grocery planning, decreased food waste, and greater family engagement in cooking.

Partners

Fred Hutchinson Cancer Center

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

Cooking for Your Health strengthens adult capacity to prepare affordable, nutritious meals and supports improved diet quality in communities facing elevated chronic disease risk. Measurable increases in fruit and vegetable intake, improved diet quality scores, and strengthened cooking confidence demonstrate meaningful progress toward chronic disease prevention. By translating evidence-based dietary guidance into practical, hands-on skills, the program supports improved health literacy, reduced reliance on processed foods, and enhanced community resilience. The Extension–health system partnership



Kitchen Creations: Statewide Diabetes Self-Management and Nutrition Education Initiative

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

New Mexico faces significant chronic disease challenges. Diagnosed diabetes costs the state an estimated **\$7.3 billion annually**, and New Mexico has one of the highest diabetes mortality rates in the nation. Rural communities experience limited access to nutrition professionals and diabetes education services. Counties such as McKinley report some of the highest diabetes prevalence and poorest overall health outcomes in the state. Evidence-based, community-delivered diabetes education is critical to improving health outcomes and reducing long-term healthcare costs.

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.

Kitchen Creations serves:

- Individuals diagnosed with diabetes or prediabetes
- Individuals at risk for type 2 diabetes
- Caregivers and family members
- Older adults and rural residents
- Federally designated special populations

In 2025, Kitchen Creations and related diabetes cooking programs served participants across **multiple counties statewide**, including Sandoval, Luna, Otero, McKinley, and Valencia.

Participants ranged in age from early adulthood to 97.

Educational Response

Kitchen Creations is a **12-hour, hands-on diabetes cooking school** delivered by Extension Family & Consumer Sciences agents in partnership with Registered Dietitians.

Core components include:

- Diabetes Plate Method instruction
- Carbohydrate awareness and portion control
- Food label reading
- Healthier cooking methods (baking, roasting, stir-frying)
- Budget-friendly meal planning
- Culturally appropriate recipe adaptation

Participants prepare full diabetes-friendly meals, receive manuals and cookbooks, and practice skills in a supportive group setting.

Several counties expanded offerings to include:

- Living Well with Diabetes programs
- Med Instead of Meds series
- Physical activity integration (Walk with Ease, Get Fit)

Programs were delivered in English and Spanish in select counties.

Statewide Outputs (2025)

Across reporting counties:

- **Over 150+ participants** engaged in Kitchen Creations and related diabetes cooking programs
- Programs delivered in **urban and rural communities statewide**
- Multiple four-session series completed
- Bilingual programming delivered in Luna County
- Partnerships established with healthcare providers, tribal programs, libraries, senior centers, and health foundations

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

Behavior Change

- 99–100% of participants reported understanding strategies to plan and prepare healthy meals
- Participants adopted an average of **5 of 7 recommended diabetes management behaviors**
- 91% reported reading food labels regularly
- 64% reported using the Diabetes Plate method
- 75% reported cooking more meals at home

Health Improvements

Participants reported:

- Decreases in A1C levels (e.g., 12.0 → 7.0)
- Blood glucose reductions of 20 points
- Increased energy and weight loss
- Improved portion control and reduced sugar intake

Confidence & Self-Management

- 100% adopted at least one new healthy behavior
- 50–75% reported increased confidence in managing diabetes
- 86% requested continued programming

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

Kitchen Creations strengthens diabetes self-management capacity across New Mexico. By increasing nutrition knowledge, improving cooking skills, and building confidence in disease management, the program:

- Reduces preventable complications
- Improves blood glucose control
- Decreases long-term healthcare costs
- Strengthens food security and household health behaviors
- Supports rural and underserved populations

Statewide implementation demonstrates the essential role of Cooperative Extension in chronic disease prevention and community health promotion. Modeled healthcare and productivity cost savings are estimated to exceed \$420,000 annually based on documented behavior change.

Addressing Childhood Obesity Among NM Youth

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7002281



Cultivating Life Skills Through Food Literacy: Hands-On Training in Food Safety, Nutrition, and Culinary Skills

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

Food insecurity remains a significant concern in New Mexico, where approximately 23% of children live in food-insecure households. In Valencia County, an estimated 12.3% of residents and over 21% of children experience inconsistent access to nutritious food. Strengthening household capacity requires not only food access but also food literacy skills, including safe food handling, nutrition knowledge, and meal preparation. Youth who lack these foundational skills may struggle to contribute to healthy family meals or manage food resources effectively. Developing culinary competence supports positive youth development, long-term health outcomes, and improved household 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.

The Young Chef program served Valencia County youth ages 10–18, including both 4-H members and non-members seeking hands-on culinary education. In 2024, twelve youth from nine families participated in the summer series. In 2025, twelve additional youth from ten families participated, including beginners with no prior cooking experience. The program prioritized youth interested in building foundational skills in food safety, nutrition, and basic culinary techniques.

Educational Activities

In 2025, the FCS/4-H Youth Development Agent delivered a condensed four-day Young Chef series designed to maximize instructional impact. Sessions covered reading nutrition labels, MyPlate principles, food safety, knife skills, cooking temperatures, seasoning techniques, and basic dining etiquette. Youth engaged in hands-on cooking experiences and applied learning through a creative meal challenge using commonly available foods. Participants received instructional binders and basic kitchen tools to support continued practice at home. Community volunteers and Extension partners contributed specialized instruction to enhance skill development.

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

Participants demonstrated measurable gains in food literacy and confidence:

- 100% reported improved ability to handle and prepare food safely.
- 100% applied learned techniques at home while cooking or grocery shopping.
- 90% reported preparing meals or dishes for family and friends after the program.

Follow-up with 2024 participants indicates sustained behavior change, including regular meal preparation at home. Families reported increased youth engagement in weekly meal planning and preparation, contributing to healthier eating habits and strengthened family involvement in food decisions.

Sandoval County FCS Extension; NMSU Hotel, Restaurant, and Tourism Department; Valencia County ICAN Educator; Valencia County Cooperative Extension Office staff; Manny's Fine Pastries.

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

Youth culinary education strengthens food literacy, supports healthier dietary behaviors, and enhances household food resource management. By equipping young people with practical food safety and meal preparation skills, the program promotes long-term health, reduces food waste, and supports improved household food security. Sustained participant engagement and family-level behavior change demonstrate the program's contribution to building resilient, health-conscious communities in Valencia County.



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

McKinley County ranks last among New Mexico's counties for overall health outcomes (County Health Rankings, 2024). The county has the highest prevalence of diagnosed diabetes in the state and exceeds state averages for obesity (44%), physical inactivity (31%), and limited access to exercise opportunities (41%). Diabetes disproportionately affects Native American residents and low-income households. Approximately 42% of children live in poverty, and 98% qualify for free or reduced-price lunch. Diabetes contributes to reduced life expectancy and increased risk of heart disease, kidney failure, amputations, and vision loss, underscoring the need for community-based prevention and management education.

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.

Youth, adults, caregivers, and families residing in McKinley County, including first-grade students, middle school students, parents participating in the Ft. Wingate FACE program, community members managing diabetes or pre-diabetes, low-income seniors, and residents seeking chronic disease prevention education.

Educational Activities

In 2024–2025, McKinley County Extension delivered multi-level diabetes and chronic disease education programming, including:

- **Ft. Wingate FACE 5-part Diabetes Series** for parents and caregivers
- **Health is Life in Balance (6-part series)** for first-grade students
- **Zuni Middle School 6-part Health Series**, including diabetes, nutrition, fitness, and stress management
- **Kitchen Creations (12-hour cooking school)** with hands-on diabetes-friendly meal preparation
- **Med Instead of Meds (6-part series)** focused on Mediterranean-style eating patterns
- **Walk with Ease** self-directed walking program with structured support

Programs incorporated nutrition education, physical activity promotion, goal setting, cooking demonstrations, and community resource connection.

Outputs

- FACE Diabetes Series: 4–6 adult participants
- Health is Life in Balance: 41 students and 2 teachers
- Zuni Middle School Series: Middle school cohort participation
- Kitchen Creations: 8 graduates
- Med Instead of Meds: Approximately 60 participants
- Walk with Ease: 4 participants in 2025 (23 total over three years)

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

2024 Outcomes:

- 85% of FACE participants planned to implement at least one health strategy learned
- Participants connected with previously unknown diabetes services
- 100% of middle school students learned new information about diabetes
- 100% increased or maintained fitness levels between assessments
- Elementary students set goals for healthy eating and 60 minutes of daily activity

2025 Outcomes:

- Kitchen Creations participants reported improved dietary habits; one participant reduced A1C from 12.0 to 7.0
- Med Instead of Meds participants reported increased fruit, vegetable, and whole grain intake
- 100% of Walk with Ease participants reported improved understanding of safe walking practices and intent to continue walking

Participants reported increased awareness, healthier food choices, improved physical activity habits, and strengthened confidence in managing chronic disease.

Partners

Ft. Wingate FACE Program; Gallup Indian Medical Center (Diabetes Program and Health Promotion); Gallup Community Health (Certified Diabetes Care and Education Specialist); Red Rock Elementary; Zuni Middle School; Octavia Fellin Public Library; Sunset Hills; Gallup Lions Club.

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

Diabetes education programming in McKinley County strengthens individual and family capacity to prevent and manage chronic disease through improved nutrition, physical activity, and self-management strategies. By increasing knowledge, encouraging behavior change, and connecting residents to local health resources, the program supports reduced risk of diabetes-related complications, improved quality of life, and strengthened community health outcomes in a high-poverty, high-risk region.

Navigating Youth Resilience

Project Director

LaJoy Spears

Organization

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Accession Number

7002269



4-H for Diné Families and Youth

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

Navajo Nation communities face economic, healthcare, and educational challenges. Agricultural education and life skills development can strengthen resilience and 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.

Navajo families and youth in rural New Mexico and Arizona.

Programs included:

- STEAM activities (rockets, hydroponics, seed germination)
- Archery and shooting sports
- Egg-to-Chick programs
- Family-based health and cultural projects
- Welding and entrepreneurship training (15 students)
- Wingate High School Ag Day (200+ students)

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

- Increased youth participation in STEM and agriculture
- Archery team placements (2nd in 2024; 4th in 2025 novice category)
- 35% of Wingate students expressed interest in trade careers
- 3 individuals enrolled at NMSU Grants
- Families reported increased confidence and knowledge

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

Strengthens cultural identity, leadership skills, workforce readiness, agricultural literacy, and educational pathways for Navajo youth and families.



Strengthening Youth Outcomes Through Cooperative Extension Educational Collaborations

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

New Mexico ranks last nationally in child well-being (Annie E. Casey Foundation, 2025 Kids Count Data Book), with approximately one-quarter of children living in poverty. Children experiencing poverty face increased risk of food insecurity, diet-related chronic illness, and lower academic achievement. Improving youth outcomes requires coordinated, research-based educational partnerships that strengthen academic engagement, life skills development, and agricultural literacy. Cooperative Extension collaborations with public schools and community partners provide structured, experiential learning opportunities that support both academic success and healthy behavior development.

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.

Elementary and middle school youth enrolled in Las Vegas City Schools participating in the Youth Agricultural Science Center (YASC) and Cooking with Kids programming. A total of 76 youth participated in collaborative agricultural and culinary education activities during the reporting period.

