

2023

AES

# IMPACT REPORT

## NMSU ACES AGRICULTURAL EXPERIMENT STATION

The College of Agricultural, Consumer, and Environmental Sciences (ACES) is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through research, teaching and extension.



**BE BOLD. Shape the Future.**  
**College of Agricultural, Consumer  
and Environmental Sciences**  
Agricultural Experiment Station

[aes.nmsu.edu](http://aes.nmsu.edu)

# MISSION

The Agricultural Experiment Station system supports fundamental and applied science and technology research to benefit New Mexico's citizens in the economic, social, and cultural aspects of agriculture, natural resources management and family issues.

**The Agricultural Experiment Station (AES)** is the principal research unit of the College of ACES. The AES system consists of scientists who work at the NMSU main campus in eight academic departments and at twelve agricultural science and research centers throughout the state. The AES system supports fundamental and applied science and technology research to benefit New Mexico's citizens in the economic, social, and cultural aspects of agriculture, natural resource management, and family issues.

AES scientists develop research programs that address key needs identified by advisory committees and local stakeholders. Each Agricultural Science Center (ASC) responds to specific research needs **within** New Mexico's varied geographical and environmental conditions. These research efforts sustain and support New Mexico's diverse environment, farms, ranches, forests, and rural and urban communities.

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Figure 1 (RIGHT): AES is part of the NMSU land-grant tripartite system with a mission to teach, conduct research, and provide extension and outreach to communities.



# AES SYSTEM

**NMSU AES CONSISTS OF 12 AGRICULTURAL RESEARCH AND SCIENCE CENTERS, VERL, AND EIGHT ACADEMIC DEPARTMENTS WITHIN ACES.**

## Agricultural Science Centers

- Alcalde Sustainable Agricultural Science Center
- Artesia Agricultural Science Center
- Chihuahuan Desert Rangeland Research Center
- Clayton Livestock Research Center
- Clovis Agricultural Science Center
- Corona Range and Livestock Research Center
- Fabian Garcia Research Center
- Farmington Agricultural Science Center
- Leyendecker Plant Science Center
- Los Lunas Agricultural Science Center
- John T. Harrington Forestry Research Center at Mora
- Rex E. Kirksey Agricultural Science Center at Tucumcari
- Veterinary Entomology Research Lab (VERL)

## Agricultural Experiment Station

## Research Departments

- Agricultural and Extension Education
- Agricultural Economics & Agricultural Business
- Animal & Range Sciences
- Entomology, Plant Pathology, & Weed Science
- Family and Consumer Sciences
- Fish, Wildlife & Conservation Ecology
- Plant and Environmental Sciences
- Hotel, Tourism, & Restaurant Management





# AES FUNDING



**AES WAS CREATED BY THE  
FEDERAL HATCH ACT OF 1887 AND  
WAS CONSTITUTIONALLY  
MANDATED IN NEW MEXICO IN 1915.**

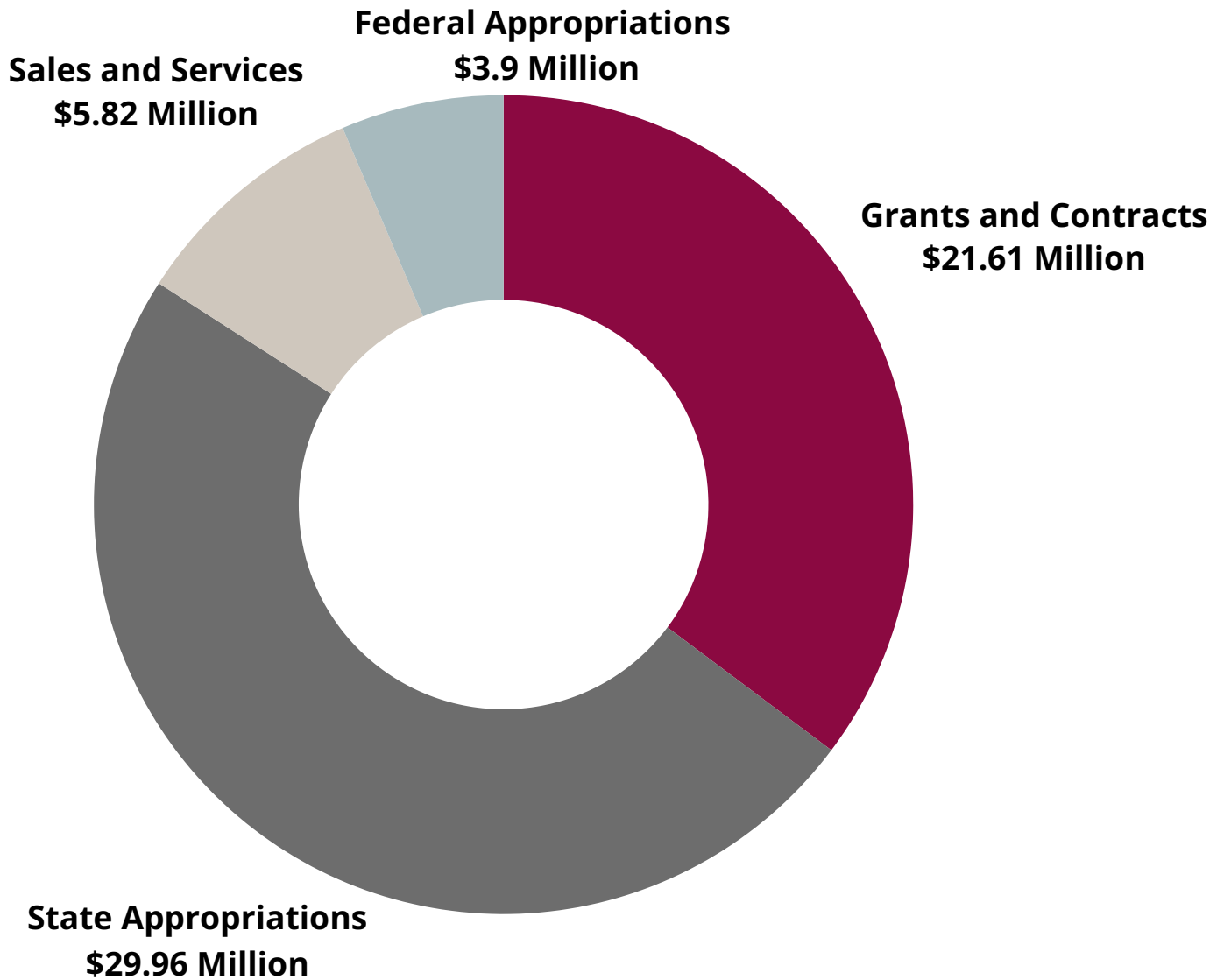


Figure 3: In FY23, the AES total amount of operating revenue was \$61.29 million. The College of ACES continues to lead NMSU in grants awarded and expended; the College of ACES faculty, staff, and students work hard to ensure New Mexico's investment in AES is matched by more than a 1:1 ratio.

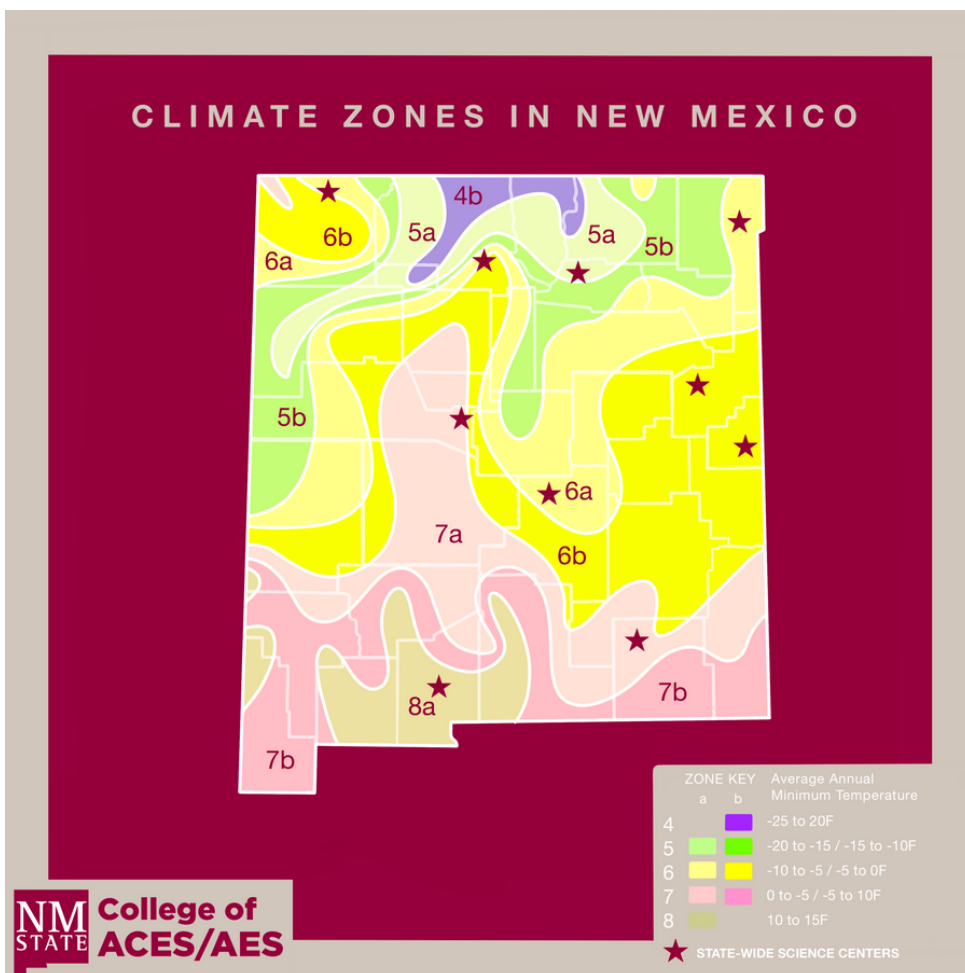
\*\$10M of the State Appropriations supported the New Mexico Reforestation Center and revegetation efforts.



# AG SCIENCE CENTERS

New Mexico is unique, with three crop production regions, ten plant hardiness zones, five defined watersheds, and 126 distinct soil types. Agricultural production varies from north to south and east to west. Each ASC produces research that provides best practices and advancements specific to agricultural producers in their climate zone.

Each AES Agricultural Science Center (ASC) is strategically located throughout the state to conduct research in various climate zones (ASCs denoted as stars in Figure 4).



- Sustainable Agricultural Science Center at Alcalde
- Artesia Agricultural Science Center
- Chihuahuan Desert Rangeland Research Center
- Clayton Livestock Research Center
- Clovis Agricultural Science Center
- Corona Range and Livestock Research Center
- Agricultural Science Center at Farmington
- Fabian Garcia Research Center
- Leyendecker Plant Science Center
- Agricultural Science Center at Los Lunas
- John T. Harrington Forestry Research Center at Mora
- Rex E. Kirksey Agricultural Science Center at Tucumcari

Figure 4: Diversity of geography in New Mexico.

### VISION

*Pioneering new approaches to native and high value crops for sustainable, climate-smart agriculture.*

- Partnering with Extension services for information dissemination and outreach efforts and cooperating on acequia hydrology research.



- Research focused on crops and cropping systems for north-central NM.



- Representative of the irrigated farmland along the Rio Grande, Rio Chama, Rio Embudo, and other smaller drainages in the area.



### Value Added to New Mexico

- Cover crop research
- Research for crop and fruit production in the presence of late spring frosts
- Jujube research, production and cultivar development



Through testing of different crops, varieties, and production techniques, the goal is to provide new information that producers can adapt to their operations for greater productivity and profitability. The Center was the first ASC to carry out research on certified organic land and hold an organic certification.

### ONGOING RESEARCH

Research at the Science Center focuses on crops and cropping systems for north-central NM, including various horticultural and agronomic crops as well as acequia hydrology. Current research focuses on jujube variety development and testing (2 acres), pome and stone fruit production (2 acres), table grapes (1 acre), soil health and cover crops (3 acres), pollinator habitat and buffer strips (3 acres), and high tunnel fruit and vegetable production (five thousand square feet of covered growing space). The Center also includes twelve acres of forage crops including alfalfa, red clover, western wheatgrass, Russian wildrye, smooth brome, tall fescue, and orchardgrass. Six acres of the station are certified organic, and certified crops in 2022 included apple, peach, plum, and sweet corn.



