College of Agricultural, Consumer and Environmental Sciences
New Mexico State University

2021 Annual Report

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Preamble

This annual report highlights impacts and accomplishments from our three main areas and special programs in the College of Agricultural, Consumer, and Environmental Sciences (ACES). These areas and programs include Academic Programs – Student Services; the Agricultural Experiment Station; the Cooperative Extension Service; Indian Resources Development; the Center of Excellence in Sustainable Food and Agriculture Systems; the Equity, Inclusion and Diversity Initiative; and the Global Initiatives Program – Aggies Go Global. It provides an overview of multiple accomplishments from 2021 such as impacts, productivity, contributions, and goals for each unit.

The year 2021 has been challenging due to all the changes that the year and COVID-19 brought us; however, thanks to ACES staff, faculty and students a wonderful job and teamwork achieved the objectives for the College of ACES. We succeeded!

The importance of ACES for NMSU and the state of New Mexico is herein presented in a succinct and visual manner. The collaboration of the ACES team in the preparation of this report and the accomplishment of our tasks and objectives cannot be praised enough.

There is a section on the building of the new facilities that will be a game changer for ACES and NMSU. It is here that we want to give our most sincere thanks to New Mexico voters for supporting our growth plans by overwhelmingly approving the GO Bond 2018. Also, we want to thank our private donors for their contributions to the success of this project. Additional contributions and donations are always welcome. Stay alert for the formal dedication for these three buildings toward the end of the year.

Rolando A. Flores Galarza
Dean and Chief Administrative Officer
College of Agricultural, Consumer
and Environmental Sciences
New Mexico State University

ACES Mission

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

ACES Executive Summary

The College of Agricultural, Consumer, and Environmental Sciences (ACES) is broadly organized into three interrelated functional areas: Academic Programs, the Agricultural Experiment Station (AES), and the Cooperative Extension Service (CES). The college structure also includes special programs – Indian Resources Development (IRD), Global Programs (GP), and the Center of Excellence in Sustainable Food and Agricultural Systems (CESFAS) – and special initiatives such as Equity, Diversity and Inclusion (EID).

Teaching, research, and Extension efforts within the College are centered on four primary pillars, with a foundation of education and training. The four pillars are (1) food and fiber production and marketing, (2) water use and conservation, (3) family development and health of New Mexicans, and (4) environmental stewardship.

In Academic Programs, a theme for 2021 was "returning to a new normal" under COVID-safe policies and procedures, including a return to in-person teaching (fall semester), recruiting and related events to increase the visibility of ACES to potential students throughout New Mexico, cultivate strong linkages with alumni and stakeholders, and promote ACES graduates as "employees of choice" with potential employers.

In 2021, Agricultural Experiment Station faculty and staff generated extensive research, education and training related to the four ACES pillars. These included tools for drought monitoring and economic impact calculations; research on consumer preferences around spicy pepper consumption; new herbicides for Roundup-resistant weeds; ways of optimizing water use by turfgrass; new crops utilizing brackish groundwater reserves; methods of using agricultural biomass in electricity generation; information on the health effects of COVID-19 among agricultural producers; investigations into the increased nutritional value of local foods; programs for creating resilient food networks in New Mexico; research to better understand and mitigate the effects of invasive species; conservation of New Mexico freshwater fishes; and facilitating New Mexicans' access to site-specific information about soils. The Agricultural Experiment Station includes scientists who work on facilities at the NMSU main campus in eight academic departments as well as at twelve agricultural science and research centers throughout the state, on 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 under 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.

The NMSU Cooperative Extension Service (CES) delivers practical, research-based knowledge and programs that improve New Mexicans' quality of life via federal, state, and county partnerships. CES has staff in all 33 counties and many Tribal areas in New Mexico, and collaborates with over 1,000 organizations, state and federal agencies, other universities, and 10,000 volunteers. Every year, Extension faculty reach over 400, 000 New Mexicans-more than one-third of the state's population who benefit from a wide range of CES educational programs in areas such as economic and community development, human nutrition, agriculture, environmental stewardship, and family and child development. In 2021, Cooperative Extension Service faculty and staff generated 547 Extension publications and 220 conference presentations and facilitated 2,573 workshops and presentations. Faculty and staff were awarded 69 grants and contracts, totaling $17,873,700. In addition, cash and in-kind donations offset total expenditures of $24,208,037. CES provided educational programming to more than 700,000 New Mexicans while also reaching people 11,814,386 times through various social media outlets.