Educational Activities (Response)

For 19 years, Las Vegas City Schools and NMSU Cooperative Extension have partnered through the Youth Agricultural Science Center to provide hands-on agricultural education. Youth engage in planting, cultivating, harvesting, and learning principles of plant science, food safety, and farming systems.

In collaboration with Cooking with Kids, classroom-based cooking instruction was aligned with garden production activities. Youth participated in coordinated field and culinary units that reinforced nutrition education, agricultural literacy, and applied science concepts. This seed-to-table model integrated experiential learning across the garden, classroom, and kitchen environments.

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

Evaluation data (N=76) indicate measurable academic and life skill gains:

- 91% reported development of life skills, such as mastery and independence
- 86% reported reinforcement of reading, arithmetic, and science concepts
- 91% reported learning new vocabulary
- 51% accurately matched ecological principles to agricultural practices
- 97% reported improved understanding of food production
- 89% reported an increased likelihood of eating fresh vegetables after cooking produce grown in the garden

Results demonstrate strengthened agricultural literacy, academic reinforcement, and positive shifts in dietary intentions.

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

Collaborative Extension-school partnerships provide experiential education that reinforces literacy, numeracy, science comprehension, and positive youth development outcomes. Integrating agricultural production with culinary education increases youth understanding of food systems and promotes healthier eating behaviors. These collaborations contribute to improved academic engagement, strengthened life skills, enhanced agricultural literacy, and greater awareness of early career pathways. By building youth capacity and connecting learning to real-world applications, Cooperative Extension partnerships support long-term educational attainment and community resilience in New Mexico.

Critical Issue

Food & Fiber Production and Marketing

A Multifaceted Approach to Strengthening the Food Supply Chain

Project Director

BRIAN SCHUTTE

Organization

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Accession Number

7006854



2025 Results for “Multifaceted Approach to Strengthening the Food Supply Chain”

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

Food supply chains include producers, processors, marketers, and consumers. Each of these links includes inefficiencies that can cause higher prices and shortages for consumers, diminished economic returns for producers, processors, and marketers. Further, each inefficiency wastes scarce natural resources that sustain food production and distribution. To safeguard food supply chains better for current and future participants, entire systems for producing, processing, distributing, and consuming food need to be more effective, efficient, and less wasteful.

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 Fiscal Year 2025, we conducted a series of studies that addressed specific shortcomings in the production, processing, distribution and consumption of food in the United States.

With respect to food production, we published a study that analyzed metabolomic profiles of sour jujube (*Ziziphus spinosa*) fruits and seeds collected from trees growing in New Mexico and Texas. Sour jujube has long been cultivated for food and medicine in China, but the nutritional and medicinal qualities of sour jujube fruits and seeds collected from trees in the United States was poorly understood prior to our study. Our results indicated that sour jujube fruits and seeds from New Mexico and Texas were rich in bioactive compounds that can improve sleep, reduce anxiety, modulate gut microbiomes, and reduce inflammation. Further, nutraceutical compounds were high in fruits and seeds collected from specific trees in Texas, suggesting this site is an excellent source of germplasm for sour jujube or middle type in the United States. We also published a paper that is guiding improvement of programs for managing weeds in chile pepper (*Capsicum annuum*). Specifically, we determined that management of weeds in chile pepper can be improved with rotational sorghum (*Sorghum bicolor*) treated with selective, non-residual herbicides. Two herbicide applications in sorghum maximized reductions in weeds in chile pepper grown the year after sorghum. However, a partial budget analysis indicated that one herbicide application in sorghum provided the greatest net economic benefit. This is because sorghum receiving one, rather than two, herbicide applications had lower input costs and greater overall gross revenue across sorghum and chile pepper growing seasons.

With respect to food processing, we advanced and published research demonstrating that maize inflorescences can serve as valuable sources of antioxidant compounds for food applications. Specifically, we developed a method for incorporating powdered maize inflorescences into concentrated cheese whey to produce a lactose solution with elevated antioxidant activity. Our approach traps polyphenols within crystals, effectively protecting them from degradation caused by UV-A radiation. These results indicate that nutritional properties of lactose can be enhanced by incorporating polyphenols from maize inflorescences that are readily available. Also, our work on food processing includes saffron (*Crocus sativus*) flowers as sources of phenolic compounds with antioxidant activity. Our results indicated that saffron stigmas and saffron flowers without stigmas are valuable sources of phenolic compounds; however, flowers with stigmas contain significantly more phenolics than flowers without stigmas. These results are guiding development of methods for harvesting saffron flowers with maximum medicinal properties. Finally, our research on food processing has been expanded to include waste reduction in meat processing. Parts of animal carcasses that are often discarded after slaughter include offal. Offal disposal is challenging in New Mexico because of a lack of companies capable of handling this material. To reduce offal disposal across the state, we are studying methods for developing value-added products from offal.

With respect to food distribution, we published a study that determined small-scale producer and low-income consumer responses to the New Mexico Double Up Food Bucks (NM DUFb) program — a program that matches Supplemental Nutrition Assistance Program spending on locally grown produce. Results indicated participation in the NM DUFb program provided producers greater sales and income, with gains rising asymptotically with increasing years of participation. For consumers, NM DUFb

participation increased fruit and vegetable purchase and consumption. NM DUFEB-induced increases in fruit and vegetable consumption were more pronounced among consumers who more frequently participated in the program, suggesting NM DUFEB habituates consumers to improve diet quality. Based on these results, we concluded that the DUFEB supports both producers and consumers in New Mexico.

With respect to food consumption, we continued our investigation into composting procedures used by colleges and universities. Our initial findings suggest barriers to adoption include a paucity of permitted facilities for hauling and receiving compost. Accordingly, we expanded our literature search to include municipal composting programs and availability of approved/licensed facilities. We also researched the use of composting in comparison to other food waste reduction strategies used by universities and food service operations. Such alternatives to composting include: 1) menu development for better product utilization and offering flexible portion sizes, and 2) distribution of excess products and foods to community organizations. Through our research, we are identifying promising, site-specific methods for reducing food waste at a large university.

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

For project activities on food production, the target audience includes vegetable crop growers and their consultants, as well as small farmers and fruit growers, in New Mexico. These growers and agricultural professionals have gained knowledge of methods for both improving profitability and diversifying income for their farm operations.

For project activities on food processing, the target audience includes the value-added agriculture industry in New Mexico. From this project, the value-added agriculture industry has gained opportunities for new products that contain high concentrations of antioxidants derived from plants, as well as knowledge of promising methods for developing value-added products from offal.

For project activities on food distribution, the target audience includes policy makers who develop government-supported assistance programs for obtaining food. These policy makers have gained a better understanding of the impact of a program that matches Supplemental Nutrition Assistance Program spending with locally grown produce.

For project activities on food consumption, the target audience in FY 2025 was food and beverage operations on college campuses. From this project, food and beverage operations on college campuses have become more knowledgeable on methods for reducing food waste contributions to landfills.

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

No single action can improve an entire food supply chain. Rather, improvement to a food supply chain requires multiple solutions that each address a specific shortcoming in the production, processing, distribution and consumption of food. Our efforts focus on: (1) developing climate- and market-smart strategies that add value to food production and

increase efficiency across New Mexico's agricultural sector; (2) conducting innovative research to support new technologies that enhance the antioxidant capacity of food products; (3) evaluating distribution and marketing programs to strengthen their ability to reach food-insecure households; and (4) creating strategies to reduce the volume of food waste entering landfills. Collectively, this work aims to provide decision makers with actionable information to increase economic returns for producers, improve the nutritional quality of foods, reduce food insecurity, and promote more sustainable approaches to managing food waste in New Mexico, the border-region, and the United States.

Comments

Publications directly related to this project:

Dsouza A, Regmi M, Dhanapal K, Crawford-Garrett B, Acharya RN, Patrick JM. (2025). Does the Double Up Food Bucks program benefit local food producers and consumers? Evidence from New Mexico. *Agricultural Finance Review*, <https://doi.org/10.1108/AFR-03-2024-0042>

Sapkota D, Holguin FO, Salmasi SZ, Yao S. (2025). Fruit and seed metabolomic profiles provide insights into the utilization of sour jujube germplasm. *Journal of the American Society for Horticultural Science*, 150:316–327. <https://doi.org/10.21273/JASHS05525-25>

Rusindo-Rodríguez IM, Ramos-Sánchez VH, Chávez-Flores D. (2025) Co-crystals of lactose-polyphenols created from two food-related by-products: Cheese whey and maize inflorescences. *Food Bioprocess Technol* 18:4513–4528. <https://doi.org/10.1007/s11947-024-03732-2>

Insa RS, Lehnhoff EA, Steiner R, Walker S, Schutte BJ. (2026) Impacts of sorghum herbicide programs across sorghum and chile pepper growing seasons. *Weed Technology* 40:e3. <https://doi.org/10.1017/wet.2025.10071>

Animal Health and Wellness in New Mexico

Project Director

Maryfrances Miller

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7006739



Animal Health and Wellness in New Mexico Livestock

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

It is the goal of livestock producers to improve animal health and welfare throughout all segments of production by providing sound animal husbandry practices. Beef producers

deliver a high-quality, low-cost product keeping in mind sustainability. For beef cattle production, the industry has sought to financially reward managerial strategies that minimize calf sickness and death while maximizing calf health and performance beyond the ranch of origin. Animal health has been reported to have a significant effect on performance in the feedlot and on the final product. In addition, there has been more focus on consumer preference with the consumer demanding more information on where their food comes from. There are several factors that impact animal health and wellness in livestock.

These factors range from bovine respiratory disease for the beef industry, to reproductive efficiency, animal traceability, vectors for livestock, and other agriculture commodities. This research has focused on identifying when bacteria that can cause bovine respiratory disease are established.

Work has also focused on management practices for equine producers including deworming practices and potential management factors for toxic plants.

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. Role of animal health and welfare on fertility

Major activities conducted during this reporting period directly supported progress toward understanding how animal health and welfare influence fertility. Our research demonstrated that disruptions to key biological signaling pathways during early pregnancy can negatively affect placental development and fetal growth, providing new insight into how maternal health status impacts reproductive success. In addition, we established and used a sheep model that mimics low-level infection commonly seen in livestock production systems. Results showed that even mild immune challenges around the time of breeding can impair ovarian function and reduce fertility potential in both young and mature females. Together, these activities advanced our objective by identifying biological mechanisms linking health challenges to reproductive outcomes and by providing practical knowledge that can help producers better manage animal health to improve fertility.

Objective 2. Incentives for improving traceability relative to animal disease

Nothing Significant to report for this objective as group continues work on grant project – which is working to develop plan for managing livestock on federal land during an foreign animal disease event

Objective 3. Role of microbes/pathogens/pests/vectors in animal health

Major activities during this reporting period supported progress toward understanding how microbes and plant-associated toxins affect animal health and productivity. We identified and described several previously uncharacterized fungal species that live within toxic plants known to poison grazing livestock. By confirming that these fungi produce the toxin responsible for livestock disease and by comparing their genetic and physical characteristics, we improved understanding of how these organisms vary among plant species and regions. This work is important because it helps predict when and where toxic

plants may pose the greatest risk to cattle and sheep, ultimately supporting better grazing management decisions and reducing economic losses for producers.