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#### ACES Pillars for Economic and Community Development



## RECENT IMPACTS

- The NMSU jujube program evaluated more than 50 cultivars in the past eight years and identified 8-10 fresh eating cultivars, with the potential to provide more choices with extended maturation dates and \$1-2 premium per pound. Since jujube blooms later, can avoid late frosts in most years, and produce a reliable crop, it will be a perfect alternative crop for growers and home gardeners in NM.
- Lavender is not native to NM, but grows well in most parts of the state. Identifying and generating well-adapted and productive cultivars could help make existing operations more sustainable, promote expansion of production, and expand the offerings of small-scale growers.
- Limited research exists on growing methods most suitable for NM apple growers. An investigation into this phenomenon is purposed to address NM production strategies and increase revenue.
- Research is being conducted to determine infrastructure, labor, and energy inputs required to protect tree blooms and produce a more reliable crop when grown under cover.
- An investigation is being conducted to develop improved strategies, models, and metrics to optimize productivity, sustainability, ecosystem services, and climate variability adaptation of organic systems.
- The NM hemp industry is faced with numerous challenges. Investigations are being conducted to develop recommendations for farmers, establish pest management guidelines, disseminate treatments of interest to increase crop yields, and identify crop residues with potential for value-added products.

## COMMUNITY OUTREACH

The Center hosts numerous educational outreach opportunities each year. In 2022, the Center hosted five programs in community outreach efforts. Two online opportunities included presentations on building capacity for agriculture through small-scale drip irrigation and extended season production workshops focused on hoophouse management and maintenance. Partnerships for these projects included San Juan County Extension and Southern Pueblo Extension Agriculture and Flower Hill Institute. Workshop topics presented by the Center included fruit tree pruning, fruit tree training systems and planting density, and fruit tree grafting.

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### VISION

*Developing solutions to agricultural and water challenges.*

- Utilizes three different irrigation application techniques: flood, side roll pressurized, and lateral overhead pressurized.



- Provides Hachita grass bales to the Living Desert Zoo and Gardens State Park, which are excellent feed sources for Bison and other animals living at the park.



- Partnership with the Center of Excellence in Hazardous Materials Management (CEHMM) has resulted in research focused on algae oil production.



### Value Added to New Mexico

- Resident extension entomologist and team regularly respond to insect pest outbreaks in NM
- Biological control evaluations
- Saline water usage investigations



Artesia ASC faculty collaborate in local, regional, national, and international research and extension efforts, and are often asked to bring their expertise to colleagues and clientele across the U.S. and in foreign countries. The Center's goal is to be the premier off-campus center for novel research and extension programming in integrated pest management, water management, soil health, soil fertility and remediation, and the evaluation of new crop genetic material.

### ONGOING RESEARCH

The Artesia ASC is dedicated to providing high caliber research efforts toward sustainable crop production. Variety development and deficit irrigation strategies are utilized to accomplish these efforts in food and fiber production. Investigations are also conducted to decipher crop productivity utilizing saline water sources.

Of note, the Artesia ASC conducts insect research with respect to agricultural pests such as the bollworm, alfalfa weevil, and pecan weevil, and household pests such as Kissing Bugs. Biological control interventions are additionally investigated.



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#### ACES Pillars for Economic and Community Development



## RECENT IMPACTS

- Kissing bugs have been a recent concern in southeastern NM. Data collected indicates the risk of Chagas disease is higher than previously thought, but the biggest concern is the risk of allergic reactions and transmission to dogs who directly consume kissing bugs. These pests are an issue the Center routinely engages with the public about, including school children and ASC field day participants.
- Determining that there is resistance to insecticides and field resistance to Bt genes will prompt growers to closely monitor performance of these products. Ultimately, it will save money when growers do not purchase products when they no longer provide adequate control. Confirmation of resistance issues is prompting Artesia ASC officials to look at alternative means of controlling lepidopterous pests, including biological control and the use of okra leaf cotton, in addition to other management practices investigated.
- Maximizing biological control will save NM growers money from reduced insecticide applications, reduce environmental impacts, and enhance worker safety. Effective biological control of alfalfa weevil could save NM growers \$1.2 million per year in reduced insecticide applications and reduced yield losses. Biological control of pecan nut casebearer could potentially save growers up to \$1.6 million on an annual basis. ASC officials continue to identify key predators of insect pests for viable biological control and conservation.

## COMMUNITY OUTREACH

Every year the Center conducts research and events that involve and serve the community. During the annual field day, this free event brings together the community to interact and share ideas about ongoing agricultural research projects. The Center also hosts the Entomology and Soils Workshop for 6th-grade STEM students, allowing participants to sweep alfalfa hay for insect pests. They also learn about soil types and identify insect pests in the field.

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### VISION

*Combining knowledge gained from the past with tools of the future to improve ranch management, rangeland productivity, and ecosystem health.*

- CDRRC is home to many historic and long-term studies providing data on ecological health and livestock productivity.



- Location of a Long-Term Ecological Monitoring site since 1984, with study pastures featuring 27 years of continuous vegetation monitoring.



- 205 day adjusted weaning weight which is used in the Beef Improvement Federation guidelines was developed at the CDRRC.



### Value Added to New Mexico

- 110 documented archaeological sites located throughout the ranch
- Virtual fencing research site
- Rangeland environmental protection



The Chihuahuan Desert Rangeland Research Center (CDRRC) is a cardinal research station within the New Mexico Agriculture Experiment Station system. The CDRRC (or more colloquially the “College Ranch”) serves as a model of sustainable ranch and rangeland research, teaching, and extension, composed of a robust working group of scientific collaborators whose goals are to identify sustainable management protocols for managing New Mexico rangelands.

### ONGOING RESEARCH

Digital Ranching tools at the Chihuahuan Desert Rangeland Research Center are used to improve ranch operational efficiencies and rangeland resilience in the Southwest. Information from high throughput sensors, including multi-sensor platforms mounted on herds of Heritage Criollo, Angus, Brahman, and Brangus cattle, field rain gauges, cattle drinking troughs, and water storage tanks is being monitored over 300 sq. miles of desert rangelands using Long Range Wide Area Network communication technology.



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#### ACES Pillars for Economic and Community Development

- Food and Fiber Production and Marketing
  - Water Use and Conservation
  - Family Development and Health of New Mexicans
  - Environmental Stewardship
- Foundational Education and Training



## RECENT IMPACTS

- Monitoring critical resources for livestock production systems can place great time and economic constraints on producers who often need to drive many miles every day to check on water storage, drinkers, forage, and livestock. With increasing cost of monitoring extensive rangelands in the Southwest, the development and implementation of tools that allow remote surveillance of livestock and ranch resources are the primary focus for research being conducted at the Chihuahuan Desert Rangeland Research Center (CDRRC).
- The ability to fence livestock virtually is gaining interest with ranchers and land managers throughout the Southwest. In 2022, the black fire destroyed perimeter fencing in several grazing allotments of the Gila National Forest, making productive rangeland unusable for livestock. Virtual fence research at the CDRRC facilitated collaborations which NMSU, the USFS and ranchers to implement virtual fencing over 40,000 acres of impacted rangeland. This study is enabling ranchers to graze more than 200 head of cattle, serving as an example for other producers in NM and the southwest with interest to implement emerging technologies to address natural disasters, climate change and economic instability.

## COMMUNITY OUTREACH

The Center is focusing on providing connectivity to ranchers to more effectively implement sensor-driven monitoring tools and solutions. NM ranchers have the potential to make more efficient management decisions to sustain animal health and forage resources in extensive, increasingly arid rangelands. Real-time analysis of shifts in animal activity and grazing patterns associated with declining forages, faulty water supply, parturition, health, or predation can be used to deploy warning systems that would eventually allow ranchers to intervene on daily to weekly time scales.

Virtual fencing research conducted at the CDRRC is providing a proof of concept for implementation of this technology throughout ranches in the southwest. Virtual fencing allows ranchers to improve livestock management and overall grazing distribution on large rangelands.

### Chihuahuan Desert Rangeland Research Center

New Mexico State University

State University Ranch Headquarters (Type in Google Maps)

Phone: 575-646-3125



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### VISION

*Inspiring the future of beef through livestock health and climate-smart production.*

- Recent processing barn updates include new prep and storage area, restrooms and mud room.



- Feed mill upgrades optimize energy efficiency and include new lighting, all new electrical wiring, and a fully automated computerized controlled batching system.



- The Center now has the capability to study cattle greenhouse gas emissions by pen with the addition of two portable, trailer mounted GreenFeed systems.



### Value Added to New Mexico

- Food animal research
- Climate-conscious beef cattle production
- Livestock health
- Sustainable managerial intervention



The Clayton Livestock Research Center (CLRC) was established on 320 acres of Kiowa National Grassland, Cibola National Forest, and is located 7 miles east of Clayton, NM on Highway 56/64/412. Plans for the CLRC began in 1972 with construction commencing in 1975. Research is focused on improving health of newly received lightweight calves that may or may not originate in New Mexico but are utilized for stocker operations grazing New Mexico rangelands, as well as, the health of New Mexico range calves shipped outside the state for placement on grass or into feed yards.

### ONGOING RESEARCH

Robust research is being conducted at the CLRC with respect to beef cattle production. Collaborative efforts with Utah State University have launched an investigation into metabolism and offspring performance in beef cattle. Nutritional studies are also being conducted by researchers at the center with newly received feedlot calves. Investigations are being conducted to determine performance and carcass characteristics of finished beef steers.



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## RECENT IMPACTS

- Recent combined studies analyzing receiving cattle and their intake of water, forage, and fat have changed ration and water formulations that increase the initial gain with less feed and can reduce livestock morbidity.
- Collaborative research with REKASCT and CRLRC compared preference and profitability of several irrigated pasture forages in contrast to native range to provide real-world comparisons for producer decision making when considering stocker cattle enterprises.
- CLRC continues to evaluate, through a collaborative grant-funded effort, ecosystem services and economic differences of the Criollo cattle breed and crossbreds thereof in contrast to other common breeds in the Southwest.

## COMMUNITY OUTREACH

Efforts of the CLRC are conducted with an emphasis upon prioritizing improvements toward beef cattle production, feeding, harvest, and final product quality optimization. Conducting research with these priorities enables the CLRC to exist as a phenomenal resource for sustainable beef cattle production and as a leader in resource-conscious managerial intervention.

Employees are engaged with the regional community to provide insight into receiving calf health, fed cattle strategies, and ration formulation, as well as, interaction throughout the community in Rotary International, local school board service and community-wide fundraising and service.

**Clayton Livestock Research Center**  
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### VISION

*Advancing climate-resilient agriculture in semi-arid agricultural systems through research and innovations in soil health, water, and carbon management.*

- Cropping systems and soil management programs investigate soil-plant-environment interactions in arid and semi-arid regions.



- Improving water cycle, soil health, and ecosystem services using circular grass buffer strips of native perennial grasses.



- Enhancing the breeding potential of Valencia peanuts for early maturity, drought and disease resistance for NM and worldwide production.



### Value Added to New Mexico

- Establishing a soil health framework for water-limited environments
- Climate resilience through carbon sequestration and soil health
- Monitoring greenhouse gas emissions in diverse cropping systems



The NMSU Agricultural Science Center at Clovis is centrally located in the largest crop production area of NM and is uniquely qualified to conduct agricultural research and producer outreach activities aimed at efficiently managing the area's limited water resources and increasing the economic viability and sustainability of agricultural production. It is the only research center focusing on sustaining the Ogallala Aquifer in the state. The efforts to address current challenges faced by reduced irrigation or dryland agriculture and preparing for future challenges will be extremely important as temperatures continue to rise, and water becomes more limited.

### ONGOING RESEARCH

ASC Clovis has positioned itself as the carbon management and soil health research center with significant activity on soil carbon sequestration, soil health assessment and management, and greenhouse gas mitigation. The carbon management program has attracted national and international collaboration. Researchers at the center also pioneered the development of a soil health matrix for water-limited regions.



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## RECENT IMPACTS

- Sustainable nitrogen (N) management has emerged as a critical challenge of the 21st century due to the need to minimize its loss to the environment and maintain food production. In a recent study, findings showed urea cocrystal fertilizer provided a balanced nitrogen supply, increased crop yield, and nitrogen use efficiency of sorghum. Enhanced-efficiency fertilizers can be alternative fertilizers for improving nitrogen supply and reducing nitrogen loss to the environment.
- By storing carbon, soil provides natural solutions to climate change, yet there is a research gap on the soil carbon sequestration potential of arid and semi-arid regions. One study synthesized the global data on soil organic carbon sequestration potential of conservation agriculture in dry environments.
- The innovative cropping design of Circular Buffer Strips improved conservation of heavy intensity rainfall events of over two in. by 100% and improved microclimate to increase efficiency of using that water by 40%.
- Newly released Valencia Breeding lines from NMSU outyielded the local varieties in Bangladesh, Canada, and Haiti to enable sustainable livelihoods, food security, and nutrition worldwide.
- Herd size of NM dairies is more than 10 times the US average. Effective training of current and future employees is imperative. Limited educational opportunities exist. A training program was launched to improve job performance and is provided in a preferred language available (English, Spanish, or K'iche). Approximately 6,000 employees have been trained in dairy safety and animal handling.