NMSU's Center of Excellence in Sustainable Food and Agricultural Systems coordinates the expertise and efforts of faculty and staff throughout the NMSU system and other stakeholders in developing solutions to problems facing New Mexico's food and agricultural systems. Coordination efforts include developing and supporting transdisciplinary "roadmap" teams, providing seed funding for innovative research projects, and collaborating with other New Mexico centers of excellence and other stakeholders. Over the past two years, roadmap teams have been formed around the following topics: carbon sequestration; hemp production and utilization; controlled-environment agriculture; food, water, and energy; sustainable agricultural systems – dairy; conservation; and healthy soils, plants, and people. Center directors and staff conduct outreach efforts with various New Mexico stakeholder groups to highlight the importance of sustainable food and agricultural systems and share how New Mexico State University is working to solve critical issues in the State's food and agricultural Systems.

The College of ACES Global Program (GP) aims to provide every student in the College of Agricultural, Consumer and Environmental Sciences an opportunity to have an inspiring international experience prior to graduation. The ACES GP also participates in grant programs to amplify the impact of research on society and the economy and to promote international collaboration by accelerating technology and knowledge transfer. Global Programs also collaborates with international companies, including three Israeli companies, Ndrip, Tal Ya and Cropx, on projects related to increasing water conservation and crop water use efficiency for the specialty crops of New Mexico. To encourage global activities, including recruitment of faculty and students, ACES GP has also initiated an annual Outstanding Global Work Award as well as travel awards. In order to further its mission and expand outreach to ACES alumni, ACES GP also gives an International Distinguished Alumni award.

Indian Resources Development (IRD) is a statewide program that offers educational and professional development opportunities for Native American students from New Mexico who are in high school and college; and supports NM tribal nations in developing their own technical and managerial expertise in agriculture, natural resources, engineering, energy, and business.In 2021, Indian Resources Development (IRD) was able to advance its mission by providing research and internship experiences for high school and college students, offering emergency scholarships and financial aid information, supporting the participation of college students in professional development conferences and meetings, and – most importantly – by serving as a connector between partners and collaborators. In 2021, IRD also secured federal funding in collaborations with other high education institutions to offer agricultural and entrepreneurial camps and professional development workshops, as well as internships that aid in keeping college students interested and focused on staying in college and graduating. Internally, IRD put together communications and fund development plans, published the first issues of its newsletter, added informational resources to its web site, hosted its first graduate student assistant, and continued the work of expanding tribal advisory groups for the program.

Equity, Diversity and Inclusion (EID) was named as a special initiative of the college of ACES in August 2021. The initiative's two co-directors are charged with coordinating and managing strategic activities within the college of ACES as well as serving as liaisons to campus-wide EID initiatives. Goals of this initiative are to (1) review, evaluate, and recommend policies and programs promoting diversity and inclusivity for ACES faculty, staff, and students and (2) collaborate with the NMSU Vice President for EID, ACES Dean, Associate Deans, and unit leaders on efforts to foster equitable and inclusive environments within the college as well as externally with community stakeholders. In 2021, the EID directors and other ACES faculty paticipated in professional development programs, including being trained as facilitators of a national CES program called Coming Together for Racial Understanding (CTRU) and offering this program to 170 participants from the ACES college. The EID directors also participated in NMSU trainings from the Borderland and Ethnic Studies Program, the Teaching Academy, Training Central, Chicano Programs, the VP for Equity, Inclusion and Diversity Office, and the College Assistance Migrant Program as well as from the following non-NMSU entities: Association of Public and Land-Grant Universities; National Academies of Sciences, Engineering and Medicine; and the Michigan State University Office of Diversity, Equity and Inclusion. The co-directors met with administrators from ACES Academic Programs, the Agriculture Experiment Station (AES), and the Cooperative Extension Service (CES) as well as with four department heads to discuss needs for EID resources and professional development training.

Introduction

A theme for 2021 was "returning to a new normal." While many key ACES Academic Program Office (ACES-APO) activities were significantly disrupted in 2020, we were able to re-engage in many of these activities and initiatives in 2021, albeit under COVID-safe policies and procedures. Of note, our College fully embraced the return to in-person teaching (fall semester), which speaks highly of our faculty's commitment to student learning. Overall, our faculty and students were committed to this approach, and to that end the College experienced a minimal level of issues related to COVID safety and compliance. Beyond the classroom, we held recruiting and related events to increase the visibility of ACES to potential students throughout NM and beyond, implemented new initiatives to enhance student success and professional development, and generally increased our level of personal engagement with stakeholders. In summary, we began to see in 2021 some initial benefits of the integrated approach to the ACES Academic Programs Office that was envisioned in 2019, and was established in 2020. Moving forward, Academic Programs will continue to provide solid leadership to leverage these advancements and accomplishments with definitive goals to increase enrollment, instill an attitude of excellence in our students and faculty, develop strong linkages with our alumni and stakeholders, and promote our ACES graduates as 'employees of choice' with potential employers.