Objective 4. Impact of nutrition on animal health and production

Major activities during this reporting period advanced progress toward understanding how nutrition influences animal health, reproduction, and production efficiency, particularly in challenging environments. We evaluated alternative feed ingredients, such as pecan shells, and demonstrated that while they may have some health-related benefits, they can also reduce feed intake and digestion during periods of immune stress, highlighting the importance of balancing health benefits with nutritional performance. In addition, several studies focused on heifer development strategies under drought and limited forage conditions, including the use of protein supplementation, rumen undegradable protein (RUP), and growth implants. Results showed that targeted protein supplementation strategies can improve reproductive outcomes, such as pregnancy success and embryo development, without negatively affecting growth or ovarian function. Together, these activities provided practical guidance for producers on how to manage nutrition to improve animal performance, reproductive longevity, and resilience while maintaining cost efficiency in semi-arid production systems.

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

This body of work provides practical benefits to livestock producers by identifying how health, nutrition, and environmental risk factors directly influence fertility, productivity, and economic sustainability. The research demonstrates that even mild immune challenges around breeding can reduce ovarian function and early pregnancy success, emphasizing the importance of strong herd health programs and stress management during critical reproductive windows. Studies on toxic plants and the fungi responsible for livestock poisoning improve producers' ability to anticipate and manage grazing risks, reducing losses associated with plant toxins. Nutrition research provides clear guidance on strategic protein supplementation and heifer development under drought or limited forage conditions, helping maintain reproductive performance without sacrificing growth or cost efficiency. In addition, efforts to improve disease preparedness and traceability strengthen producers' ability to respond to foreign animal disease events while protecting market access. Together, these findings support better management decisions that enhance reproductive success, resilience, and long-term profitability in beef and sheep production systems.

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

The broader public benefits from this work through improvements in food security, food safety, environmental stewardship, and animal welfare. By identifying how animal health and nutrition influence fertility and productivity, this research helps livestock producers maintain stable and efficient meat production, supporting a reliable and affordable food supply. Improved understanding of disease risks, traceability, and preparedness for foreign animal disease events strengthens the nation's ability to protect the food system and minimize economic disruptions. Research on toxic plants and microbial toxins enhances

grazing management, reducing animal losses and improving responsible land use in semi-arid regions. In addition, nutrition strategies that improve reproductive efficiency and resource use help reduce waste, lower environmental impacts, and promote more sustainable livestock production. Collectively, this work supports a resilient agricultural system that benefits consumers, rural communities, and the broader economy.

Comments

PUBLICATIONS

Allison, C. D., Turner, J. L. (2026). Managing New Mexico's Wild and Free Roaming Horses. Las Cruces, NM: NM Agricultural Experiment Station., Date Submitted: December 2025, Date Accepted: February 2026.

Andrade, E. L. G., Filho, J. M. P., Lucena, K. H. O. S., Barros, L.S., Barbosa, A. M., Oliveira, L. R., Gonzaga Neto, S., Oliveira, J. P. F., Fonseca, A. M., L. R. Bezerra. Effects of dietary supplementation with vegetable oils of different unsaturated fatty acids composition on intake, digestibility, nitrogen balance performance, and carcass traits of sheep. *Tropical Animal Health and Production. Trop Anim Health Prod* 57, 147 (2025) <https://doi.org/10.1007/s11250-025-04395-7>

Andrews, T. N. A. Henington, C. Bedke, J. A. Cooper, K. Richardson, R. A. Cushman, A. P. Snider, P. Fontes, M. S. Smith, A. F. Summers, and E. J. Scholljegerdes. 2025. Effects of source and level of ruminal undegradable protein on serum glucose, insulin, and urea nitrogen in developing beef heifers fed in a dry-lot. *J. Anim. Sci.* 103 (Suppl. 2): 177-178.

Andrews, T. N., A. Aizpuru, C. Bedke, J. A. Cooper, K. Richardson, R. L. Dunlap, S. H. Cox, R. A. Cushman, A. P. Snider, P. Fontes, M. S. Smith, E. Mesen, A. F. Summers, and E. J. Scholljegerdes. 2025. The influence of source and level of ruminal undegradable protein on antral follicle count and circulating concentrations of urea, glucose, and insulin in beef heifers grazing native rangelands. *J. Anim. Sci.* 103 (Suppl. 2): 176-177.

Andrews, T. N., A. Christianson, A. P. Snider, R. A. Cushman, C. Bedke, K. Richardson, J. A. Cooper, G. A. Perry, A. F. Summers, and E. J. Scholljegerdes. 2025. The effects of source and level of rumen undegradable protein on circulating lipid metabolites in beef heifers. *J. Anim. Sci.* 103 (Suppl. 2): 437-438.

Andrews, T. N., E. J. Scholljegerdes, G. A. Perry, S. H. Cox, R. L. Dunlap, C. Anderson, M. K. Chavez, K. L. Gallacher, E. Melchior, A. Selman, J. A. Cooper, C. Bedke, and A. Summers. 2025. Awardee Talk: The evaluation of management and protein supplementation strategies on growth and ovarian-follicular parameters in developing beef heifers grazing native rangelands. *J. Anim. Sci.* 103 (Suppl. 2): 22.

Andrews, T. N. E. J. Scholljegerdes, R. A. Cushman, A. P. Snider, G. A. Perry, S. H. Cox, R. L. Dunlap, J. A. Cooper, C. Bedke, K. Richardson, and A. F. Summers. 2025. The evaluation of source and level of rumen undegradable protein on growth performance and ovarian parameters in beef heifers developed in dry-lots. *J. Anim. Sci.* 103 (Suppl. 2): 47-48.

- Bezerra, L. R., Mazza, P. H. S., Lucena, K. H. O. S., Amorim, M. A. F., Moura, J. F. P., Oliveira, J. P. F., Oliveira, R. L., Barbosa, A. M., Fonseca, M. A., J. M. Pereira Filho. 2025. Slow-release urea technologies for ruminant diets: microencapsulation approaches and nutritional implications. *Ruminants*, 5(4),50, 1-28. <https://doi.org/10.3390/ruminants5040050>
- Blair, N., J.F. Dominguez Arellanes, K.L. Luna, S.C. Gurule, N. Lucero, S. Soto-Navarro, and J.A. Hernandez Gifford. Effects of repeated low-dose endotoxin exposure on immune cell and hematological parameters in multiparous ewes. *ACES Open House*. 2025.
- Cooper, J. A. T. N. Andrews, C. Bedke, K. Richardson, K. L. Gallacher, J. A. Hernandez-Gifford, S. H. Cox, R. L. Dunlap, A. F. Summers and E. J. Scholljegerdes. 2025. Effects of transportation on serum cortisol concentrations and laparoscopic artificial insemination pregnancy rates in Boer goats. *J. Anim. Sci.* 103 (Suppl. 2): 172.
- Costa, I., Pistillo, L. Z., Godinho, J. A., Fonseca, M. A., Detmann, E., Lopes, S. A., Sampaio, C. B. PSIX-25 Interaction between maternal parity and creep feeding supplementation on the productive performance and metabolism of grazing Nellore cow-calf pairs. *Journal of Animal Science*, 103 (Suppl. 3): 599–600. October 2025. <https://doi.org/10.1093/jas/skaf300.678>
- Da Silva, E.P., Cappellosza, B.I., Zervoudakis, J.T., Mendonça, F.A.C., Cabral, L.S., Galati, R.L., Fonseca, M.A., N.F. De Paula. Evaluation of direct-fed microbials as an alternative to ionophores and non-ionophore additives on in vitro ruminal fermentation, gas production kinetics, and digestibility in forage-based diets. *Translational Animal Science*, txaf148, <https://doi.org/10.1093/tas/txaf148>
- Dos Santos, F.; Bezerra, L.; Vieira, J. ; Marcelino, P.; Barbosa, A.; Arce-Cordero, J.; Fonseca, M. ; Silva, T.; R. Oliveira. Intake, digestibility, nitrogen balance, rumen and blood parameters of cattle supplemented with *Acacia mearnsii* extract. *Animal Science Journal*. Manuscript ID: *ASJ-2024-0191.R3*. Accepted on 7/30/2025.
- Jero, N. P., Meiman, Paul J., Stringham, T. K., Fonseca, M. A., T. Parker. 2025. Virtual Fences Successfully Contain Cattle Over a Wide Range of Stocking Densities and at Stubble Heights Below Common Riparian Management Targets. 2025. *Rangeland Ecology & Management*. Volume 98, Issue 4, January 2025, Pages 539-549. <https://doi.org/10.1016/j.rama.2024.11.002>
- Macias Franco, A., Silva, A. E. M., Brody, T., Holton, G., Rockwell, M., De Paula, N. F., Bezerra, L. R., M. A. Fonseca. 2025. Investigating variability of craft microbreweries spent grains for classification and incorporation into precision diet formulation through multivariate analyses. *Heliyon*, Volume 11, Issue 2, e41606. <https://doi.org/10.1016/j.heliyon.2024.e41606>
- Mota, L. ‡, Smithyman, M. ‡, Smithyman, C., Paula, N. F., Kleinschmit, D., Socha, M., Branine, M., Fonseca, M. A. ‡, Löest, C. A., Duff, G. PSXII-22 Effects of branched-chain fatty acids and protein-energy supplementation on rumen fermentation and digestive kinetics in dairy × beef steers grazing native or irrigated cultivated pasture, *Journal of Animal Science*, Volume 103, Issue Supplement_3, October 2025, Pages 618–619. *Hollywood, FL, July 2025*.doi: <https://doi.org/10.1093/jas/skaf300.700>