## COMMUNITY OUTREACH

The Center plays a major role in connecting the rural agricultural producers in this region with expertise for efficient and higher yield farming practices. Every year, the ASC at Clovis hosts multiple community outreach events to inform industry partners, youth, and local farmers about various projects and their results. On field days, producers and researchers can visit and interact with each other. This is the perfect opportunity for producers to tour and see the research projects that are being conducted at the Center and also to engage with researchers in a one-on-one setting. Additionally, Cultivating Young Minds is an annual event targeting 5th grade students from Clovis elementary schools. Students can visit the Center and learn about plants. At the end of their visit, students are able to go to the center's pumpkin field and pick a pumpkin or two to take home. In 2022, about 661 students from 14 schools attended the event.

### Agricultural Science Center at Clovis

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### VISION

*Innovating at the nexus of livestock, rangeland, and sustainability.*

- Provides research facilities for beef cattle, sheep, goats, wildlife, rangeland, fire science, and renewable energy.



- University-wide collaborative investigations into Carbon, Water and Energy on large rangeland landscapes.



- Serves as a hub for community engagement, education, and research initiatives.



### Value Added to New Mexico

- Sustainability initiatives, including wind and solar energy
- Cattle and sheep production
- Rangeland research
- Wildlife preservation



Established in 1980, the CRLRC is a 27,886-acre working ranch laboratory located near the center of the state of New Mexico, just east of the village of Corona. Research programs, as well as graduate student studies, are a major part of the CRLRC and are incorporated into the normal production cycle of the cattle and sheep commercial operations.

### ONGOING RESEARCH

Colleagues from the NMSU Department of Fish, Wildlife, and Conservation Ecology, in collaboration with the Bureau of Land Management, initiated a project to determine if wind farms influence site occupancy of primarily ungulates, and other mammals.

Separate investigations into the impact of growth promoting implants, and dietary supplements fed to beef cows, on bovine reproduction efficiency are being conducted. These projects will provide insight for effective managerial intervention to producers involved in beef cattle production.



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#### ACES Pillars for Economic and Community Development





## RECENT IMPACTS

- Estrus synchronization in sheep flocks when using natural service can significantly reduce labor associated with lambing by tightening up the lambing season. This produces a more uniform lamb crop, which is more desirable when marketing lambs and also offers an economic advantage.
- Reproductive success in beef heifers and young cows can be challenging. Work conducted at CRLRC aims to provide producers with targeted short-term nutritional systems that increase pregnancy rates and longevity. By improving these, the cost associated with developing heifers or needing to cull non-pregnant cows will improve the financial viability of beef cattle producers.
- CRLRC and researchers from NMSU are actively investigating current environmental issues that range from Carbon Management to wildlife interactions with renewable energy sources. These research projects will improve our ability to provide much needed information to clientele in regards to ecological services in the future.

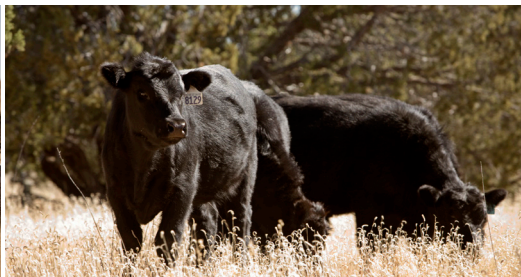
## COMMUNITY OUTREACH

The CRLRC and the Southwest Center for Rangeland Sustainability host a week-long program for senior undergraduate and graduate students in Animal Sciences and Veterinary students from throughout the U.S. This program is called the US Beef Academy (USBA) and is an opportunity to expose students to leaders in the beef industry. The USBA provides exposure to the robust beef production system of New Mexico all while making lasting relationships with students from other universities, upper academia, and industry leaders.

The CRLRC hosted various community engagement programs and seminars addressing sustainable agricultural production amidst rangeland ecosystems. Numerous state, county and local officials, as well as agency personnel, also toured the wind farm in collaboration with Pattern Energy.

### Corona Range and Livestock Research Center

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### VISION

*Building agricultural and community resilience with innovative science that respects regional cultural values in the Four Corners Region (Navajo Nation and beyond).*

- NMSU is the only 1862 Land-grant University to reside on sovereign First Nations Land, the Navajo Nation.



- Home to the Yéego! Healthy Eating and Gardening Project which evaluates community and school garden curriculum working with the surrounding community.



- Weather conditions in the Four Corners region are variable and influence crop growing periods across the region with late spring fronts and early fall frosts.



### Value Added to New Mexico

- Center pivots and drip irrigation
- Specialty, commodity, cover crop, and certified organic crop production
- Agroforestry; Environmental and agricultural soil quality monitoring



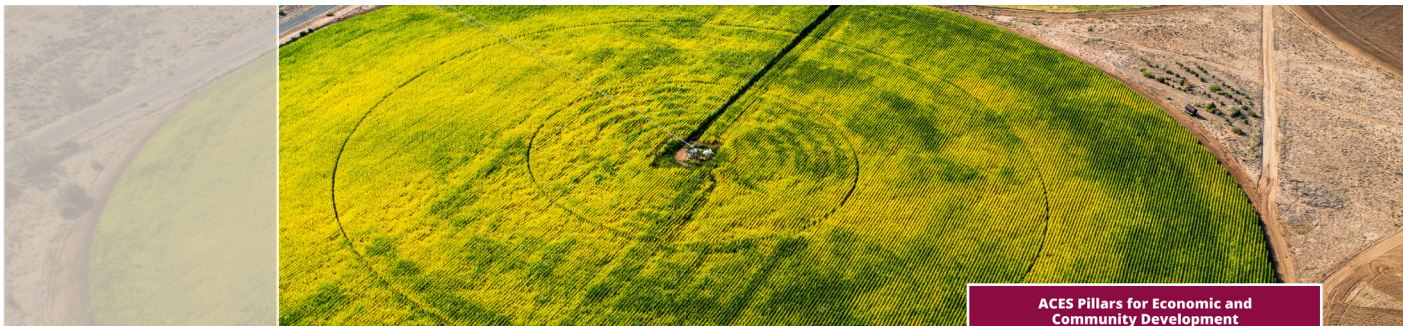
The NMSU Farmington ASC conducts research to support fundamental and applied science and technology research to benefit New Mexico’s citizens in the economic, social, and cultural aspects of agriculture, natural resource management, and family issues.

Research is conducted in soil and crop evaluations and their intersects with community wellness, economic development potential, water conservation and environmental stewardship.

### ONGOING RESEARCH

Potato response to irrigation and nitrogen fertilizer is being investigated with the intent of exploring the best intervals of water and nitrogen input to ensure water and fertilizer conservation while maintaining high yield, quality, and improving crop water productivity.

Farmington features one of three ASC vineyards established in the state to cultivate and test 12 table grape varieties, grown using a “Y” trellis system. Sensory evaluations with students are conducted to determine likability. Other trials of specialty crop evaluations include specialty grains, pollinator plants, jujube, and cherries.



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- Family Development and Health of New Mexicans
- Environmental Stewardship

Foundational Education and Training



## RECENT IMPACTS

- Farmington ASC viticulture enables evaluation of potential table grape varieties for fresh market sales and consumption. Impacts can contribute to diversified variety production.
- One study aims to develop nitrogen fertilizer production functions for potatoes and holds the potential to increase potato growers' net economic returns while reducing contamination of soil and groundwater by nitrates.
- An investigation was launched to establish the first and second-year optimum nitrogen fertilizer application rate of corn after 3 to 5 years of irrigated alfalfa production. Findings could potentially increase corn growers' net economic returns while reducing contamination of soil and groundwater from applied nitrates.
- Few healthy eating, school-based interventions have been rigorously evaluated in American Indian communities. Type-2 diabetes is a serious issue on the Navajo Nation. Collaborative efforts supported the implementation of a school gardening project in local areas. Students in the intervention schools had self-efficacy scores for eating fruits and vegetables that were significantly higher than those in the comparison schools.

## COMMUNITY OUTREACH

Farmington ASC community engagement occurs at multiple scales, from backyard gardens to center pivot field production. Field days and farmer visits form the basis for traditional place-based outreach. Since 2009, Farmington ASC faculty have been partnering with Public Health researchers from the Fred Hutchinson Cancer Research Center to examine the transects of horticulture and diabetes risk reduction. This outreach-oriented research enables Farmington ASC faculty to work with communities to address solutions that promote both gardening and healthy eating among Navajo elementary school children and their families with the ultimate goal of impacting public policy across the Navajo Nation. The Farmington ASC continues to assist farmers with understanding the impacts of the Gold King Mine spill of 2015. The impact of this work is aiding a broader effort in San Juan County, NM to reduce the stigma of the spill and build up the agricultural economy of Northwestern NM. Of note, in 2022, officials from the Farmington ASC and University of Arizona teamed up to host the "Sustainability Fair" at Shiprock.

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### VISION

*Advancing innovations in high-efficiency agriculture.*

- Includes a botanical garden and gazebo open to the community for photography and seasonal landscape enjoyment.



- Research on plant breeding, regionally adapted and alternate crops, viticulture, algae, brackish water, and best management practices in research plots and greenhouses.



- Includes a student-run greenhouse, providing opportunities for clubs, the Floral Team, the Horticulture Forum, and classes.



### Value Added to New Mexico

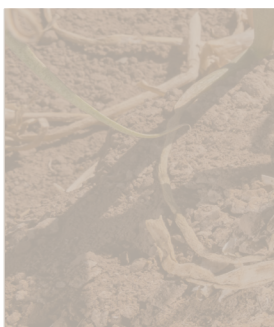
- Onion and chile pepper research
- Investigations into usage of brackish groundwater in agricultural systems
- Forage and alternate crop research



The first deed for Fabian Garcia Science Center was signed in 1906 and today the center has 41.1 acres of land. The Center not only houses the Chili Pepper Institute, but includes, and is not limited to research plots and greenhouses supporting alfalfa breeding and genetics, viticulture, cotton, horticulture, nematology, micro-plot, turf grass water management, IR-4, and onion research. Another greenhouse project occurring is the phytoremediation of contaminated soils.

### ONGOING RESEARCH

Current research at the Center focuses on drought-resilient varieties of alfalfa, onion cultivars resistant to diseases and pests, and chile peppers that can be mechanically harvested. Investigations are being conducted to reduce reliance on declining freshwater through irrigation with brackish water, using regionally adapted cover crop mixtures adapted to hotter and drier climates, and testing of alternative, water-saving crops such as guar. The Jose Fernandez Garden continues to support vegetable growers through testing of underutilized and heat-tolerant vegetables and demonstrating management practices such as solarization for weed control. Research on microalgae contributes to our understanding of its role in sustainable energy sources, human nutrition, and soil health.



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## RECENT IMPACTS

- Investigations for irrigating crops with brackish groundwater may assist in reducing stress on declining freshwater supplies. Improved phytonutrient profiles could change the perception of salinity from being an agricultural threat to being a value-added product.
- Integrated analysis of Alfalfa DNA sequence and field-based data are conducted to identify genetic factors influencing forage yield and nutritive value to develop drought-resilient cultivars for the arid southwest.
- Onion stakeholders identify onion thrips and Iris yellow spot virus as the greatest pest and disease threats to onion yield and economic sustainability. Onion germplasm is being developed and evaluated for onion thrips and Iris yellow spot impact. Also, Fusarium basal rot (FBR) is a soil-borne fungal disease that causes disintegration of the onion bulb basal plate. Investigations are being conducted for breeding for host plant resistance to FBR, which may eliminate the detrimental effects of the disease.
- A post planting, delayed preemergence application of pendimethalin could provide comparable or better control of annual weeds as currently used herbicides in autumn-sown and winter-sown onions in NM.
- An investigation to develop new Chile cultivars with higher mechanical harvested yield and improved quality is being conducted.
- Numerous projects are focused on Guar, drought tolerant crop. Evaluating its performance under different salinity levels will help identify tolerant genotypes as well as understand the underlying tolerance mechanisms. Guar can also be used as an alternative legume forage crop in the region that uses less water and produces an optimum amount of good quality forage. The legume and grass mixture may help in producing balanced quality forage.

## COMMUNITY OUTREACH

The Center is highly involved in outreach efforts and hosts numerous educational opportunities each year. In 2022, eight different opportunities were offered, including the NMSU Onion Field Day, the NM Chile Conference, the NM Agriculture Sustainability Workshop, the Jose Fernandez Memorial Garden Ceremony, and five separate presentations to scientists, students, growers from western India, and the local community.