- Ormond-Melo, V. C., Cerisara, L. A. C.; Silva, E. P.; Cunha, R. J. J.; Pereira, T. B.; Zervoudakis, J. T.; Cabral, L. S.; Fonseca, M. A.; Manzano, R. P.; N. F. De Paula. 2025. Evaluation of the effects of natural additives on in vitro gas production kinetics and digestibility in Xaraés grass combined or not with dry fiber plus solubles. *Semina: Ciências Agrárias*, 46(3), 965–982. <https://doi.org/10.5433/1679-0359.2025v46n3p965>
- Otomura, J. Q., Silva, E. P., Cappellozza, B., Zervoudakis, J. T., Mendonça, F. A. C., Arruda, T. C., Ormond, V. C., Galati, R. L., Fonseca, M. A., N. F. Paula^{*,‡}. PSXIII-22 Impact of feed additives on in vitro dry matter and fiber digestibility of forage-based diets, *Journal of Animal Science*, Volume 103, Issue Supplement_3, October 2025, Pages 622–623. *Hollywood, FL, July 2025*. doi:<https://doi.org/10.1093/jas/skaf300.704>
- Pistillo^{*,‡}, L. Z., Godinho, J. A. M., Borba, P. H., Fonseca, M. A., Detmann, E., Paulino, P. V. R., Sampaio, C. B. PSXIII-24 Performance and blood characteristics of beef heifers supplemented with yeast during the prepubertal period, *Journal of Animal Science*, Volume 103, Issue Supplement_3, October 2025, Pages 623–624. *Hollywood, FL, July 2025*. Doi: <https://doi.org/10.1093/jas/skaf300.705>
- Rondon, A.P., Silva, E.P. [‡], Fernandes, R.B., Rodrigues, C.H.O.A., Fonseca, M.A., Galati, R.L., Zervoudakis, J.T., N.F De Paula[‡]. Effects of monensin, narasin and flavomycin on in vitro methane production in low-quality forage-based diets. In: SIMBOV – 11th Symposium on Beef Cattle Production of the state of Mato Grosso, Cuiabá, MT. Brazil. *August 28th–30th, 2025*.
- Silva, A. E., Macias Franco, A., Solomon, J., Freiria, L., Moura, F. H., Mazza, P., Birkenstock, B., Bezerra, L. R., Shenkoru, T., M. A. Fonseca. Cactus (*Opuntia ficus-indica*) diets reduce voluntary water intake, water footprint and enteric methane production improving ruminal fermentation in steers. *Journal of Arid Environments*. [Volume 227](#), March 2025, 105311. <https://doi.org/10.1016/j.jaridenv.2024.105311>
- Turner, J. L. (2025). Help your horse handle heat stress (2025 Revision) (ed., vol. Guide B-711). Las Cruces, NM: NMSU Cooperative Extension Service. aces.nmsu.edu/pubs/_b/, Date Submitted: August 2025, Date Accepted: August 2025. Date published: August 2025.
- Turner, J. L. Mineral contamination of water sources and potential for toxicity in horses. Las Cruces, NM: EASNR Department, NMSU., Abstract/Synopsis: Report prepared by Extension Horse Specialist at the request of the Directors of the Southwest Border Food Protection and Emergency Preparedness Center at NMSU., Date Submitted: November 24, 2025.
- Turner, J. L., Young, B., Adams, C. (2026). Strategies for Managing Horses During Drought Conditions. Las Cruces, NM: NM Cooperative Extension Service., Date Submitted: October 2025.
- Valencia, J., S.C. Gurule, J. Dominguez, N. Lucero, K. Luna, S. Soto-Navarro, and J.A. Hernandez Gifford. Repeated low-dose endotoxin exposure on hematological and febrile response in nulliparous Rambouillet ewes. SSASAS-WSASAS. Arlington, TX April 5-8, 2025.
- Windh, J., Meredith, G., Miller, M., Lee, K., Ritten, J., Thayer, A. W. Torell, G., Spiegel, S., & Wulfhorst, J. D. (2025). Identifying a Path Forward: Evaluating Ranch Socio-Economic

GRANT AWARD

Wilson, M., Dean, T., Ward, M., Miller, M., Wenzel, J., Witte, J. "On Common Ground – Enhancing Strategies and Awareness of Quarantine Movement Control for Public Land Grazers in the event of a Foreign Animal Disease." Sponsoring Organization: USDA APHIS Sponsoring Organization Is: Federal, PI Total Award: \$227,569.00, Current Status: Active. (March 1, 2023 - July 14, 2025).

Genetic enhancement in crop systems

Project Director

STEPHANIE WALKER

Organization

New Mexico State University Main Campus

Accession Number

7006719



Improved Sustainability of Crop Production in New Mexico's Arid Lands Through Genetics

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

Abiotic stressors such as drought, salinity, and extreme temperatures reduce yield and are increasingly a challenge to crop production. Additionally, crop disease pressure increases as environmental stresses increase. The development of new genetic resources and cultivars, focusing on increased climatic resilience and disease resistance, are needed by New Mexican producers to increase crop production and maximize productivity and profitability on their farms.

Pecans - Understanding the genetic mechanisms underlying stress tolerance in pecan trees is essential for developing resilient cultivars that can maintain consistent productivity and profitability under adverse environmental conditions. This knowledge directly empowers pecan growers to make informed breeding and management decisions, provides agricultural researchers with molecular targets for crop improvement, and ensures continued supply of pecans, a healthy source of vitamins, minerals, and protein for consumers worldwide.

Multiple assays were performed with pecan micropropagated genotypes that span the geographic native region for pecan. These assays included heat stress, salinity stress,

drought stress, and micronutrient uptake assays with zinc and nickel. Additional assays were performed with different combinations of stresses to understand how pecan tree genotypes respond. Physiological responses to these stresses were noted. For instance, it was found that pecan trees that originated from a Northern region were less tolerant of heat stress than trees that originated from more Southern regions. The trees from the North exhibited more leaf scorch when exposed to high temperatures than trees from the South. Further analyses were performed to determine active genes and gene networks that may play a role in stress tolerance. This was done using a technique called RNA-Seq analyses. Gene and gene networks were identified for how pecan genotypes responded to heat, salinity, and drought. In addition, genes that are responsible for the uptake of micronutrients such as Zinc and Nickel were also identified and validated.

The salinity assays performed on pecan clonal trees revealed LEA genes that are within pecan that can provide stress tolerance. One of these genes CiLEA4.1 was identified as a highly expressed candidate in two pecan cultivars, establishing it as a priority target for breeding programs and biotechnology applications. Functional validation in *E. coli* demonstrated that LEAP3 and LEAP4 expressing cells conferred dramatically enhanced tolerance to osmotic stress and desiccation. Most significantly, LEAP4-expressing cells demonstrated a 2.5-fold growth advantage under salinity conditions, a substantial protective effect directly applicable to developing stress-resilient pecan cultivars for growers facing ongoing productivity challenges. Pecan tree studies in the lab confirmed that LEAP4 functions as a critical early-stress response element, with transient expression peaking at 48 hours post-exposure to 75 mM NaCl salinity, revealing the precise temporal mechanism by which pecan trees orchestrate cellular defense. These results provide pecan growers, agricultural breeders, and the broader tree crop industry with validated genetic targets for developing cultivars that maintain consistent productivity and profitability under adverse environmental conditions, while simultaneously advancing scientific understanding of stress-adaptation mechanisms applicable to other economically important perennial crops.

A field drought study was performed on grafted clonal rootstocks that were planted at Leydecker. The trees in this study were not watered for more than 30 days and analyses performed to determine if the same genes and gene networks were activated as we observed in the micropropagated trees in the lab. We did verify that a number of the same genes and gene networks that were either activated or turned off were the same when comparing the lab assays and the field assays.

Valencia Peanuts - Stem rot, caused by *Agroathelia rolfsii*, is a major disease of peanut (*Arachis hypogaea* L.). Using RNA sequencing, this study compared gene expression in a resistant genotype (Georgia-03 L) and a susceptible genotype (Valencia C) under infected and non-infected conditions. Results revealed that resistance in Georgia-03 L is associated with enhanced pathogen recognition, oxidative stress regulation, secondary metabolism, and cell wall reinforcement. Key upregulated genes included receptor-like kinases, NBS-LRR genes, and transcription factors such as MYB and zinc finger proteins. Co-expression analysis identified critical resistance-related pathways, whereas Valencia C showed limited defense activation. These findings provide insights into the molecular basis of stem rot resistance and potential targets for breeding resistant cultivars.

Short-day Onions: Fusarium basal rot (FBR) is a soil-borne fungal disease that causes disintegration of the onion bulb basal plate, killing plants growing in the field. Onion stakeholders have identified FBR as a severe disease threat to onion yield and economic sustainability. Breeding for host plant resistance to FBR may eliminate the disease's detrimental effects. Onion germplasm was evaluated for FBR susceptibility by inoculating onion bulbs with a virulent pathogen isolate. After 21 days of incubation, bulbs were evaluated for disease severity. Onion germplasm was identified that exhibited a lower disease severity than an FBR-susceptible and an FBR-resistant onion cultivar used in the evaluation. Selection for reduced disease severity was successful, as severity decreased over successive generations. Our research demonstrated that our evaluation method reliably produced disease symptoms essential for developing disease resistance. Germplasm has been selected for lower disease severity. We have identified in onion a group of host plant compounds that appear to confer resistance to this disease. Selection for these compounds will aid in the development of FBR-resistant onion cultivars. Commercial seed companies can use this information and germplasm to develop FBR-resistant onion cultivars. This will result in improved onion cultivars that growers in New Mexico can use to improve their productivity.

Chile Peppers: The chile pepper research program focused on utilizing genomic approaches to develop stress-resilient chile pepper (*Capsicum annuum* L.) cultivars. In 2025, water-stress (drought) trials through polyethylene glycol (PEG) treatments (0, 5, 10% PEG solutions) were performed using four different genotypes of chile pepper (*Capsicum annuum* L.) at the Fabian Garcia Science Center, NMSU, Las Cruces, NM. The average germination percentages were calculated for each genotype. 'NuMex Enchantment' demonstrated the highest mean germination percentage (58%), followed by 'NuMex Joe E. Parker' (50%), and 'NuMex Odyssey' and 'NM No. 9' (43%). Through these PEG trials, we have made progress towards characterizing potential water-stress tolerance (through the percentage of germination) of select pepper varieties previously released by the NMSU Chile Pepper Breeding and Genetics Program.

Alfalfa - Alfalfa is a perennial, outcrossing species with obscure genetic architecture and a genome size of 800-1000 Mb. The genetic complexity and cross-pollinated nature make breeding substantially more challenging than for other field crops. As a result, the national average yield of this crop has remained stagnant at approximately 3.4 tons/ha over the past four decades. Improving its resilience to abiotic and biotic stresses is vital for the sustainability of livestock production systems, particularly in the arid and semi-arid regions of the Southwest. Drought and salinity stress are the two most significant abiotic constraints to alfalfa productivity and persistence. The program is launching Machine Learning (ML) research including ruminant nutrition aspects of alfalfa to accelerate efficient cultivar development and to ensure nutrient-rich diet for dairy and cattle industries.

The Alfalfa Breeding and Genetics team at NMSU has developed outstanding alfalfa germplasm that performs exceptionally well under early irrigation termination (EIT), providing outstanding forage quality and forage biomass yield. In addition, we have compiled a rich, multi-year dataset that includes Uncrewed Aerial System (UAS) - imagery, DNA sequence, forage quality metrics (~400 NMSU samples and ~600 Cornell samples), and biomass yield from three diverse locations. We are working on developing robust predictive analytics and elite alfalfa cultivars with improved **drought-salinity** tolerance

and combined resistance to *Aphanomyces* root rot (Races 1 & 2), Blue Alfalfa Aphid (BAA), and Stem Nematode (SN).

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.

Research findings were communicated to growers, processors, and other clientele groups through diverse methods. The team shared their findings with the public in an accessible manner using social media educational campaigns and websites. Extension publications, including guides and circulars, are in development through team member collaboration. Presentations on the latest research discoveries were given to stakeholders at state, national and international conferences. Agricultural Science Center Field Days also showcased research discoveries from team members.

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

Pecan - Environmental stresses including prolonged drought, increased soil salinity, and extreme temperatures threaten this agriculture sustainability and the livelihoods of farming communities. Identification of genes and gene networks that can provide stress tolerance will greatly benefit the industry. For example, by identifying LEAP4 as a promising genetic target for stress tolerance in pecan, this study provides foundational knowledge for developing more resilient pecan cultivars through molecular breeding or biotechnological interventions. The findings have applications beyond agriculture, LEA proteins' desiccation tolerance could be harnessed for medical purposes, enabling improved tissue preservation and opening new avenues for biotechnology. Additionally, this research contributes to scientific understanding of LEA protein evolution and function across plant species, informing research on other perennial crops facing similar challenges. The insights generated support the goal of maintaining a stable, nutritious food supply by helping ensure pecan productivity remains viable despite changing environmental conditions.

Valencia Peanuts: Newly developed Valencia cultivars demonstrate enhanced productivity and profitability through improved resistance to soil-borne pathogens, reducing crop losses. They produce high-quality peanuts with a sweet flavor, four seeds per pod, and larger seeds, enabling access to premium markets. Adapted to the hot, dry conditions of eastern New Mexico and western Texas, these cultivars support yield stability and market competitiveness.

Short-day Onions - Our research demonstrated that our evaluation method reliably produced disease symptoms essential for developing disease resistance. Germplasm has been selected for lower disease severity. We have identified in onion a group of host plant compounds that appear to confer resistance to this disease. Selection for these compounds will aid in the development of FBR-resistant onion cultivars. Commercial seed companies can use this information and germplasm to develop FBR-resistant onion cultivars. This will result in improved onion cultivars that growers in New Mexico can use to improve their productivity.

Chile Pepper -Growers will benefit from knowing the potential water-stress tolerant varieties identified from implementing PEG treatment screenings of diverse chile pepper genotypes in the breeding program. The broader public will benefit from the activities of the project through contributing to the development of protocols to screen, select, and breed for water-stress tolerant pepper genotypes. Furthermore, the activities related to this project will provide training for a PhD student, helping develop a skilled scientific workforce. Outreach efforts through participation in commodity-based meetings (e.g., New Mexico Chile Conference) will help increase public understanding of drought tolerance in chile pepper.

Alfalfa - The alfalfa breeding and genetics program at NMSU provides need-based drought tolerant, multiple disease and pest resistant (MPR) germplasms and cultivars for New Mexico and adjacent areas.

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

The Genetic Enhancement in Crop Systems Team at New Mexico State University investigates, develops and provides valuable genetic resources and new cultivars to improve abiotic stress resilience and disease resistance in key, economically important crops produced in New Mexico.

Comments

Peer Reviewed Publications.

Pulicherla, S., Clermont, K., Prestenburg, E., Mattison, C.P., and **Randall, J.J.**, 2025. "Stress Regulatory Capabilities Discovered in Late Embryogenesis Abundant (LEA) Proteins Expressed During Pecan (*Carya illinoensis*) Kernel Development", *BMC Genomics* **26**, 845 (2025). <https://doi.org/10.1186/s12864-025-12040-8>

Cervantes, K., Heerema, R.J., Randall, J., 2025, Fungal community observations of fully watered and deficit-watered micropropagated rootstock pecan trees. *Acta Horticulturae* **10.17660/ActaHortic.2025.1420.25**

Meeting Abstracts:

Pulicherla, S., Mattison, C.P., Arnedo, D.A., **Randall, J.J.**, (2025), Responses of late embryogenesis abundant (LEA) genes reveal the potential of stress resilience in pecans, Plant and Animal Genomic Conference 2025. (poster).

Harmon, A., **Randall, J.J.**, (2025), Elucidating the role of allergen genes in *Carya illinoensis*' pollen and the human immune response. Plant and Animal Genomic Conference 2025. (poster)

Arnedo, D.A., Cervantes, K., Hilton, A.E., Pulicherla, S., Gabriel, P., **Randall, J.J.**, (2025), Heat Tolerance: A multifactorial genomic analysis. Plant and Animal Genomic Conference 2025. (poster)

Randall, J. J., XXVI Simposio Internacional de Nogal Pecanero 2025, Inifap, Hermosillo, Sonora, Mexico, "El Estudio de la genomica para decodificar el futuro en nogal pacanero", Scope: International, published in proceedings, Invited or Accepted? Invited. (September 2025).

Arnedo, D. A., Pulicherla, S., Randall, J. J., XXVI Simposio Internacional de Nogal Pecanero 2025, Inifap, Hermosillo, Mexico, "Interacciones moleculares de estrés abiotico y viviparidad en nogal pacanero:repuestas al calor, sequía y salinidad", Scope: International, Invited or Accepted? Invited. (September 2025).

Pulicherla, S., Randall, J. J., National American Pecan Scientist Meeting, American Pecan Promotion Board, Chicago, IL, "Exploring the genetics behind abiotic stress regulation in pecan", Scope: National, Invited or Accepted? Accepted. (July 2025).

Randall, J. J., National Pecan Scientist Meeting, American Pecan Promotion Board, Chicago, IL, "Trees for the future", Scope: National, Invited or Accepted? Invited. (July 2025).

Arnedo, D., Randall, J. J., National Pecan Scientist Meeting, American Pecan Promotion Board, Chicago, IL, "Under pressure: how pecan trees respond to heat, drought, salinity, and micronutrients", Scope: National, Invited or Accepted? Accepted. (July 2025).

Pulicherla, S., Randall, J. J., Arnedo, D. A., Western Pecan Growers Conference, Western Pecan Growers Association, Las Cruces, NM, "Pecans for Generations: Defying Heat, Drought, Salinity and Nutrient Deficiencies", Scope: Regional, Invited or Accepted? Invited. (March 2025).

Trade Magazine:

Cervantes, K., Mason, K., Sahithi, P., Gabriel, P., Randall, J. J. (2025). A bright future ahead: The USDA NIFA SCRI "Trees for the Future" grant.. *Pecan South*.
<https://www.pecansouthmagazine.com/magazine/issue/2025-07/>

Presentations:

King, J., The New Mexico Vegetation Management Association's Annual Conference, "Vegetable arthropod management" for Ruidoso, NM. (November 20, 2025).

King, J., CPI Chile Alliance Chile Chat, "Pepper pests and their management.", Las Cruces, NM. (November 5, 2025).

King, J. (Presenter), Lujan, P., Southwestern Branch Meeting, Entomological Society of America, "Get to know chile pepper pests and their IPM," Round Rock, TX. (March 26, 2025). Oral presentation. Invited.

King, J., Pesticide Applicators Program - Edgewood (Central Tri County SWCD), "Agricultural pests and IPM for Edgewood". Virtual/Zoom (September 16, 2025).

Apple rootstock trial with tall spindle system in New Mexico

Project Director

Shengrui Yao

Organization

New Mexico State University Main Campus

Accession Number

7005055



Apple rootstock trials with tall spindle system in New Mexico-2025 annual report

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

This apple rootstock trial was the first formal evaluation of apple rootstocks under high-density planting systems in New Mexico and has served as an important demonstration for fruit growers since its establishment in 2015. The year 2024 marked the final year of the 10-year commitment for the NC-140 project. Although no data were collected in 2025, the trial continued to be used as a demonstration site for visitors, pruning workshops, and Field Days.

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.

Over the past 11 years, we have evaluated the performance of these apple rootstocks, assessed their stress sensitivities, and identified G.890 as the most suitable rootstock for conditions in New Mexico. This information has been disseminated to growers and visitors through Field Days, pruning workshops, and the Annual New Mexico Fruit Growers Workshops.

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

Fruit growers and home gardeners in northern and central New Mexico will directly benefit from this project. Data generated from this trial will guide apple rootstock selection for the region. To date, G.890 has emerged as the preferred apple rootstock for high-density plantings.

During Alcalde Field Days and pruning workshops, this organic apple rootstock is consistently a popular stop, providing an effective opportunity to educate growers and home gardeners about appropriate apple rootstock selection in New Mexico.

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

During Alcalde Field Days and pruning workshops, this organic apple rootstock trial is consistently a popular stop for educating growers and home gardeners about apple rootstock selection in New Mexico. Visitors can also directly observe rootstock performance at the Alcalde site.

Cultivating Urban Landscapes: Empowering Communities with Extension Master Gardener Training and Programming

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7007071



Expanding Community Horticulture Capacity

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

Demand for research-based home horticulture information remains high following increased interest in home gardening. Ongoing volunteer training is essential to meet community demand and support environmental stewardship.

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.

- 17 counties and one tribal group
- 869 Extension Master Gardener Volunteers statewide
- New interns and veteran volunteers

Educational Activities

- 15-week asynchronous online training (87+ hours)
- Modules covering soil health, entomology, IPM, plant pathology, irrigation, pollinators, and arid-adapted plants
- Weekly live Q&A sessions
- Volunteer mentoring
- Minimum 30 volunteer hours (intern year)
- 10 continuing education hours annually for veterans

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

- 869 volunteers served statewide

- 25 donation gardens
- 41,368 pounds of produce donated to food banks
- \$1,256,511 estimated value of volunteer service (based on \$33.49/hour)

Volunteer workforce capacity equivalent to approximately 27 entry-level Extension agents, significantly expanding statewide Extension service delivery without additional personnel costs.

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

Master Gardeners increase access to research-based horticulture education, support food security through produce donations, strengthen environmental stewardship, and significantly expand Extension capacity statewide.

Nourishing New Mexico: Addressing Food Insecurity and Supporting Agricultural Sustainability

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7007072



NMSU Plant Diagnostic Clinic: Strengthening Crop Health and Biosecurity

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

New Mexico's \$3.99 billion agricultural sector includes a diverse array of specialty crops. Most farms are family-operated and lack in-house agronomic teams. Timely, accurate disease diagnostics are critical to preventing economic loss and ensuring regulatory compliance.

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 agents, producers, consultants, master gardeners, retailers, researchers, government agencies, and homeowners statewide.

Educational Activities

- Culture-based and molecular diagnostics

- Expanded biochemical and molecular testing
- Phytosanitary seed testing (including ToBRFV)
- Outreach through conferences, tours, and workshops
- IPM education for disease prevention

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

- 847 samples processed in 2024
- Projected 1,200+ samples in 2025 (~30% increase)
- 15% increase in chile industry seed samples
- 92% workshop attendees learned new disease management strategies
- 95% master gardener interns gained new diagnostic knowledge

By eliminating diagnostic fees through Extension channels, the clinic saved stakeholders an estimated \$36,000 while improving disease response timelines.

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

Accurate diagnostics reduce unnecessary chemical applications, protect biosecurity, prevent crop losses, and support the sustainability of high-value crops, including chile and pecans.

Genetic Improvement in the NM Cow Herd

Project Director
 LaJoy Spears
 Organization
 New Mexico State University Main Campus
 Accession Number
 7002255

Grant County Livestock Production Profitability

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

Cattle and calf income in New Mexico rose 63.8% from 2022 to 2024, yet herd inventories continue to decline. Producers face drought, rising input costs, regulatory pressures, aging demographics, and potential screwworm threats.

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.

49 cattle producers reached (2024–2025).

Response

Programs addressed:

- Beef Quality Assurance (BQA) certification
- Injection protocols and antimicrobial use
- Range monitoring and drought decision-making
- Virtual fencing
- Producer's mental health
- Drone use for herd and water management
- Succession planning
- Calving management
- Screwworm identification and prevention

A screwworm podcast expanded educational reach nationally and internationally.

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

2024 (37 survey respondents):

- 100% increased understanding of BQA and consumer trends
- 100% planned operational changes
- 100% increased range monitoring knowledge
- 100% increased awareness of mental health resources

2025 (12 producers):

- 100% increased drone knowledge
- 100% increased calving management confidence
- 100% increased succession planning knowledge
- 100% increased screwworm identification knowledge

One producer successfully resolved a dystocia case using skills learned, preventing economic loss.

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

Improved herd management, reproductive success, and disease prevention enhance profitability, sustainability, and risk mitigation for New Mexico cattle operations.

Growing New Mexico's Agriculture: Engaging Youth for the Future

Project Director

LaJoy Spears

Organization



AgXplorer: Advancing Youth Agricultural Literacy and Career Awareness

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

Many New Mexico youth are increasingly disconnected from agriculture, natural resources, and food production systems. With fewer young people pursuing agricultural careers, early exposure to agricultural science, technology, and career pathways is critical to workforce development and long-term sustainability of the agricultural sector.