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### VISION

*Leading the arid southwest in climate-smart and precision agricultural management systems for sustainable and climate-resilient irrigated cropping systems.*

- Features approximately 200 acres of land dedicated to a variety of research and demonstration trials to enhance the sustainability of southern NM.



- NMSU Weed Science Program hosted at the Leyendecker PSRC and has developed several farmer-friendly weed control techniques for weed suppression in farm fields.



- Long-term soil health research field established to evaluate how different practices affect crop productivity, carbon sequestration, soil resiliency, and greenhouse gas emissions.



### Value Added to New Mexico

- Evaluating interaction between tomato growth and solar panels energy production
- Development of guayule trials with potential to facilitate domestic demand
- Evaluating and breeding commercial varieties of Alfalfa



The Leyendecker ASC headquarters was purchased by the University in 1969 and consists of 203 acres. Projects occurring at the Leyendecker Plant Science Center include cotton, chile, alfalfa, and onion plant breeding, precision farming, pecan research, drip irrigation research, soil health research, and a multitude of other projects and programs.

### ONGOING RESEARCH

Research conducted at the Leyendecker Plant Science Research Center is purposed to improve the lives of New Mexicans, the nation, and the world through research, teaching, and Extension. The Leyendecker Plant Science Research Center serves as the outdoor agronomic laboratory for researchers located on the NMSU main campus in Las Cruces. Leyendecker is an emerging hub for the application of digital agriculture tools to southwestern agriculture.



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#### ACES Pillars for Economic and Community Development





## RECENT IMPACTS

- In 2022, research conducted at Leyendecker Plant Science Research Center advanced agricultural productivity and sustainability in southern NM. Specific impacts of these research projects include the development and dissemination of the best management systems and improving the yields of commodity crops such as chile, alfalfa, cotton, pecan, guayule, guar, and corn. Diseases, weeds, nutrients, and irrigation management strategies were developed and shared with producers and stakeholders in southwestern NM during field days that occurred at the station.
- Research at the center demonstrated a 13% increase in crop yield and improvements in multiple soil indicator measurements after the application of soil health practices. Funding for research projects was procured from several agencies, including the US Department of Agriculture-National Institute of Food and Agriculture; the Foundation for Food and Agricultural Research; the New Mexico Chile Commission; Western Sustainable Agriculture Research and Education; the New Mexico Department of Agriculture; and private companies.
- Leyendecker PSRC provided opportunities for training for different categories of clientele, ranging from K-12 school students to university students, agricultural professionals, farmers, and stakeholders in southern NM, by using research plots as living labs. Research and outreach activities at Leyendecker PSRC are well-positioned to address the needs of producers, agricultural support professionals, students, and other stakeholders in southwestern NM.

## COMMUNITY OUTREACH

The Center is an integral asset in outreach efforts purposed to engage with youth, undergraduate, and graduate students, along with state, national, and international academics and stakeholders. The Center hosts numerous educational events throughout the year. Annual field days are hosted at the Center. These free events enable participants to learn about research being conducted at the Center while providing the opportunity to ask questions and engage with research personnel in a one-on-one, in-person environment.

### Leyendecker Plant Science Center

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### VISION

*Innovating at the nexus of livestock, rangeland, and sustainability.*

- Shares a unique cooperative agreement with the USDA-NRCS Plant Materials Center; both units are housed within the same facility.



- Los Lunas ASC Plant Materials Center has released 31 grasses, forbs, shrubs, and trees for conservation utilization.



- Committed to increasing awareness of crop and food production among urban stakeholders through research and educational events.



### Value Added to New Mexico

- Hay and forage crop cultivation
- Alternative and cover crop usage
- Soil health and carbon management
- Urban agriculture, horticulture, and landscapes



Located on 200+ irrigated acres, just 20 miles south of Albuquerque, the ASC evaluates crop adaptability, performance, and related cultural practices such as irrigation, pest management, plant growth and persistence, and propagation techniques. Having a research center centrally located within the state, near the largest metropolitan area, is a major asset and allows for broad rural and urban stakeholder service. Research and demonstration crops include alfalfa and other forage crops, beans, chile, cover crops, fruit trees, wine and table grapes, jujube, tomatoes, ornamental landscape plants, and others.

### ONGOING RESEARCH

Researchers at the ASC are studying strategies to alleviate heat and water stress and reduce fatality rates of tomatoes in an effort to increase production and improve the gardening experience. Evaluation of new hybrid table grape and jujube cultivars is ongoing, and wine grape hybrids continue to be evaluated to determine the best adapted varieties suited to the region. Cover crop studies are conducted to investigate pest suppression in chile pepper and potential to improve soil health parameters.



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#### ACES Pillars for Economic and Community Development





## RECENT IMPACTS

- Research has demonstrated positive urban landscape management plays a role upon soil quality and carbon sequestration.
- 'NuMex Odyssey' was released recently. This cultivar possesses traditional New Mexican green chile pepper flavor, low heat, and provides a higher percentage of mechanically harvested marketable green chile fruit without mechanical damage compared to current, standard industry NM type green chile pepper cultivars. The development of high-yielding, machine harvestable chile pepper cultivars is important for NM growers due to the issues related to manual labor and the presence of different production constraints.
- Results from the shaded tomato study suggest multiple benefits of shade cloth such as possible improved fruit quality, reduced water requirements, and potential exclusion of the the beet leafhopper.
- Forage programs improve regional production by increasing awareness of hay and pasture species and variety selection, water management, and alternative crop and high-value forage marketing opportunities.

## COMMUNITY OUTREACH

The Los Lunas ASC hosts multiple extension and outreach events each year. These include several seed saving, horticultural and fruit educational workshops, forage and chile field days, as well as a large array of online workshops and webinars. A large field day and open house is hosted every other year, where the community is invited to see research projects being conducted at the station. Faculty and staff respond to hundreds of stakeholder requests for information each year via phone calls, emails, office walk-ins, and site visits, including from surrounding states and internationally.

The Los Lunas ASC hosts twice-weekly Outreach workdays for volunteers to help with various horticultural efforts at the center, like fruit tree pruning in winter, maintaining experimental tomato plots and data collection in summer, and perpetual weeding. Events like these provide an opportunity for community participants to learn the basics of plant care and accumulate volunteer service hours.

The NMSU Los Lunas Ag Science Center Learning Garden serves as a convenient site for visitors to the station to learn about sustainable gardening and landscaping practices, integrated pest management, and pollinator ecosystem services. The garden is truly a place for 'cultivating' educational experiences.

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### VISION

*Leading the nation in climate-smart reforestation research that supports the entire reforestation pipeline from seed to nursery systems to tree planting.*

- The Hermits Peak- Calf Canyon Fire grew to more than 341,700 acres by July, making it the largest fire in the history of NM. The JTH FRC was in the path of the fire and all personnel, the entire seed bank, and approximately 75,000 seedlings were evacuated.



- The property where the JTH FRC is located was purchased in Spring 2023 by NMSU from the Trambley family. The Trambley family is recognized for their advocacy of reforestation efforts throughout New Mexico, and their legacy will continue at the research center.



- Research is being conducted to develop a baseline model for calculating carbon storage of recently established ponderosa pine across the southwestern US. This will contribute to the understanding of carbon sequestration amid reforestation activity.



### Value Added to New Mexico

- Climate-smart reforestation research
- Seedling development, nursery systems, and tree planting efforts
- Post-fire restoration research
- Investigating drought tolerance of *Pinus ponderosa* and *Populus tremuloides*



The JTH Forestry Research Center also provides science-based solutions for private, tribal, state, and federal forest managers, who face the threat of catastrophic fires due to overgrown forests and the inability of post-fire forest communities and ecosystems to naturally regenerate after such fires. The center is the only program in the four corner states (NM, UT, AZ, and CO) focusing research efforts along the entire reforestation pipeline. It is located in Mora, New Mexico.

### ONGOING RESEARCH

Research efforts to evaluate vegetation control and animal protection measures in a post-fire restoration environment revealed preliminary results that use of managed nurse vegetation improves survival. Additionally, investigations to optimize outplanting strategies in a post-fire environment through seedling size, planting windows, and drought conditioning led to preliminary results that monsoonal plantings improve survival of planted trees. Nucleation planting strategies in post-fire environments to improve long-term values such as water resources and forest health contributed to preliminary results showing high-density nucleation plantings maintain proper stocking levels.



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#### ACES Pillars for Economic and Community Development



## RECENT IMPACTS

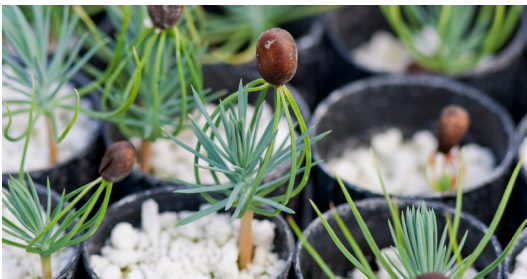
- Studies to optimize seedling performance by comparing stock size, planting window, and use of drought condition treatments in the nursery are being conducted.
- An investigation into nucleation planting strategies for ponderosa pine post-fire reforestation efforts is purposed to understand what combinations promote greater survival and growth for individual ponderosa pine seedlings. A similar investigation is being conducted for aspen planting densities.
- Assessment of log and snag microsites for reforestation of aspen in a post-fire environment aims to understand the influence of log and snag microsites on outplanted aspen seedling performance.
- A study is being conducted to compare planted ponderosa pine seedlings under an interaction of animal protection methods and vegetation management intensities to improve reforestation success. This research will examine the cost-effectiveness of these treatments.
- An investigation into physiological and morphological responses of *Pinus ponderosa* seedlings to moisture limitations in the nursery and their implications for restoration was conducted. This study assessed, to a limited extent, the potential interactions between seed source and water limitations in nursery production.
- A *pinus ponderosa* carbon modeling and provenance test was conducted to assess effects of climatic changes across 75 sources of ponderosa pine on survival, growth, physiological parameters, and carbon sequestration over 10 years of growth.

## COMMUNITY OUTREACH

The JTH FRC offers a unique educational opportunity to learn about forestry research and the importance of forests to not only agricultural production in NM, but also how forests provide water, wildlife habitats, and so many other benefits to the state. The annual field day is an event open to the public to visit the Center and get an up-close look at the seedling nursery and ongoing reforestation efforts.

Results from research conducted at the JTH FRC are used to inform land managers throughout the western US on reforestation strategies that improve seedling survival and growth. Local communities around Mora, NM, that are impacted by the recent fires in 2022 will benefit from this research due to the added value it has on many ecosystem services that reforestation has on water, recreation, wildlife, timber, and many other valuable resources.

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## VISION

*Leading innovative, water-smart crop and livestock research to help farmers in semiarid environments adapt to the changing climate for agriculture.*

- The Tucumcari Feed Efficiency Test, LLC (TFET) conducts an annual Tucumcari Bull Test and other feed efficiency tests to encourage beef cattle herd improvement.



- The only NMSU research facility historically conducting both crop and livestock (irrigated pasture and confined animal) research.



- Only ASC reusing treated municipal water for irrigation, providing a year-round source for irrigated research.



### Value Added to New Mexico

- Usage of reclaimed water
- Alternate, opportune, and cover cropping systems and soil amendments
- Efforts to mitigate effects of limited irrigation due to climate change



The Rex E. Kirksey Agricultural Science Center is the oldest NMSU ASC, adding historical knowledge and value to the local community and state. The ASC's property consists of 464 acres, with 170.9 acres having Arch Hurley Conservancy District water rights and a contract for 300 acre-feet annually for treated municipal wastewater to be delivered from the City of Tucumcari Wastewater Treatment Plant.

Efforts at the center focus on improving the quality, safety, and reliability of food and fiber products, which enhances agricultural profitability; stimulates economic development using natural resources; sustains the environment and protects natural resources with sound practices; and improves the quality of life for the people of New Mexico.

## ONGOING RESEARCH

Primary research conducted at the Rex E. Kirksey ASC focuses on semiarid cropping systems, irrigated forage crops and grazing management, genetic improvement of beef cattle through feed efficiency testing, and reuse of treated municipal wastewater for agricultural irrigation.



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### ACES Pillars for Economic and Community Development

- Food and Fiber Production and Marketing
- Water Use and Conservation
- Family Development and Health of New Mexicans
- Environmental Stewardship

Foundational Education and Training



## RECENT IMPACTS

- The Tucumcari Feed Efficiency Test has grown 100% since 2013, from 75 to 160 bulls tested annually. Genetic improvement in feed efficiency of New Mexico's beef cattle herd brings greater returns to the state's ranchers and those retaining ownership in the feedlot. It also helps with limited forage production during drought and greater pregnancy rates at New Mexico's ranches. The widening audience of the Feed Efficiency Test and Sale has resulted in a more competitive market for the participating producers.
- Successful identification of efficient cropping systems to replace the traditional semi-arid cropping systems will not only help the local NM farming community achieve greater resource use efficiency (especially water), productivity, and sustainability, but also reduce the seasonal risk of crop failures due to water scarcity. Opportune crop rotations with winter wheat are being evaluated for their water use and production capacity under limited irrigation conditions using grain/forage legumes, millets, and cover crops to replace fallow. Opportune cropping to achieve greater resource use efficiency (especially water and nutrients) and productivity will not only generate increased farm-level income for producers but also promote broader marketing and economic opportunities in NM.
- Acreage of haylage (non-alfalfa) in NM has increased by approximately 50%. Planting legumes with forage sorghum may increase protein content and/or yield and save on nitrogen fertilizer applications. Increasing protein content of harvested forage also reduces protein supplementation requirement for livestock. Each of those scenarios reduces production costs for New Mexico's forage producers, also maintaining lower food costs for all New Mexicans.

## COMMUNITY OUTREACH

The Rex E. Kirksey ASC serves as a hub for community support in Tucumcari. By hosting an annual bull sale, 4-H events, field trips for elementary students and other educational events, the center takes pride in offering a space for agricultural research to be accessible to New Mexicans.

The Center annually hosts a Field Day to showcase their research efforts. The purpose of this free event is to bring producers and researchers together to visit and interact with each other and share ideas and opinions about different cultural practices. This is the perfect opportunity for producers to tour the Center and see the research projects that are being conducted, providing an environment for visitors to ask questions and get answers with the research team in a one-on-one setting.

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# AES RESEARCH DEPARTMENTS

The AES has eight academic research departments that house the on-campus research efforts within the College of ACES. Many of these on-campus researchers utilize the near-campus agricultural science centers as outdoor research laboratories. Some of these research efforts expand across the state to other ASCs, creating trans-departmental connections and strengthening ACES research efforts across the state.



- 
- **Agricultural and Extension Education**
  - **Agricultural Economics and Agricultural Business**
  - **Animal and Range Sciences**
  - **Entomology, Plant Pathology & Weed Sciences**
  - **Family and Consumer Sciences**
  - **Fish, Wildlife & Conservation Ecology**
  - **Plant and Environmental Sciences**
  - **School of Hotel, Tourism & Restaurant Management**





# Agricultural Experiment Station

Department of Agricultural and Extension Education

axed.nmsu.edu • 575-646-4511



## MISSION

The primary focus of the Department of Agricultural and Extension Education (AXED) is to teach and transform leaders in agriculture.

## Quick Facts

- In 2022, AXED faculty and staff led or collaborated on research initiatives seeking nearly \$65 million in extramural funding.
- Nearly 60% of agricultural educators in New Mexico are AXED alumni.
- Home to the only agricultural communications program in New Mexico and one of the few in the Southwest.
- NMSU AXED faculty and students won the outstanding innovative idea at the National Agricultural Communications Symposium in 2022 and 2023.
- Drs. William Norris and Shannon Norris-Parish received the distinguished manuscript award at the 2023 National American Association for Agricultural Education (AAAE) conference.
- Led by Dr. Don Edgar, AXED is emerging as a leader in precision and digital agricultural research.

AXED equips students to influence the future. AXED undergraduate and graduate students are prepared for careers in agricultural education, agricultural communications, Extension, government and industry affairs, and international agricultural development. AXED researchers have a holistic approach to applied agricultural research and provide scientific communications in a clear and effective way for multiple audiences.

## SELECTED PROGRAM IMPACTS

- **Mechanization allows society to prosper due to its impact on agriculture.** This impact includes the widespread availability of agricultural products. To gain further understanding into this area of inquiry, Dr. Don Edgar designed a study to gauge the impact of male and female instructors in areas of mechanization. The study, which began in the spring of 2021, involves a female instructor who provides data as she leads lectures and lab classes for a designated course. As the need for more STEM career ready professionals has been called for nationally, understanding gender differences associated with these professions is important.
- **The Young Agri-Scientist Program is a collaborative effort with Texas Tech University to recruit future scientists in Agriculture, Food, and Natural Resources (AFNR).** Supervised by Drs. Steve Frazee and Lacey Roberts-Hill, the program was created to provide and evaluate an enhanced undergraduate research experience. Selected students at New Mexico State University will engage in active research with a faculty mentor in the College of ACES. The goal of the program is to increase the number of diverse graduates with critical thinking and research skills to meet the global need for agricultural scientists and science communicators.
- **Preparing students for real-world issues by being stronger communicators.** In New Mexico, nearly 650,000 people are reached annually by Extension programming and outreach. Similarly, nearly one in nine children in public and private schools in New Mexico interact with 4-H School Enrichment programs. Because Extension professionals and volunteers are the primary land-grant representatives for disseminating agricultural information to the public, investigating agricultural literacy is vital for future programming. Dr. Shannon Norris-Parish partnered with faculty from Utah State University and Kansas State University to investigate the agricultural literacy levels of Extension agents and volunteers. Using the JMALI instrument for agricultural literacy, we determined that the participants had at least a foundational awareness of agricultural production as noted by their agricultural literacy equaling factually literate ( $\geq 8$  correct answers out of 15) or higher. This study provided a baseline of agricultural literacy and identified the need to provide additional access to a variety of agricultural opportunities.



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## Selected Partnerships and Collaborators

- Café Mayapan
- Inter-American Institute for Cooperation on Agriculture (IICA)
- La Semilla Food Center
- New Mexico Ag Education and FFA
- New Mexico Department of Agriculture
- New Mexico Farm and Livestock Bureau
- New Mexico High Schools
- New Mexico Livestock Board
- New Mexico State 4-H
- NMSU Cooperative Extension Service
- Our Lady of Hope
- Santa Teresa Border Crossing
- Southwest Border Food Protection and Emergency Preparedness Center
- U.S. Department of Homeland Security
- U.S. Department of Agriculture

## SELECTED PROGRAM IMPACTS (CONT.)

- **New Beginnings for Tribal Students- An Innovative Approach to Expanding Agricultural Opportunity for Navajo Students.** Currently, 11.2% of New Mexico's population identifies as Native American. In collaboration with Dinè College, Drs. William Norris and Kevin Lombard (ASC- Farmington) supervise this project which strives to lead Native American students into careers in agriculture. This project connects agricultural educators that teach Native American students with graduate programs at NMSU. In addition, Native American students enrolled in secondary education are engaged in non-formal educational activities in agriculture and dual enrollment through local school systems.
- **Alumni making a difference in agricultural education and Extension.** Alumni are making a difference in both formal and non-formal education. Agricultural educators and teachers impact students daily in the areas of leadership, career development and agricultural awareness and literacy. NMSU Cooperative Extension Service (CES) agents impact community members and youth daily through agricultural workshops, nutritional programming and youth events. Agricultural and scientific communicators impact communities through messaging, policy development and translating scientific information to the public. Our alumni work with communities to bring life-changing information to families and agriculturists based on university research.
- **Wind Power Technology Center.** Water is an important resource that is in short supply in the U.S. Southwest. Even in today's high-tech world, windmills continue to provide water to farm and ranch operations throughout the country. In Windmill Technology Workshops taught at the Wind Power Technology Center on NMSU's main campus, over 850 participants have learned the fundamentals of using wind and solar applications to pump water where it is needed. NMSU's workshop is the only windmill workshop taught by a university in the United States, and has attracted participants from every part of our country as well as Afghanistan, Brazil, Chile, Nigeria, and Mexico. A single class will often include ranchers, professional millers, Tribal range managers, windmill enthusiasts, and traditional college students.
- **The primary focus of Dr. Dawn VanLeeuwen's work conducted through the Agricultural Biometric Service is to promote the use of appropriate statistical techniques on ACES college projects.** Her work contributes to using research dollars efficiently. Consultation from a statistician may result in designs that are much more likely to yield information that can be used to answer questions of importance.



## FACULTY AND EXPERTISE

- **Steven Frazee, Department Head, Professor,**  
Agricultural Teacher Education, Extension Education
- **Don Edgar, Professor,**  
Agricultural Teacher Education, Mechanization, Extension Education
- **William Norris, Assistant Professor,**  
Agricultural Teacher Education, Extension Education
- **Shannon Norris-Parish, Assistant Professor,**  
Agricultural Communications
- **Lacey Roberts-Hill, Assistant Professor,**  
Agricultural Communications
- **Lajoy Spears, Assistant Professor,**  
Program Development and Evaluation Specialist
- **Dawn VanLeeuwen, Professor,**  
Applied Statistics





# Agricultural Experiment Station

Department of Agricultural Economics and Agricultural Business

aeab.nmsu.edu • 575-646-3215



## MISSION

Enhancing the well being of the citizens of New Mexico, the nation, and the world through excellence in teaching, research, and extension programs, our mission includes the three cornerstones: education, research, and extension.

## Quick Facts

- The academic department has nine faculty members with a wide variety of research efforts that range across the entire food and fiber supply chain, e.g., from input supplies and production agriculture to the final consumer.
- Researchers work with various stakeholders, including individual producers (farmers and ranchers), industry organizations, and government agencies.
- Most of the research projects conducted by faculty within the department include graduate and undergraduate students, providing them with opportunities for experiential learning.

We design and conduct research that improves society's capacity to develop and manage its resources efficiently, fairly, and sustainably.

## SELECTED PROGRAM IMPACTS

**Assessing and improving USDA's Farm Income Baseline projections.** The USDA releases two types of U.S. farm income forecasts each year. They are short- term annual forecasts and the long-term decade-long projections of farm income components. These statistics often play a role in changes to U.S. farm policies. Dr. Regmi is leading an effort to develop a new baseline projection model to improve long-term projections of farm income components. The prediction accuracy of existing and new models is compared for a model selection recommendation. A recently approved USDA grant aims to extend this work by examining responses of farm income projections to production, policy, and market shocks.

**Assessment of rural New Mexico Communities' readiness for change: succession and transition planning.** Succession and transition planning can be a difficult process and requires business owners to evaluate and consider options for the continuation of their establishment. With New Mexico's average age of agriculture producers being 59.8 and one-third of the population living in "rural" areas, it becomes imperative that these rural businesses ensure the longevity of their operation. Research conducted by the Department of Agriculture Economics and Agriculture Business assessed the understanding of the succession process, as well as the individual's progress towards preparation. Results provided evidence of the need for resources for rural communities to assist local businesses with succession/transition planning.



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## Selected Partnerships and Collaborators

- Ag New Mexico Farm Credit
- Bridgestone
- Foundation for Food and Agriculture Research
- New Mexico Chile Association
- New Mexico Department of Agriculture
- New Mexico Farmers' Marketing Association
- New Mexico Office of the State Engineer
- U.S. Agency for International Development
- U.S. Geological Survey
- United Nations Food and Agriculture Organization (FAO)
- USDA Agricultural Research Service
- USDA Economic Research Service
- USDA Foreign Agriculture Service
- USDA Natural Resource Conservation Service
- World Bank

## SELECTED PROGRAM IMPACTS (CONT.)

**Impacts of environmental pulse flows on regional economies and water stocks.** Environmental flows are used to maintain hydrological health, biological health, and water quality within river systems. These can be controversial because, in water-scarce regions, programs that establish environmental flows usually involve reallocating water from another productive use. Few peer-reviewed papers to date have investigated impacts on system-wide economic performance resulting from environmental flow regimes. We presented an original approach to address that gap by developing and applying a basin-scale hydroeconomic optimization model of North America's Middle Rio Grande Basin to explore the impacts of environmental pulse flows on the region's economy and water stocks. Results show that climate change, in the form of highly variable inflows, has an impact on the total and marginal cost of implementing environmental pulse flows, amplified by the conjunctive nature of the system.

**Responding to a foreign animal disease outbreak.** Dr. Frannie Miller has participated with the Southwest Border Food Protection and Emergency Preparedness Center in two grants focused on preparation for responding to a Foreign Animal Disease (FAD) in a manner that minimizes economic loss to the New Mexico livestock industry. Miller's role in this effort is to incorporate producer views and a categorization of management practices so that planning efforts will harness local customs and knowledge. This work is augmented by related work investigating how wildlife, invasive species, and international trade all affect the potential for FAD introduction, spread, and economic impact.

## FACULTY AND EXPERTISE

- **Ram Acharya.** Food security, food marketing, climate change, and sustainability.
- **Alwin Dsouza.** Production efficiency analysis, Economic impact analysis, Food supply chain management, and Consumer preference.
- **Brian Hurd.** Economic impacts and adaptation of agriculture and water systems.
- **Frannie Miller.** Impacts of foreign animal diseases. Dairy and beef livestock economics.
- **Madhav Regmi.** Agricultural finance, agribusiness risk management, production economics, and public policy.
- **Chadelle Robinson.** Marketing, consumer preferences, and supply chain management.
- **Greg Torell.** Renewable sources of electricity, issues related to the intersection of water and energy resources, valuation of ecosystem services on rangelands.
- **John Townsend.** Commodity futures and options, agricultural marketing, commodity risk management.
- **Frank Ward.** Irrigation economics and policy.