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.

- Nearly 1,500 third- and fourth-grade students
- Schools across Doña Ana County
- 40+ presenters, volunteers, and educators
- Teachers and chaperones

Participants represented rural and urban schools, and many were experiencing hands-on agriculture for the first time.

Educational Activities

AgXplorer was delivered over four days at the NM Farm & Ranch Heritage Museum and Southern NM State Fairgrounds.

Students rotated through 16 interactive stations aligned with Extension pillars:

- Food and Fiber Production (livestock handling, dairy production, feed efficiency)
- Environmental Stewardship (soil and water conservation, pollinator health)
- Family Development and Health (nutrition education)
- STEM and Technology (drones, irrigation systems, ag mechanics)

Each session lasted 10 minutes and emphasized experiential learning, problem-solving, and career exploration.

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

- 100% of teachers reported valuable career exploration opportunities
- 95% of students learned something new about agriculture
- 95% could identify a career of interest
- 90% of presenters plan to return

- Students demonstrated increased awareness of agriculture's integration with science, technology, and local economic systems, reinforcing early exploration of workforce pathways.

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

AgXplorer builds agricultural literacy, increases STEM engagement, and strengthens youth awareness of career pathways that support local food systems and economic vitality.



Increasing Youth Understanding of Food and Fiber

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

Research shows many Americans are agriculturally illiterate, with most consumers several generations removed from production agriculture. Agricultural literacy influences public perception of modern food systems and supports informed decision-making.

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.

- 135 students (K–8) in Carlsbad
- 305 students (8–9) in Artesia
- 90 students (K–5) in Loving
- Total: 530 students

Educational Activities

The agent delivered 16 classroom programs using NMPED-approved curriculum.

Topics included:

- Ruminant digestion
- Food waste
- Cattle byproducts
- Nutritional value of zinc, iron, and protein
- Grazing benefits on marginal land
- Monogastric vs. polygastric systems

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

- 97% learned the correct definition of ruminant digestion
- 95% learned the difference between simple and ruminant stomach systems

- 90% developed more positive views of cattle grazing
- 88% learned about cattle-derived medical byproducts
- 80% learned that 98% of a cow is utilized

Students demonstrated improved understanding of cattle's role in food systems, ecosystem management, and consumer products, strengthening agricultural literacy and informed consumer awareness.

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

Improving agricultural literacy strengthens consumer understanding of food production, supports informed public dialogue, and builds future workforce awareness.



New Mexico Youth Ranch Management Camp

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

The average age of livestock producers exceeds 60. Engaging youth is essential for industry succession and workforce sustainability.

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.

30 youth (ages 15–19) from NM, U.S., and Mexico.

Five-day camp covering:

- Beef production
- Agricultural economics
- Natural resources
- Range management
- Ranch planning

Youth worked in teams to develop and present comprehensive ranch management plans.

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

- 30 youth exposed to agricultural career pathways
- All participants completed public presentations
- Alums have pursued agricultural degrees or returned to family ranch operations, reinforcing workforce pipeline development and industry succession. Post-program evaluations indicated increased confidence in ranch planning, financial decision-making, and public speaking skills.

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

Builds future agricultural leaders, strengthens workforce pipelines, and supports the long-term viability of New Mexico's livestock industry.

Effects of arginine supplementation during early gestation on fetal development

Project Director

Eric Scholljegerdes

Organization

New Mexico State University Main Campus

Accession Number

1025673



Effects of arginine supplementation during early gestation on fetal development

Final Result

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

Nutrient supply during pregnancy is critical for proper development of offspring.

Supplements specifically formulated to increase the nutrient supply to the fetus may allow for development to occur in these situations.

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.

Poor nutrition during early pregnancy is common in cow-calf operations in the desert Southwest and can interfere with proper placental development. Early gestation is a critical time when the placenta is forming and establishing the blood supply that delivers nutrients and oxygen to the growing calf. Our research examined how limiting a heifer's feed intake during this period affects the signals in the placenta that control growth and development. We found that nutrient restriction altered key biological signals that help regulate placental function, confirming that poor maternal nutrition can disrupt the early environment needed to support the fetus.

We also tested whether supplementing rumen-protected arginine could help offset some of these negative effects. Arginine is a nutrient known to support blood vessel development and growth-related processes. Results showed that providing arginine changed some of the placental signals affected by nutrient restriction, suggesting it may help support placental function during periods of limited nutrition. Although not all measurements were affected, the study demonstrates that targeted supplementation during early pregnancy has the potential to help protect fetal development when cows are grazing under challenging environmental conditions.

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

Livestock producers benefit from this research because it helps identify practical strategies to protect pregnancy success and future calf performance during times of limited forage or drought. In many desert Southwest operations, cows and heifers experience some level of nutritional stress during early gestation. This is a critical period when the placenta is forming and establishing the nutrient supply to the developing calf. If placental development is compromised, calves may be born lighter, grow more slowly, or have reduced long-term productivity.

This research shows that nutrient restriction alters important placental signals tied to growth and development, but it also demonstrates that targeted supplementation with rumen-protected arginine can influence those same biological pathways. For producers, this means there may be specific windows during early pregnancy when strategic supplementation could help maintain placental function and support fetal development—even when feed resources are limited.

Ultimately, improving placental efficiency can lead to healthier calves, improved growth, better reproductive performance in replacement females, and greater lifetime productivity. By identifying when and how supplementation may be most effective, this work helps producers make more informed, cost-effective nutrition decisions that improve herd performance and long-term profitability.

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

First, improving nutrition strategies for pregnant beef cattle helps ranchers raise healthier calves, even during drought or limited forage conditions common in the desert Southwest. Healthier calves are more likely to survive, grow efficiently, and reach market weight successfully. This supports a more stable and reliable beef supply, which benefits consumers through consistent food availability and potentially more stable prices.

Second, identifying targeted supplementation strategies—such as using rumen-protected arginine during early pregnancy—can improve efficiency rather than simply increasing feed use. This means producers may be able to support animal health without dramatically increasing feed inputs. Greater efficiency reduces waste, improves nutrient use, and can lower the environmental footprint of beef production by minimizing unnecessary resource use.

Third, stronger calf development early in life can reduce long-term health and productivity problems. Animals that start life with better placental support often have improved growth, immune function, and reproductive performance. This reduces the need for medical treatments and lowers losses in the production system, which benefits both producers and consumers. While findings in cattle cannot be directly applied to people without clinical research, this work strengthens our understanding of how early maternal nutrition influences placental development and long-term health outcomes.

Finally, this work strengthens the resilience of livestock systems in arid and semi-arid regions. As climate variability increases, strategies that help animals cope with nutritional

stress will be increasingly important. By helping ranchers maintain productivity under challenging conditions, this research supports rural economies, food security, and the long-term sustainability of beef production systems that many communities depend on.

Comments

Due to drought, Objective 2 was not conducted. Research animals to be used for this experiment had to be sold due to lack of available forage.

Critical Issue

Water Use and Conservation

Alternative Crops, Cropping Systems, and New Crop Pests for New Mexico Drought Conditions

Project Director

Sangamesh Angadi

Organization

New Mexico State University Main Campus

Accession Number

7006662



Alternative Crops for Water Limited Systems 2025 Report

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

In spite of large variations in farm sizes in New Mexico, water and water-related stresses are the most limiting factors for crop productivity and farm economy for all farmers in the state. This project is trying to find crop and management alternatives to address those challenges by using multiple approaches that include researching on industrial crops like guar and winter canola for large farmers, halophytes for farms with salinity issues, medicinal and spice crops like calendula, marshmallow and saffron crops for small farms as well as finding management solutions for irrigation, planting, soil microbiome, pests and weeds.

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.

Projects from this group conducted a wide variety of research activities during 2025, which are highlighted below. Guar and winter canola are potential alternative crops for large farms in the state, and these have high demand for industrial use like fracking by oil and natural gas, edible oil and many other industries. Guar research focused on agronomic management, salinity tolerance in collaboration with USDA-ARS Salinity Lab,

demonstration and outreach activities and inclusion in teaching curriculum. Winter canola research focused on developing better-adapted cultivars and hybrids for New Mexico and understanding radiation and water use relationships. The National Winter Canola Variety Trial was conducted at Clovis in collaboration with Kansas State University's public breeding program. Winter canola varieties are relatively new in the US and hybrids are even newer. Therefore, the results of this research will provide better-adapted winter canola open-pollinated cultivars and hybrids for the region. Understanding the radiation use patterns of winter canola may provide knowledge to better manage irrigation water resources more efficiently.

Working on medicinal plants, the research identifies pathways to agricultural resilience for arid and semi-arid small farms. High-value crops with medicinal properties are being cultivated using organic farming practices. Nine plant species were grown for one year and will be monitored for establishment, yield, growth traits, and quality for the next two years. First-year data indicate that calendula (*Calendula officinalis*) and marshmallow (*Althaea officinalis*), and clary sage were the most successful. Clary Sage flowers were harvested and essential oil was distilled from the flowers.

Saffron, a high-value and low-input crop, shows strong potential for this region, but specific production guidelines for the region are limited. Saffron research plots were established at the Alcalde Sustainable Agriculture Science Center using three irrigation levels and three planting dates in both high-tunnel and open-field environments. By harvesting saffron flowers for two consecutive years (2024 and 2025) and measuring flowering time, flower counts, and stigma yields, we generated multi-year data to understand how saffron performs under northern New Mexico's climate. These activities directly support our goal of identifying production practices that make saffron a viable, water-efficient crop for regional farmers.

Strategic planning for appropriate rotation crops in time and space to achieve higher production and resource-use efficiency is needed in the state. A long-term study was initiated at Tucumcari, NM to evaluate the water use productivity of 9 alternate cropping systems that include grasses, millets, and legumes under limited irrigated conditions. The crop rotations includes both winter and summer crops. We planted barley, cowpea, guar, and sorghum crops in the summer of 2025. The results showed the highest seed and forage yields in sorghum, followed by cowpea. Barley and guar stands are thin. Data analysis in progress. We planted Winter Austrian Pea and barley in the winter of 2025 as part of the rotation. Alternate cropping to achieve higher resource use efficiency (especially water and nutrients) and productivity will not only generate higher farm-level income to the producers but also promote broader marketing and economic opportunities in New Mexico.

Weed control is a major issue in perennial grass pasture and hay systems due to the inherent weak competition of grasses and the lack of effective herbicides, particularly those that control grassy weeds. The umbrella group responded by developing research evaluating various rates of an herbicide (imazapic; Plateau) labeled for use in many grass species, but mostly unknown to forage producers or unutilized in the state. Varying rates (from low to high) of Plateau were applied (May 23, 2025) to grass species: tall fescue, smooth brome, meadow brome, green wheatgrass, and two native species, western wheatgrass and galleta. Injury ratings were documented every 2 weeks for up to 8 weeks.

All grasses tolerated the lowest (4 oz/ac) rate of herbicide, although growth was suppressed on the first harvest following treatment compared to the untreated. Tall fescue was the most sensitive to the higher treatment rates (6 and 8 oz/ac), and some stand loss occurred. Native grasses (Western Wheatgrass & Galleta) tolerated the herbicide best of all the grasses, even the high rates.

To assess soil-borne pathogens, the research focused on the relation of water, salinity, and their interactive effects on pathogens and beneficial microbiome, especially beneficial fungal species. In a collaborative work, a review was compiled and published on the effect of irrigation on *Phytophthora capsici*, a major pathogen of vegetable crops, including chile pepper. Currently, work is underway to explore the role of endophytic microorganisms in the resilience of weeds in ecological habitats with extreme environmental conditions. The goal is to harness endophytic microbiome from weeds to enhance crop fitness and tolerance to biotic and abiotic stresses.

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

The main goal of this group is to develop crop alternatives and management practices for them in water-stressed environments of New Mexico. Different agroclimatic zones in the state have their own unique challenges and one or a few crops will not address all the challenges. So many crops and their management practices are focused by this group and will be continually looking for other alternatives. Developing information on these alternative crops will be a great resource for the farming industry and creating awareness. Adoption of these alternative crops will depend on many aspects, including farm policies and insurance availability. Each group of researchers are making their own effort in communicating information to clientele through field days, workshops, demonstrations, farm tours, one-on-one producer visits, regional conferences, annual reports, extension publications, etc. Summarising multiyear research on saffron flowering and yield information and communicating all related data will make farmers think how saffron could fit into their production systems. Identification of resource-efficient alternate cropping systems to replace partial fallow in the current semi-arid cropping systems will have a potential production impact on more than 200,000 acres, accounting to approximately 27% of total agricultural production area in New Mexico and the impact can be much more substantial when applied to similar environments globally. The effort to harness endophytic microbiome from weeds to enhance crop fitness and tolerance to biotic and abiotic stresses will be significant in our environment. Producers can utilize this new knowledge to assess the impacts on several different common species grown in New Mexico and determine if weed control is worth the potential risk of injury to their pastures. The latest Agriculture Census data is showing the benefit of this kind of research (e.g., adoption of guar in New Mexico).

It is also important to think if expanding organic systems can support small farms to achieve the water demand reductions needed to preserve cultivation across agricultural valleys while also achieving overall agricultural resilience. Organic systems could be critical for resilience, and our project will identify crops and practices that are culturally relevant to small farmers in the southwest. In addition, this project will offer cultivation practices for medicinal plants.

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

In general, the world is flooded with information on the top 5-6 crops, and information on much-needed alternative crops, including medicinal, spice and other food crops, is limited. Our research on crops that are well adapted to semiarid and arid environments and understanding management practices that can improve adaptability or profitability of these crops will be conducted. This is valuable and important for clientele in the state but also in other water stressed environments. The information generated can help the general public by informing our efforts to reduce the water foot print of agriculture and also developing crops that can contribute for local bioeconomy. Peer-reviewed publications and presentations in national and international conferences disseminate information to a wide audience.

The impact will improve strategies and models to optimize water use and crop production in the southwest. High-value crops that perform well and use less water will be characterized and this work will be disseminated regionally and nationally, and the study will be published in a peer review article. Medicinal crops that were successfully grown in our study will serve as examples for farmers and also for local herbalists looking to purchase locally grown herbs. By demonstrating over two years of results that saffron can perform well under drought-prone conditions, this project supports diversification of local agriculture and the development of new economic opportunities. Expanded outreach efforts also help increase public awareness of how alternative, low-input crops like saffron can strengthen community adaptability to water limitations and changing climate conditions.

Presentations and demonstrations on guar and guar gum and its importance were delivered to high school students participating in the New Mexico State FFA conference. Similarly, presentations and demonstrations on guar and guar gum were delivered to the general public at the NMSU College of Agriculture, Consumer and Environmental Sciences Open House held on campus. High school students were involved in summer internship through the Dona Ana County internship program.

New Mexico forage and livestock industries account for over \$2.5 billion annually, impacting both directly and indirectly consumers of animal-based products. Forages constitute a large proportion of the livestock diet, and high-quality pasture and feed are necessary for meat and milk production and proper animal performance. This research provided an opportunity to improve livestock-system efficiency and increasing products on the market, while showcasing how Extension is continually striving to use research-based information to educate hay and pasture producers on methods to increase farm sustainability and profitability and protect animal health.

Sustainable Management of Water Resources

Project Director

Alexander Fernald

Organization

New Mexico State University Main Campus



Post Fire and Flood: Identifying and Assessing AgroEcosystem Health for Land Management

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

Wildfires and floods in the southwestern United States pose significant threats to agroecosystem health, impacting soil quality, water resources, and biodiversity. These disturbances make it challenging for land managers and farmers to sustain productive, resilient landscapes. This proposed project will address the need for comprehensive assessment and monitoring of soil, water, and ecosystem conditions to support informed post-disturbance land management decisions.

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 funding of this proposal will allow our team to collect a wide range of data, including water quality, soil properties, streamflow observations, acoustic monitoring of wildlife, GIS and remote sensing data, and feedback from community outreach and Extension activities. We will develop new hydrologic models using these data to evaluate post-fire and flood impacts on agroecosystem health. These activities will provide a detailed, data-driven understanding of ecosystem conditions and management needs following disturbances.

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

The development of predictive models on post-fire and flood impacts provides farmers, land managers, and extension professionals with timely, actionable information on soil health, water availability, and ecosystem conditions. Educational materials, fact sheets, visualizations, and model outputs make this data practical for land management planning, while stakeholder feedback ensures the results address community and agricultural needs.

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

The broader public will benefit from improved management of lands affected by wildfires and floods, leading to healthier soils, water resources, and wildlife habitats. Publicly available datasets, visualizations, and outreach materials will increase awareness of ecosystem resilience and climate impacts. These efforts contribute to long-term environmental sustainability, food security, and the economic and ecological well-being of communities in the southwestern United States.



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

New Mexico and the southwestern United States are facing increasing water scarcity due to reduced surface water, declining aquifer levels, and rising demand from communities, agriculture, and ecosystems. This scarcity threatens economic health, food security, and environmental sustainability. The project addresses the need for comprehensive understanding of residential attitudes toward the use of conservation practices in the management of water resources to ensure equitable and sustainable use for people, agriculture, and wildlife.

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.

We conducted an online survey of 1,657 residents across New Mexico and Arizona to assess their attitudes toward water conservation and the actions they take to conserve water. Our analysis examined how these attitudes and behaviors varied across demographic groups, including age, gender, ethnicity, household composition, education, and agricultural water use. These results provide a baseline understanding of residential water conservation perspectives in the semi-arid Southwest, informing future outreach, education, and policy strategies.

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

The published results of this project will allow researchers to gain a better understanding of water conservation attitudes and practices. The findings of this project point to additional research questions that may help direct future work on understanding influential dynamics guiding residential perspectives of water conservation in the Southwest region.

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

The project advances sustainable water management by improving researchers' understanding of how residents think about and practice water conservation. This knowledge helps inform strategies that support greater food and economic security in New Mexico and the broader Southwest. Collectively, these efforts benefit the broader public by promoting long-term environmental health, economic stability, and improved quality of life for residents across the region.

Project Director
April Ulery
Organization
New Mexico State University Main Campus
Accession Number
7006726



Water Quality and Availability in New Mexico 2025 Results

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

New Mexico communities and those around the western U.S. are experiencing increased severity and frequency of droughts. In New Mexico, farmers and ranchers are worried about the sustainability of future water supplies. Our goal is to understand and document water quality issues and offer recommendations for sustainable productivity.

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.

Numerous water, wastewater, and soil samples were collected and analyzed from various sources around New Mexico and the southwestern USA. A project sampling 18 sites in the Rio Hondo watershed near Taos was wrapped up and reported mostly excellent water quality with regard to potential contaminants. Results were shared with the public through fact-sheets and community outreach.

Water wells across the NMSU Corona Range and Livestock Research Center have been periodically sampled since 1989. Across sampling years, mineral concentrations differed by well but followed some consistent patterns. The New Mesa and Ortiz wells showed the greatest concern due to recurring elevated sulfate concentrations (generally 1,300–2,100 mg/L), which create periodic risk for young or stressed cattle, even though total dissolved solids remained in an acceptable range for mature animals. Johnson Well consistently had the most favorable overall profile, with lower total dissolved solids and only mild sulfate elevation in recent samples. North Camp/Nalda sources were moderately mineralized with elevated sulfate when measured, while Chute Well showed the highest total dissolved solids historically, but still within ranges usable for beef cattle. Hauled municipal water (Village of Corona) was the highest quality source overall, aside from elevated iron, which is primarily an aesthetic or equipment concern rather than a livestock health risk.

A site visit was made to The Club at Las Campanas to assess irrigation performance concerns at the golf course and investigate the causes of clogged sprinkler heads and filters that had led to uneven water distribution and turf stress. Water used for irrigation is sourced in part from a nearby municipal wastewater treatment plant. During the visit, a sample of incoming irrigation water was collected and analyzed under a microscope. The sample contained protists, most likely ciliates, which are commonly found in biologically active or nutrient-rich environments. These organisms are indicative of high organic loading and microbial activity. Ciliates alone are unlikely to directly cause mechanical

clogging, but they contribute to the development of biofilms within the system. Their presence indicates excess organic matter and microbial growth, which can accelerate clogging in filters and emitters. Fine particulate matter and biological solids are likely entering the system with insufficient removal during wastewater treatment.

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

Documenting the quality and availability of New Mexico water supplies benefits both target audience and the broader public. Work done at the Corona Research Center resulted in recommendations to manage sulfate exposure rather than total salinity, since sulfate represents the most likely nutritional and health limitation. Cattle ranchers should prioritize lower-sulfate water sources for young calves, newly received cattle, or animals under nutritional stress, and consider blending higher-sulfate water with lower-sulfate water during high-risk periods. Monitoring sulfur intake from feed and supplements is also important when using groundwater wells to avoid compounding total sulfur intake. Periodic water testing should continue, particularly during drought or changes in water table conditions, because sulfate concentrations can fluctuate substantially over time. Overall, the water resources appear adequate for mature beef cattle with targeted management during sensitive production stages.

Findings from the Las Campanas Golf Course indicated that the Municipal Water Treatment Plant should review and enhance their current treatment procedures for effluent water supplied to the golf course. Specifically, solids should be removed prior to discharge, particularly suspended solids, organic material and biological load. It was also recommended that treatment steps such as filtration and disinfection be upgraded or added.

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

At least twelve peer-reviewed journal articles have been published and several presentations made at professional meetings that share the results of this project. A list of the papers is listed in the comments section. Taos Soil & Conservation District and local community members were advised of Rio Hondo water quality through outreach and fact-sheets. Although the heavy biological load from the municipal water treatment plant was detected at a golf course, the recommendations made by our faculty will enhance and improve the water quality for all of the end users (including the broader public) in the area.

Comments

Funds from this project were used to support one graduate student's travel to the Soil Science Society of America annual conference, where he presented his research. Several other graduate and undergraduate students were advised by faculty members on this project, including assisting with sample collection and analysis.