## MISSION

The Department of Animal and Range Sciences is committed to providing premier programs to those we serve by focusing on education, research, and outreach.

## Quick Facts

- In 2022, ANRS secured over \$6 million in funding and in-kind donations. For every dollar we bring in from state and federal sources, we bring in additional dollars more from outside sources.
- In 2022, ANRS was awarded \$1 million USDA-NIFA grant to increase the number of Hispanic students entering PhD program in animal science. This is a 5 year grant.
- Currently, ANRS is training 42 graduate students and 22 undergraduate students in research techniques related to livestock production, range management, and water science at three agricultural science centers and the on-campus livestock farms.
- ANRS researchers are focused on enhancing efficiency in beef cattle production, managements of rangeland resources, and overall sustainability to preserve our resources for future generations.

Research conducted in animal science and rangeland resources benefits livestock producers and land managers in semi-arid and arid environments, and allows for training of students to be future leaders in the industry.

## SELECTED PROGRAM IMPACTS

- **Factors that impact pregnancy in livestock and humans.** Specific types of infections, including those resulting in subclinical or non-detectable disease states are capable of disrupting normal ovarian and may lead to infertility. These events may contribute to the number of non-pregnant females being culled from the herd, resulting in a loss of productivity and profitability for the producer. Delineating the impact of bacterial infections on ovarian function can lead to increased understanding and management of reproduction and reduce the consequence of disease on female fertility.
- **On-going efforts aimed at advancing integrated pest management options for various ectoparasites effecting livestock production.** Pasture based cow-calf operations common throughout the Southwest are continuously searching for profitable and sustainable management options to overcome a variety of environmental challenges. Horn flies constitute one such threat that requires managerial intervention to avoid economic losses which are estimated to exceed \$1 billion annually. Recently, the Veterinary Entomology Research Laboratory investigated the impacts of rainfall and intake rates on pour-on and feed-through efficacies, respectively. This research supports the development of a fully comprehensive understanding of these popular filth fly control products that will contribute to the development of holistic management plans for cattle growers helping secure food production and health of New Mexicans and surrounding regions.

### ACES Pillars for Economic and Community Development

Food and Fiber Production and Marketing

Water Use and Conservation

Family Development and Health of New Mexicans

Environmental Stewardship

Foundational Education and Training

The College of Agricultural, Consumer, and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through academic, research and Extension programs.

## Selected Partnerships and Collaborators

- Elephant Butte Irrigation District
- Feed and pharmaceutical companies, including Westway Feed Products,
- Hi-Pro Feeds, Paul's Veterinary Supply, Merck, Zoetis, Cargill, and Elanco
- New Mexico Acequia Association
- NM Cattle Growers
- NM Department of Agriculture
- NM Wool Growers
- NMSU Range Improvement Task Force
- Society for Range Management
- USDA and USDI federal agencies, including BLM, NRCS, EPA, Forest Service, Fish and Wildlife Service, and Valles Caldera National Preserve
- USDA-ARS Research Laboratories, including Fort Keogh, Miles City, MT; Meat Animal Research Center, Clay Center, NE; Jornada Experimental Range, Las Cruces, NM; and Northern Great Plains Research Laboratory, Mandan, ND
- Various livestock breed associations, cooperatives, and producer groups
- Various universities, including Texas A&M University, Oklahoma State University, University of Nebraska, University of Arizona, Texas Tech University, San Angelo University, and North Dakota State University

## SELECTED PROGRAM IMPACTS (CONT.)

- Pregnancy complications are the leading cause of maternal, fetal, and neonatal morbidity and mortality in farm animals and humans, typically originating from improper embryo implantation. A greater understanding of embryo implantation and placental development is needed to alleviate pregnancy loss and adverse health outcomes for mother and offspring. With our innovative model, we deliver treatments into the uterus to investigate fetal-maternal interactions controlling placental development and have continued to generate a comprehensive analysis of parameters unfeasible to obtain or characterize in humans. Our efforts have provided a greater understanding of CXCL12 and its regulation of placentation and pregnancy success.
- **Understanding basis of plant invasions. Why do species become invasive?** This issue has puzzled humanity for decades. Research by the collaborators in NMSU herbarium have continued a new genomic project to identify the genetic basis behind several mechanisms driving plant invasion in drylands. DNA is being harvested from century-old herbarium specimens and gathered for experimental greenhouse data, in collaboration with Tel Aviv University, Israel and the NSF-funded Consortium for Plant Invasion Genomics Initiative. Results may help mitigate detrimental effects of invasive species and could reduce the \$36 million annually spent on invasive plant control in the US.

## FACULTY AND EXPERTISE

### Animal Sciences

- Ryan Ashley, Professor, Reproductive Physiology
- Hannah Bilovesky, College Instructor, Equine Science
- John Campbell, College Associate Professor, Judging Team Coordinator
- Glenn Duff, Professor, Ruminant Nutrition
- Gaylene Fasenko, Professor, Companion Animals
- Francine Giotto, Assistant Professor, Meat Science
- Jennifer Hernandez-Gifford, Professor, Reproductive Physiology
- Shanna Ivey, Department Head/Professor, Rumen Microbiology
- Clint Loest, Professor, Ruminant Nutrition
- Craig Painter, College Instructor, Livestock Judging Coach
- Tim Ross, Emeritus Professor, Sheep Production
- Eric Scholljegerdes, Associate Professor, Ruminant Nutrition
- Adam Summers, Associate Professor, Reproductive Physiology
- Sergio Soto-Navarro, Professor, Ruminant Nutrition

### Range Science

- Derek Bailey, Professor, Grazing Management and Behavior
- Andres Cibils, Emeritus Professor, Grazing Management and Ecology
- Alexander "Sam" Fernald, Professor, Water Quality Hydrology
- Sara Fuentes-Soriano, Assistant Professor, Rangeland Plants
- Magda Garbowski, Assistant Professor, Rangeland Restoration
- Hatim Geli, Associate Professor, Landscape Hydrology
- Santiago Utsumi, Associate Professor, Rangeland Ecology





# Agricultural Experiment Station

Department of Entomology, Plant Pathology, and Weed Science

eppws.nmsu.edu • 575-646-3225



## MISSION

The Department of Entomology, Plant Pathology, and Weed Science (EPPWS) is a multi-disciplinary group of scientists and teachers whose mission is to provide academic instruction, research, and service that focuses on managing pests and conserving beneficial species in semi-arid ecosystems. The department emphasizes problem-solving in its teaching and research to manage current and emerging issues in plant and animal health and protection, using tools from molecular to landscape scales

## Quick Facts

- EPPWS scientists study insects, microorganisms, and weedy plant species as well as their interactions with host organisms (crops or animals). Our research allows us to develop sustainable strategies to avoid economic losses through integrated pest management, variety improvement, or other means.
- In the past three years, EPPWS faculty authored or co-authored more than 140 refereed articles and more than 200 presentations at professional meetings. EPPWS faculty served as primary advisors for more than 20 graduate students in four different programs half of whom were Ph.D. students, in 2022.
- Over the past three years, EPPWS investigators have attracted nearly \$15 million in extramural funds from public and private sources. The products of our research, deployed largely by Extension faculty, have an annual economic impact estimated to be roughly 30 times our faculty salaries.

The strength of the department is the interaction of these disciplines in understanding the biology of pest organisms, their interactions, and how pests impact urban, agricultural, and natural resources.

## SELECTED PROGRAM IMPACTS

- **Work-around for resistant weeds.** New Mexico growers face increasing pressure from herbicide-resistant weeds, such as kochia and pigweed in corn-producing areas. These weeds not only reduce yield by competing with the crop but also produce more seeds, exacerbating infestations. Our scientists at the Agriculture Science Center in Clovis are developing strategies to manage glyphosate-resistant kochia and pigweed. Corn yield losses due to kochia and pigweed competition were reduced by 90 %. Corn growers are using this information to increase income and reduce weed infestations.
- **Cutting labor costs by reducing hand weeding.** Profitable chile and onion production in New Mexico is challenged by escalating costs for hand hoeing. To develop strategies for reducing hand hoeing in New Mexico's principal vegetable crops, we assessed cultural and chemical strategies for controlling weeds. Our results indicated specific cover crops and herbicides that suppress weeds and reduce hand hoeing in chile. For onion, we identified a novel herbicide application that is more effective, less expensive, and introduces fewer environmental risks than the conventional herbicides. These practical, non-manual strategies for managing weeds in chile and onion potentially increase profits for farmers in New Mexico.



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### Selected Partnerships and Collaborators

- 4-H
- American Phytopathological Society, Entomological Society of America, Weed Science Society of America, American Society for Microbiology, and Soil Science Society of America
- Ag Industry Support
- Future Farmers of America
- Independent growers engaged in on-farm research
- IR-4
- Many NMSU departments
- Navajo Agricultural Products Industry
- New Mexico Chile Association
- New Mexico Department of Agriculture
- NM Cotton Growers Association
- NM Organic Commodity Commission
- USDA-APHIS
- USDA-ARS
- USDA-NIFA
- Various universities, including the University of Georgia, Oklahoma State University, University of Tokyo, Michigan State University, University of California, University of Illinois, Montana State University, University of Florida, and University of Wyoming

## SELECTED PROGRAM IMPACTS (CONT.)

- **A drier microclimate suppresses caterpillars in cotton.** Virtually all corn and cotton varieties grown in NM are transgenic Bt varieties. Insect pests are developing resistance to Bt in the state, thus alternative methods are needed. EPPWS scientists at the Agricultural Science Center in Artesia are monitoring resistance to Bt genes and developing alternative tools for controlling lepidopterous pests. Recently developed okra leaf cotton varieties have a more open canopy to produce a hotter and drier microclimate than conventional cotton, resulting in higher mortality of lepidopterous pests. Results from field trials in 2020-2022 indicated that bollworm mortality was greater in okra leaf vs standard cotton varieties and egg hatch rates were reduced by 36% in okra leaf cotton.
- **The pecan microbiome.** Pecan trees produce a highly valued and desired nut crop; with production expanding worldwide. Important attributes of pecans and their ability to adapt to different environments aside from their native regions are of great interest. Microbial communities are known to play an important role in crop productivity and overall plant health. Studies in other plant species have shown that the plant microbiome may be influenced by both the environmental conditions and genetics of the plant. By establishing the core microbiome of pecans, the selection of microbes for breeding and improving pecan production will become a possibility.

## FACULTY AND EXPERTISE

### Entomology

- Ricardo Ramirez, Department Head, Entomology
- Scott Bundy, Professor, Insect Taxonomy and Outreach
- Joanie King, Assistant Professor/ Extension Specialist, Entomology
- Jane Pierce, Associate Professor, Economic Entomology
- Alvaro Romero, Associate Professor, Urban Entomology

### Plant Pathology

- Rebecca Creamer, Professor, Plant Virology
- Steve Hanson, Associate Professor, Molecular Biology
- Jennifer Randall, Professor, Plant Physiology
- Soum Sanogo, Professor, Fungal Plant Pathology

### Weed Science

- Leslie Beck, Associate Professor/ Extension Specialist, Weed Science
- Erik Lehnhoff, Associate Professor, Weed Science
- Abdel Mesbah, Associate Professor, Weed Science
- Jerry Sims, Professor, Environmental Microbiology
- Brian Schutte, Associate Professor, Weed Science



# Agricultural Experiment Station

Department of Family and Consumer Sciences

fcs.nmsu.edu • 575-646-3936



## MISSION

The mission of the Department of Family and Consumer Sciences is to serve the culturally diverse clientele of New Mexico and the border region through quality teaching, research, and service.

The Department of Family and Consumer Science is committed to research and strives to embrace NMSU's strategic plan goal 2 of elevating research and creativity. While each of the program areas FCSE, FMAD, FSTE, HDFS, and HNDS strive to balance quality teaching with research and faculty in each program area have varying research expectations, each area is involved in important research activities.

## Quick Facts

- Research in FCS is collaborative and focuses on enhancing the lives of the people of New Mexico.
- FCS is home to NMSU's equine therapy program. Horses help humans to understand relationships. The area of equine-assisted psychotherapy has been used to enhance the lives and well-being of the people of New Mexico.

## SELECTED PROGRAM IMPACTS

### • Human Development and Family Science (HDFS)

Dr. Merranda Marin is involved in the MARC (Maximizing Access to Research Careers) program, whose goal is to increase the number and capabilities of scientists from underrepresented groups who are engaged in biomedical research, and to strengthen science curricula and student research opportunities. She also collaborates with NMSU's Student Success Center and Honors College on the McNair Scholars Program, a federal TRIO program designed to prepare undergraduate students for doctoral studies through involvement in research and other scholarly activities.

Dr. Marcel Montañez develops psychometric instruments for a variety of research and evaluation purposes. He recently developed a measure of change in a variety of behavior and perceptive outcomes that theoretically are a consequence of participating in 4H events. The instrument can be used in the evaluation of programs. One important contribution to the research community is the ability to show ancillary outcomes that are meaningful, but often unintentional as an artifact of participating in an agricultural-based, human development program.

### • Fashion, Merchandising, and Design (FMAD)

The current apparel market volatility and new technologies disrupting the local and global economy have led to a more connected and identifiable fashion consumer. To keep up with the ever-changing industry, our students are taught innovative and sustainable industry models while addressing the human, environmental, and social costs that arise from the fashion industry. Our program strives to serve the culturally diverse clientele of New Mexico as well as globally and embrace the diversity, equity, and inclusion (DEI) focus that NMSU has stated in its mission statement.

### • Family and Consumer Science Education (FCSE)

Family and Consumer Sciences professionals concentrate on consumerism and share their expertise in managing and allocating resources with clients to clothe, house, nourish, and educate families adequately. Typical practice settings for Family and Consumer Sciences professionals include but are not limited to academic education, community education (including Cooperative Extension programs), business and industry, government, and health and human services.



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## Selected Partnerships and Collaborators

- Cornell University
- Families and Youth, Inc.
- Illinois Institute of Technology
- Iowa State University
- La Pinon Sexual Assault Recovery Services
- Michigan State University
- NMSUs Honors College
- NMSUs Student Success Center
- Oregon State University
- Rutgers University
- South Dakota State University
- The Ohio State University
- The Pennsylvania State University
- UC Davis
- University of Arkansas
- University of Illinois, Urbana-Champaign,
- University of Kentucky
- University of Maryland
- University of Minnesota
- University of Nebraska-Lincoln
- Washington State University
- University of Arizona
- North Texas University
- Sejong University, Korea

## SELECTED PROGRAM IMPACTS (CONT.)

### • Food Science and Technology (FSTE)

Consumers are increasingly interested in healthy foods with natural as well as the sustainability of food manufacture. This has prompted the food industry to investigate alternative thermal and nonthermal technologies. While advanced thermal-based technologies (such as Ohmic heating and microwave heating) employ volumetric heating, nonthermal technologies use lethal agents other than heat (such as pressure, high voltage, and UV light as examples) to minimize the thermal impact on nutrient and product quality. Investigator Martinez-Monteagudo's laboratory has been evaluating the benefits and limitations of different technologies. (*Food Bioprocessing Studies on food quality and process sustainability* | Dr. Sergio Martinez-Monteagudo)

Researchers are collaborating with New Mexico agricultural producers including the producers in the chile, pecan, wine, and cotton industries. Leveraging external funding, the research is exploring ways to extract alternative plant proteins and antioxidants from agro-industrial byproducts. These proteins and antioxidants can be used as ingredients in food and feed.

Dr. Sabillon's research program is generating novel experimental data to better understand the impact of visible light photosensitizer on the inactivation of enteric pathogens. aPDT technology may play an important role in eliminating persistent pathogen reservoirs, thereby reducing the risk of food safety incidents. (Dr. Luis Sabillon)

### • Human Nutrition and Dietetic Science (HNDS)

Ms. Gaby Phillips is the Director of the Dietetics Internship Program, where she teaches graduate-level classes and is in the process of ensuring the accreditation for the program is up to standard. The main research that she conducts is developing and assessing the impact of dietetics Virtual Reality and simulation curricula to alleviate the shortage of Registered Dietitian Nutritionists.

Dr. Martin conducts classroom activities such as group work, and role-playing patient-client interaction that allows students to participate in what they are learning. SAND (Student Association Nutrition and Dietetics) is also growing. There are approximately 20 members, Dr. Martin being the advisor for the club and all its activities. Dr. Martin has secured the Paso Del Norte Health Foundation grant and hosted the Continental Cooking and Gardening class for teens.

## FACULTY AND EXPERTISE

### FCSE | Family and Consumer Science Education

- Ms. Jessica Azcarate, College Assistant Professor

### FSTE | Food Science and Technology

- Dr. Efren Delgado, Department Head and Professor
- Dr. Sergio Martinez-Monteagudo, Assistant Professor
- Dr. Luis Sabillon-Galeas, Assistant Professor
- Dr. John Flores, Professor
- Dr. Francine Mezzomo Giotto, Assistant Professor

### HDFS | Human Development and Family Science

- Dr. Merranda Marin, Professor, Licensed Psychologist, Licensed Marriage and Family Therapist
- Dr. Marcel Montanez, Professor, Licensed Marriage and Family Therapist
- Dr. Kourtney Vaillancourt, College Professor, Licensed Marriage and Family Therapist (LMFT), Licensed Alcohol, Drug Counselor (LADC), and AAMFT Approved Supervisor

### HNDS | Human Nutrition and Dietetics

- Dr. Shadai Martin PhD RDN
- Ms. Brigit O'Donnell, MS, RDN, LD, Didactic Program in Dietetics Interim Director
- Ms. Gaby Phillips, College Assistant Professor, Dietetic Internship Director

### FMAD | Fashion Merchandising and Design

- Dr. Insook Ahn, Assistant Professor
- Dr. Kelley Coffeen, College Assistant Professor







# Agricultural Experiment Station

Department of Fish, Wildlife, and Conservation Ecology

fwce.nmsu.edu • 575-646-1544



## MISSION

The Department of Fish, Wildlife, and Conservation Ecology is dedicated to natural resource stewardship. They work collaboratively with state, federal, tribal, and private stakeholders to resolve fishery and wildlife management challenges. FWCE faculty train the next generation of professionals using traditional and emerging scientific methods, and apply this knowledge to the conservation and management of fish and wildlife in New Mexico, the southwestern US, nationally and internationally.

## Quick Facts

- FWCE has very strong ties to state and federal agencies, with three federal scientists acting as faculty.
- The department trains approximately 150 undergraduates and 40 graduate students and is the premier wildlife and fisheries management programs in the southwestern US.
- Faculty and students engage work on diverse issues, including endangered species management, human wildlife conflict, game and sport fish restoration, understanding playa lake ecology, addressing the impact of forest fires and energy development on wildlife, assessing the impact of wildlife diseases, & mapping animal migrations.
- FWCE research occurs not only in southwestern states, but across the USA and the globe, with recent research addressing wildlife topics in Belize, Brazil, India, Madagascar, Mexico, Namibia, Nepal, Nigeria, Pakistan & South Africa, among others.

The FWCE research program provides innovative solutions to natural resource problems by maintaining a competitive research agenda that results in peer- refereed publications and technical reports that advance our knowledge and enhance the management and conservation of fish and wildlife.

## SELECTED PROGRAM IMPACTS

- **Understand the Habitat Suitability for Species Restoration:** Research on species as diverse as the Gila chub (a fish of New Mexico) and the red wolf (a mammal of the southeastern US) is being conducted in collaboration with federal and state agencies to better understand where species reintroductions might successfully occur.
- **Recovery of Mexican Wolves and Management of Elk in the Southwest:** Data on elk survival rates, cause-specific mortality and habitat selection is limited for periods after reintroduction of Mexican wolves into New Mexico and Arizona. This lack of data impedes the development of the most informed management plans for elk in the Mexican wolf recovery area. Researchers are assessing survival, cause-specific mortality, behavior and habitat selection of elk across the Mexican wolf recovery area.
- **Raptor Sustainable Take Rates:** Research on eagle mortality at wind energy projects resulted in the U.S. Fish and Wildlife Service modifying the eagle permitting process for wind energy facilities. Similar studies for other raptors are underway.
- **Ensuring Continued Persistence of Rio Grande Cutthroat Trout:** Collaborations with the New Mexico Department of Game and Fish helped identify and save trout populations that were vulnerable to ash and sediment flow following forest fires. These fish were removed from streams prior to sediment run-off and used to population other steam sections in the state.



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## Selected Partnerships and Collaborators

FWCE collaborates with government, nongovernment, and international agencies.

Type(s) of collaboration: **I:** Internships; **H:** Hire students that graduate from our department; **MOU:** A specific memorandum of understanding exists between FWCE and the agency; **R:** Research funded by agency, often supporting graduate students to work on project; **S:** Scholarships

### Government Agencies and Organizations

- Arizona Game and Fish Department—R
- Arkansas Game & Fish Commission—R, I
- Bureau of Land Management—I, H, MOU, R
- BOR/Army Corps of Engineers—R
- City of Las Cruces—R
- Department of Defense (Fort Bliss, Kirtland Air Force Base, Fort Irwin – National Training Center; White Sands Missile Range)—R
- Environmental Protection Agency—R
- Mescalero Apache Tribe—R
- Mesilla Valley Bosque State Park—R
- New Mexico Department of Game and Fish— I, H, R, S
- National Park Service (White Sands National Park, Valles Caldera National Preserve)—R
- Natural Resource Conservation Service (NRCS)—R
- Navajo Nation—R
- Texas Parks and Wildlife—R
- US Fish and Wildlife Service—I, H, R, MOU
- US Department of Agriculture – Animal and Plant Health Inspection Service (Wildlife Services)—I, H, MOU, S
- US Department of Agriculture (Agricultural Research Service; Farm Service Agency)—R
- US Forest Service—H, R
- US Geological Survey—H, MOU, R, S

### Non-Government Agencies and Organizations (R)

- AmericaView, Inc.
- El Paso Zoo
- Envirological Services
- Global Owl Project
- International Arid Lands Consortium
- Mesa Ecological Services
- New Mexico and Arizona Audubon Societies New
- Mexico Ornithological Society
- New Mexico Association of Conservation Districts
- Safari Club International
- Southwest Environmental Center
- T & E, Inc.
- The Nature Conservancy
- Trout Unlimited
- Turner Endangered Species Fund
- Wilburforce Foundation

### International Agencies (R)

- ProFauna (Mexico)
- Scarlet Six Biomonitoring Team (Belize)

## SELECTED PROGRAM IMPACTS (CONT.)

- **Endangered Species Conservation:** Research with collaborating state, federal, and tribal agencies on endangered birds, fish, mammals, reptiles, and invertebrates leads to more efficient survey protocols and a better understanding of how modifications to management approaches can be used to help recover species.
- **Large Mammal Responses to Forest Restoration:** The increase in catastrophic wildfires over the past two decades has spurred forest restoration projects. Researchers are determining the influence of landscape- scale forest restoration treatments on patterns of resource selection by mule deer, elk, black bears, and mountain lions in northern New Mexico to help land managers determine how best to implement vegetation treatments that will meet forest restoration and wildlife management objectives.
- **Understanding the Impacts of Disease on Wildlife:** Research on pneumonia in bighorn sheep and Rabbit Hemorrhagic Disease Virus in native cottontails and jackrabbits was conducted to understand how these disease outbreaks are affecting these species in southern New Mexico
- **Conducting Species Status Assessment:** A Species Status Assessments (SSA) is an analytical approach used to deliver foundational science for informing all Endangered Species Act decisions. The drafting of an SSA for several reptiles is being conducted for the US Fish and Wildlife Service.
- **Ecology of State Endangered Small Mammals:** FWCE faculty are researching the ecology of state endangered small mammal species to aid in the development of management plans and to forestall federal protections under the Endangered Species Act.

## FACULTY AND EXPERTISE

- **Wiebke J. Boeing**, Professor, aquatic communities and algae as biofuel
- **James W. Cain III**, Affiliate Professor, wildlife-habitat relationships and large mammal ecology
- **Martha J. Desmond**, Regents Professor, avian ecology and conservation
- **Jennifer K. Frey**, Professor, mammalian diversity and conservation
- **Fitsum Abadi Gebreselassie**, Associate Professor, capture-recapture models, integrated population models, Bayesian inference
- **Jay Gedir**, Senior Research Scientist, vertebrate population dynamics, raptor demographic modeling
- **Matthew E. Gompper**, Department Head and Professor, mammal ecology, management and conservation; disease ecology and zoonoses
- **Obed Hernandez-Gomez**, Assistant Professor, disease ecology, herpetology, conservation genetics
- **Kelly Jones**, Professor, human dimensions of conservation, environmental economics, evidence-based conservation, social-ecological systems research
- **Zachary Klein**, Assistant Professor, fish ecology and conservation, fisheries management, population ecology
- **Theresa Laverty**, Assistant Professor, mammalian ecology and conservation, population and community ecology, social dimensions of conservation
- **Abigail J. Lawson**, Affiliate Assistant Professor, population ecology, harvest modeling, endangered species, ornithology, herpetology
- **Brian Millsap**, Senior Research Scientist, raptor ecology, bayesian inference, integrated population models, wildlife policy, wildlife law
- **Kasey Pregler**, Affiliate Assistant Professor, Population ecology, fish ecology, conservation genetics, conservation of small populations



## MISSION

PES will improve the quality of life for the citizens of New Mexico, the United States and globally, through teaching, research, outreach, and service in the study and application of plant and environmental sciences relevant to agriculture, food and fiber production and environmental sustainability, particularly in New Mexico, the arid southwestern USA, and drylands globally.