Peer-reviewed papers:

1. Chuanjun Zhan, C., J.J. Jiao, Y. Ma, H. Wang, M.R. Soltanian, K.C. Carroll, Z. Dai (2025) Impacts of validation strategy and geological complexity on machine learning-based subsurface structure modeling. *Journal of Hydrology*, 666, 134797, ISSN 0022-1694, <https://doi.org/10.1016/j.jhydrol.2025.134797>.
2. Soltanian, M.R., C.D. Wallace, F.P.J. de Barros, Z. Dai, and K.C. Carroll (2025) Fluid stretching at facies interfaces governs solute transport. *Geophysical Research Letters*, 52, e2025GL119033. <https://doi.org/10.1029/2025GL119033>.
3. Yin, H., S.J. Ikard, D.F. Rucker, S.C. Brooks, Z. Dai, and K.C. Carroll (2025) Imaging hyporheic exchange by integrating deep learning and physics-informed inversion of time-lapse self-potential data. *Geophysical Research Letters*, 52, e2025GL118772. <https://doi.org/10.1029/2025GL118772>.
4. Yin, H., K.C. Carroll, Yuan, Y., Jamil, A., Rucker, D.F., Dai, Z., & Soltanian, M.R. (2025) Hybrid vision transformer with convolutional blocks approach for subsurface electrical resistivity tomography inversion. *Journal of Geophysical Research: Machine Learning and Computation*, 2, e2025JH000734. <https://doi.org/10.1029/2025JH000734>.
5. Xua, L., Z. Dai, Y. Du, X. Zhang, H. Yin, M.R. Soltanian, H.V. Thanh, M. Cai, and K.C. Carroll (2025) Second-order degradation modeling and multiscale feature fusion for high-fidelity segmentation of low-quality digital rock images. *Geophysical Research Letters*, 52, e2025GL117039. <https://doi.org/10.1029/2025GL117039>.
6. Moeini, F., K.C. Carroll, Z. Dai, and M.R. Soltanian (2025) Vadose Zone Inverse Modeling of Pneumatic Pumping Tests at the Hanford Site: Influence of Barometric Pressure Fluctuations. *Science of the Total Environment*, 1001, 180526, ISSN 0048-9697. <https://doi.org/10.1016/j.scitotenv.2025.180526>.
<https://doi.org/10.1016/j.scitotenv.2025.180526>.
7. Abbott III, J.B., G.R. Tick, N.H. Akyol, and K.C. Carroll (2025) Characterizing Equilibrium Dissolution of Trichloroethene and Toluene from Binary NAPL Mixtures as a Function of Molecular Structure. *Journal of Hazardous Materials*, Volume 498, 139889, ISSN 0304-3894. <https://doi.org/10.1016/j.jhazmat.2025.139889>.
8. Noyes, C., G. Ferguson, A. Seltzer, J. Ng, K.C. Carroll, R. Tyne, K. Markovich, R. Purtschert, M. Stute, J. Severinghaus, and J.C. McIntosh (2025) Variations in groundwater recharge and water table elevations across the Holocene in a semi-arid alluvial basin. *Water Resources Research*, 61, e2024WR037606. <https://doi.org/10.1029/2024WR037606>.
9. Cao, Y., Z. Dai, H. Wang, X. Zhang, M.R. Soltanian, H. Yin, and K.C. Carroll (2025) Stepwise Identification of Geochemical Processes and Parameters for Chromium Reactive Transport in Heterogeneous Porous Media. *ACS Earth and Space Chemistry*, 9 (9), 2230-2244. DOI: 10.1021/acsearthspacechem.5c00077.
10. Dai, Z., C. Zhan, H. Yin, J. Chen, L. Xu, Y. Xia, S. Yang, W. Chen, M. Cao, Z. Du, X. Zhang, B. Yan, Y. Ma, H. Wang, F. Moeini, M.R. Soltanian, and K.C. Carroll (2025) Incorporating Deep Learning into Hydrogeological Modeling: Advancements, Challenges, and Future Directions. *Journal of Geophysical Research: Machine Learning and Computation*, 2, e2025JH000703. <https://doi.org/10.1029/2025JH000703>.

11. Yuan, Y., K.C. Carroll, M.K. Shukla, D.F. Rucker, E.H. Fuchs, A.J. Pearson, C.-H. Tsai, and D. Humberson (2025) Intermittent and Transient River-Groundwater Transitions from Disconnection to Connection. *Water Resources Research*. 61(6), e2024WR038069. <https://doi.org/10.1029/2024WR038069>.
12. Ma, Z., L. Qi, Z. Dai, Z. Yang, Y. Ma, D. Wang, K.C. Carroll, and M.R. Soltanian (2025) Impact of multiscale heterogeneous sediments and boundary conditions on dispersivity spatial variations. *Water Resources Research*, 61(6), e2024WR039151. <https://doi.org/10.1029/2024WR039151>.

Water Wise: Educating for Conservation in New Mexico

Project Director

LaJoy Spears

Organization

New Mexico State University Main Campus

Accession Number

7004640



Cozy River Valley: An Educational Game to Teach Conjunctive Surface and Groundwater Management

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

Water management in arid agricultural regions requires balancing tradeoffs among crop production, aquifer sustainability, ecosystems, and community needs. In New Mexico, interactions between surface water and groundwater in river valleys complicate irrigation decision-making. Explaining conjunctive water-use concepts to youth and adult learners can be challenging when using traditional instruction alone. Understanding these dynamics is critical for preparing future agricultural producers, natural resource professionals, and informed community members. To address this need, New Mexico State University partnered in a USDA-NIFA-funded multistate project led by UC Merced to develop a digital educational game that models irrigation tradeoffs and watershed impacts.

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.

Cozy River Valley was designed primarily for high school and college students but has also been implemented with middle school youth, agricultural professionals, and adult Extension audiences. Among 72 study participants, 65% (n=47) were young adults ages 18–24. The game provides an interactive learning environment where players make

irrigation decisions, respond to drought, and balance agricultural productivity with environmental stewardship.

Educational Activities

Cozy River Valley is a digital educational game developed by the NMSU Learning Games Lab in collaboration with the New Mexico Water Resources Research Institute and multistate partners under a USDA-NIFA-funded project led by UC Merced. The game was showcased at the Western Pecan Growers Conference and the National Association of Colleges and Teachers of Agriculture (NACTA) Conference. In 2025, the game was played 8,412 times. Data were collected to assess participant engagement, understanding of water tradeoffs, and perceived learning outcomes.

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

Among 42 survey respondents, 95% (n=41) reported enjoying the game. Sixty-two percent (n=26) strongly agreed, and 29% (n=12) somewhat agreed that the game expanded their understanding of how farmers make water management decisions. Ninety-three percent (n=41) indicated intent to share the game with others, including college students, high school students, middle school youth, agricultural professionals, and community members. These findings suggest strong engagement and perceived knowledge gains in conjunctive water-use decision-making. Additional data analysis is ongoing to assess the educational impact further.

The project was developed by the NMSU Innovative Media Research & Extension team in collaboration with the New Mexico Water Resources Research Institute, led by Alexander Fernald. Content expertise was provided through the Sustainable Water Futures project led by Joshua Viers at the University of California, Merced. Richard Heerema, NMSU Extension Pecan Specialist, contributed to development and formative testing.

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

Cozy River Valley increases public understanding of the complex trade-offs in water management in arid agricultural systems. Through interactive gameplay, participants explore how irrigation choices influence aquifer levels, river systems, and community outcomes. In 2025, the game was played 8,412 times, demonstrating broad engagement. Evaluation data indicate increased understanding of the trade-offs in conjunctive water management and of system interdependence. By strengthening water literacy among youth and agricultural stakeholders, the program supports informed decision-making, sustainable resource management, and long-term resilience in water-limited regions.



Agrivoltaics for Water Conservation and Crop Resilience in Rio Arriba County

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

Rio Arriba County's small farms rely on acequia irrigation systems and face increasing drought pressure, frost events, hail damage, and irrigation limitations. Water scarcity and weather variability threaten crop productivity and village sustainability. Producers require innovative systems that conserve water, protect crops, and reduce energy costs while maintaining agricultural viability.

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 partnered with a local producer, Sandia National Laboratories, Skysun, and Jemez Mountain Electric to construct a 4-kilowatt agrivoltaics microgrid system at the Gonzales Farm in Los Luceros.

Key features:

- 10 solar modules (270W each)
- Adjustable panel system allowing tractor access
- On-site power generation for irrigation pumps
- Microgrid energy storage for use during outages
- Weather protection from hail, frost, and sun scorch

Installation was completed in 14 days for \$10,987.50.

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

- 90% of small crops are projected to survive hail events under panel coverage.
- Initial crop harvest completed without weather damage.
- Reduced irrigation and energy costs through on-site solar generation.

- Increased producer interest in grant funding to expand agrivoltaics systems countywide.

Participants demonstrated increased awareness of dual-use solar systems as tools for water conservation and crop protection.

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

Agrivoltaics integrates renewable energy production with water-efficient agriculture. By reducing irrigation energy costs, protecting crops from extreme weather, and improving water-use efficiency, this system strengthens small-farm resilience in drought-prone regions. The microgrid design also enhances rural energy reliability during outages. Scaling agrivoltaics supports sustainable agriculture, renewable energy adoption, and long-term water conservation in New Mexico's acequia communities.



Turfgrass Irrigation Water Conservation Using Subsurface Drip Irrigation

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

Urban growth and landscape development continue to increase demand on limited potable water supplies in New Mexico. Recreational turf areas, including parks, golf courses, athletic fields, and residential lawns, are commonly irrigated with traditional sprinkler systems that result in overspray, evaporation loss, runoff, and wind drift. Improving irrigation efficiency is critical to conserving water while maintaining functional green spaces that support recreation, cooling, and erosion 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.

Homeowners, golf course irrigators, turf managers, and landscape professionals are responsible for irrigated urban landscapes.

Extension delivered:

- One conference presentation
- Two online seminars
- One hands-on workshop

Programming focused on the installation, operation, and maintenance of subsurface drip irrigation (SDI) systems. Educational content emphasized improved distribution uniformity,

reduced evaporation loss, and direct rootzone water application compared to conventional sprinklers.

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

- 100% of participants reported gaining new knowledge about SDI systems.
- 94% indicated intent to install SDI or improve existing irrigation systems.

Participants demonstrated increased understanding of efficient irrigation design and water conservation strategies for turf systems.

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

Subsurface drip irrigation reduces water loss from evaporation, runoff, and wind drift while maintaining recreational turf quality. Improving irrigation efficiency in urban landscapes contributes to potable water conservation, reduced infrastructure strain, and long-term sustainability of green spaces that mitigate urban heat and support community recreation. Enhancing irrigation practices strengthens responsible water stewardship in water-limited regions.



Western Pecan Growers Webinar: Improving Orchard Floor Management and Profitability

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

Pecan growers face rising production costs, declining prices, insect pressure, weed challenges, and weather variability. Timely management information is critical to sustaining orchard profitability.

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.

30 pecan growers across NM, AZ, CA, and TX.

Educational Activities

A 2.5-hour Zoom webinar included:

- 60-minute presentation on cool-season orchard floor vegetation management
- Four regional grower reports (one per state)
- 30-minute USDA FSA program update
- 1 CEU for pesticide license holders

13 participants received CEUs.

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

Of survey respondents (30% response rate):

- 100% received useful information
- 100% will apply practices in orchards
- 100% plan to attend future webinars

Participants highlighted weed and herbicide management as particularly valuable.

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

Pecans contribute \$168 million to New Mexico’s agricultural economy. Improved orchard floor management supports profitability, sustainability, and long-term industry viability.

Type
Projects / Programs without a Critical Issue
Not Provided

Projects / Programs
0