The Department of Plant and Environmental Sciences has experienced and internationally recognized faculty with varied specialties, including plant breeding, genetic engineering, biotechnology, ornamental plant production, landscape design, horticulture, turfgrass management, sustainable crop production, soil remediation and environmental science.

**Values:** PES is committed to developing the next generation of agricultural and environmental stewards, committed to science-based understanding, improvement and management of plant and environmental systems, rooted in the historical, social and cultural contexts of New Mexico. PES is committed to developing and maintaining an inclusive, welcoming and equitable environment for students, faculty and staff that recognizes, encourages and embraces diverse backgrounds, cultures, experiences and aspirations.

## Quick Facts

- Over the past five years, PES faculty have published more than four books and 400 refereed journal articles, and have had five papers appear as cover articles on scientific journals.
- The department is home to many research and outreach programs, such as the alfalfa, chile, cotton, and onion breeding programs; the State Climatology Office; and the Partnership for the Advancement of Cancer Research.
- PES's award-winning faculty have received 60 academic awards and 10 service awards, released 111 cultivars, and been awarded four patents. The department has two Regents Professors and four endowed chairs. Over the last three years, faculty have attracted nearly \$8 million in external grants and contracts.

## SELECTED PROGRAM IMPACTS

- Improving the availability of soil survey data and knowledge to address persistent and on-going resource use needs of New Mexican's requires novel and efficient methods of soil survey. This research is foundational for stewards of all natural and working land in NM including federal and state land managers, agricultural producers, private ranchers and foresters, and the NMDA Healthy Soil Program by providing the baseline information necessary to assess site-specific land management decisions such as grazing intensity, brush management, or livestock rates.
- The hyporheic zone within streambeds is the biogeochemical reactor of streams controlling nutrient cycling, habitat selection and suitability, and primary production and respiration. However, mapping methods for spatial interpolation under data-limited conditions can be challenging, especially for constrained environments such as streams and rivers, which exhibit mapping errors due to low point-measurement data density and clustering. Adding left censored data increased the data density to recommended ranges, reduced data clustering, increased the spatial dependence for some attributes, and reduced the standard error for each of the three attributes. Now, hyporheic zone mapping can be more accurately used to assess nutrient management and ecosystem functioning of streams even in locations with lower data density, and data collection costs are decreased with decreased data density. This will allow better management of water resources, water quality, and ecosystems.



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## Faculty and Staff

### Agronomy and Soils

- Colby Brungard
- John Idowu
- Koffi Djaman
- Kulbhushan Grover
- Leonard Lauriault
- Mark Marsalis
- Murali Darapuneni
- Rajan Ghimire
- Robert Flynn
- Sangamesh Angadi
- Xiufen (Sophia) Li

### Environmental Science

- April Ulery
- Blair Stringam
- Brandon Edwards
- Caitriana Steele
- David DuBois
- F. Omar Holguin
- Jacqueline Jarvis
- Julius Anchang
- Kenneth C. Carroll
- Manoj Shukla
- Niall Hanan
- Nicholas Webb
- Nicole Pietrasiak
- Njoki Kahi
- Owen Burney
- Rajan Ghimire

### Genetics and Biotechnology

- Christopher Cramer
- Dennis Lozada
- Ian Ray
- Jinfa Zhang
- Naveen Puppala
- Richard C. Pratt

### Horticulture and Turf Science and Management

- Bernd Leinauer
- Geno Picchioni
- Ivette Guzmán
- Kevin Lombard
- Marisa Thompson
- Rachel Gioannini
- Richard Heerema
- Ryan Goss
- Shengrui Yao
- Stephanie Walker

## SELECTED PROGRAM IMPACTS (CONT.)

- Faculty identified potential opportune crops to replace fallow in the current cropping system. Introducing these crops will not only increase the overall productivity per unit area but also improve the resource use efficiency, such as water and soil nutrients. Pearl millet, German millet, proso millet, cowpea, and sesbania are some of the potential species with consistently greater yields and water use efficiencies.
- Water management is one of the most pressing issues turfgrass managers face in the arid regions of the world and periodically in temperate regions. The results of this research provide turfgrass managers a decision making tool to determine which herbicides should be applied to maximize herbicide efficacy on weeds and minimize herbicide injury to desired turfgrasses. These tools have been utilized by NM golf course and athletic field managers to protect their desired turfgrass stands from herbicide injury and ensured herbicide applications were made to maximize efficacy based on plant water status.
- Best management practices arising from multiple years of trials with guar and guayule are being shared with producers in the state. Demonstration trials at different locations in New Mexico have been used to explain important production practices to farmers. Growing guar and guayule as industrial crops in New Mexico can diversify the income of farmers and provide much-needed support towards economic and cropping systems sustainability.
- Acreage for the New Mexican chile crop has decreased 73% in the last 25 years. A three-pronged strategy was developed to increase competitiveness of NM type green chile through mechanization. Regaining lost NM type green chile acreage will result in approximately \$70 million additional cash receipts for New Mexico growers.
- Declining irrigation water resources and increasingly variable climate are threatening sustainability of Ogallala Aquifer irrigated agriculture in the Southern Great Plains. Circular buffer strips improved rainfall conservation, reduced crop stress, improved biomass production and improved rainfall water use efficiency. Benefits of circular buffer strips depended on rainfall intensity.

## SELECTED PARTNERSHIPS AND COLLABORATORS

- Alforex Seeds
- Bureau of Land Management
- Cotton Incorporated
- Dow AgroSciences
- U.S. Forest Service
- Fred Hutchinson Cancer Research Center
- J. Frank Schmidt & Son Nurseries
- Local farmers
- National Cancer Institute
- New Mexico Acequia Association
- New Mexico Chile Growers Association
- New Mexico Environment Department
- Oak Ridge National Laboratory
- USDA-ARS, USDA-NRCS
- Other universities, including Arizona State University, University of California, and the University of Arizona





# College of Agricultural, Consumer and Environmental Sciences

School of Hotel, Restaurant and Tourism Management  
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## MISSION

The School of Hotel, Restaurant & Tourism Management’s mission is to serve the needs of our constituents as an engine for economic growth and community development in New Mexico through innovative teaching, research, service, professional applications and partnerships in a multi-cultural and international environment.

## Quick Facts

- Visitors to New Mexico spent \$7.4 billion in 2019, which generated \$10.4 billion in total business sales, including indirect and induced impacts and after two disappointing years 2022 is on track to pass 2019 according to the Department of Tourism.
- Tourism’s prominence is illustrated by Santa Fe being the 3rd best travel destination in the world and the #1 attraction in the USA for 2022 by Forbes Magazine.
- The deep space food research initiative will grow New Mexico Fairy Shrimp from the playa lakes.

## RECENT IMPACTS

### • Robotics and Hospitality

Traditionally a people industry, the hospitality industry is becoming increasingly automated. The pandemic has accelerated automation with the need for contactless services. Dr. Betsy Stringam’s leadership in several projects assists in successful implementation of automation and technology for the hospitality industry. As part of an NSF funded large multi-university and entity project, Dr. Stringam is helping to prepare workers and workplaces for increased technology and automation. Dr. Stringam also leads the Sodexo/KiwiBot collaborative project examining the implementation of food delivery robots. Dr. Stringam’s inclusion of both undergraduate and graduate students in these projects prepares future leaders.

### • Supporting and Sustaining Independently Owned New Mexican Rural Tourism Business Operators

Dr. Keith Mandabach’s Hatch Project studies supporting and sustaining independently owned New Mexican rural tourism business operators. The project’s initial needs assessment is in process. It was presented at university conferences and discussed at an industry conference and with stakeholders. He is working with a graduate student who submitted a feasibility proposal to develop a bi-national farmers market in Columbus, NM to promote rural tourism. Based in part on the research, he authored a related book chapter for the Routledge Handbook of Wine Tourism, “Integrating Wine Tourism in the Rural Tourism Experience” which was published in November.

### • Deep Space Food Project

Faculty from HRTM participate in the NMSU team consisting of engineering, aquatic environment, food science and hospitality professors. The project is sponsored by Virgin Galactic to enhance their space tourism and sustainable foods on site. This team created a bioreactor to grow aquatic foods on deep space flight. Once these foods have grown, the food is cooked into a space steak with a waffle iron-type cooking device. Phase One of the project was to design the food making equipment. The group is now in Phase Two - experimentation of the processes to grow and cook the space steaks.



The College of Agricultural, Consumer, and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through academic, research and Extension programs.

## Selected Partnerships and Collaborators

- American Culinary Federation
- American Hotel and Lodging Association
- Center for the Advancement of Foodservice Education
- El Paso Hotel and Lodging Association
- Greater Albuquerque Hotel and Lodging Association
- International Council of Hotel, Restaurant and Institutional Educators
- Las Cruces Chamber of Commerce
- Visit Las Cruces and its Industry Partner Group
- New Mexico Department of Agriculture
- New Mexico Hospitality Association
- New Mexico Restaurant Association and National Restaurant Association
- New Mexico Beef Council
- Viva Vino - New Mexico Wine

## Employers Recruiting HRTM Students and Graduates

- 4UR Ranch
- Alto Lakes Golf and Country Club
- Angel Fire Resorts
- BC Lynd Hotel Group
- Chick-Fil-A
- Courtyard by Marriott Las Cruces
- Dion's Restaurants
- Enterprise
- Enchantment Resorts
- Hormel Foods
- Heritage Companies
- Hyatt Regency Tamaya Resort and Spa
- Jason's Deli
- Lettuce Entertain You Restaurants
- Las Cruces Convention Center
- Marriott International
- Republic National Distributing Company
- Pappas Restaurants
- Salud! De Mesilla
- The Club at Las Campanas
- Sun Travel



- **NMSU University Research Council Excellence in Team Research Award**  
In January 2022, Dr. Keith Mandabach and Dr. Dawn Van Leeuwen received the NMSU URC Excellence in Team Research award. They have collaborated since 1998 with 17 joint papers that generated 299 citations. Their research focus is primarily food-related but contributes to the boundary-spanning areas of food allergies, food safety, foodservice, restaurants, culinary, agriculture and agri-tourism. 739,000 in grants have arisen from their collaboration. Jointly, they have worked with 10 graduate students who have published 5 journal articles, as well as 13 other authors. Their collaboration has been of benefit to NMSU, New Mexicans, and hospitality, business, and education researchers.

- **Reducing Service Sabotage: The Influence of Supervisor Social Undermining, Job Stress, Turnover Intention and Ethical Conflict**

Dr. Christina Dimitriou's most recent published article is a collaboration with Dr. Charles H. Schwepker, Jr. from the University of Central Missouri "Reducing service sabotage: The influence of supervisor social undermining, job stress, turnover intention and ethical conflict" was published in Journal of Marketing Theory and Practice. It was based on a sample of 316 hotel/motel employees and deals with unethical behavior in the form of supervisor social undermining and its impact on service sabotage, the job stress and the ethical conflict that hotel/motel employees are experiencing. It aims to help hotel managers better understand and approach the industry challenges.

## FACULTY AND STAFF EXPERTISE

**Jean Hertzman:** Director and Professor

- Hospitality and food service operations
- Culinary, wine, and beverage education

**Daren Bloomquist:** College Assistant Professor

- Sustainable facilities management
- Marketing and tourism

**Christina Dimitriou:** Assistant Professor

- Tourism and hospitality operations
- Ethical leadership

**Keith Mandabach:** Professor

- Rural and culinary tourism
- Restaurant and bar management
- Higher education assessment

**Pete Mitchell:** College Assistant Professor

- Culinary arts and restaurant management
- Food safety

**Betsy Stringam:** Professor

- Educational technology
- Hotel and resort management
- Robots in hospitality

**Danielle Young:** College Assistant Professor

- Food preparation, service and safety
- Event and venue management

**Andrea Arrigucci:** Senior Program Specialist, Marriott Hospitality Futures Center

- Professional development
- Communication and social media

**Jacob Villa:** Program Assistant, Marriott Hospitality Futures Center