2021 Recruitment Accomplishments

In 2021, a more modern approach to student recruitment was adopted. No doubt, increasing enrollment is critical to the future of the College. Thus, the College's approach to student recruitment is being revised with more emphasis on broadening our reach, developing focused marketing strategies, and taking a more active (vs passive) approach. Of particular note, we partnered with Keystone Academic Solutions to recruit undergraduate and graduate students globally, re-established our participation in state fairs, increased social media activity, linked with alumni to assist in recruitment, expanded the scope of ACES Ambassadors recruitment activities, and established an ACES Recruitment Committee. Primarily due to the pandemic, our undergraduate enrollment dropped for 2021, so reversing this trend is a priority.

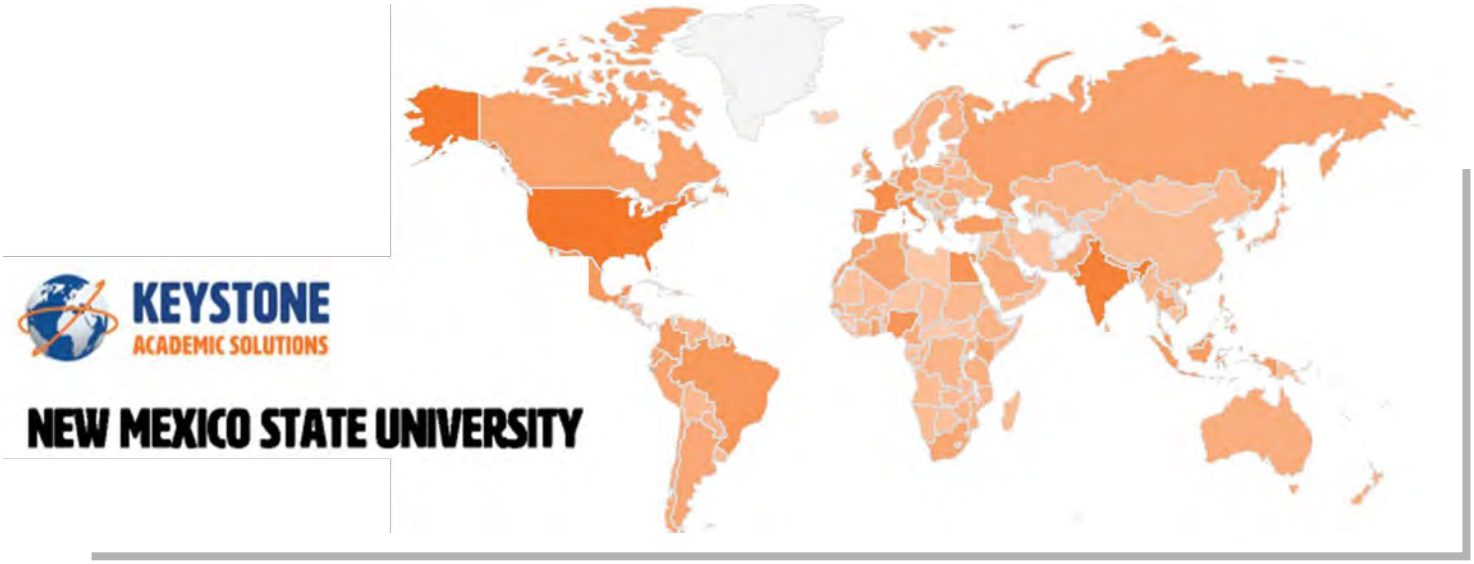
While the primary responsibility for student recruitment, retention and placement lies with the College,, the College must successfully partner with NMSU central offices - namely Admissions, Financial Aid, CAASS, Career Services and Student Records, to be successful. Very strong working relationships with these offices have been establihed, which in turn has allowed the ACES College to be more responsive in meeting needs of our students and faculty. This bridge building continues to be a work-in-progress and remains a high priority.

2022–2025 Goals

In support of ACES Strategic Goals 1.1 and 1.3, the ACES-APO will continue to bolster its recruitment efforts. Undergraduate and graduate recruitment events have begun to be re-established, with a particular focus on in-person statewide events.

Strategies to improve responsiveness to student leads will begin being utilized. By using resources within the NMSU system and efforts within the ACES-APO we will begin generating more personal responses to student inquiries and applications. Efforts will also include an increased social media presence.

To help leverage our recruitment efforts throughout the state, we plan to continue improving our scholarship award processes. This will allow scholarships to be given to potential students by our College Recruiter and to begin awarding scholarships earlier.



Equity Inclusion and Diversity (EID) Initiatives Related to Student Recruitment

ACES is home to eight academic departments that offer 23 different undergraduate majors. Therefore, our College appeals to and supports students representing diverse backgrounds and academic interests. This is a message that needs to be well communicated to a broader audience. To that end, recruitment efforts will be enhanced to target underrepresented students, with an initial effort to increase recruitment of tribal students and military veterans.

2021 Retention Accomplishments

In the ACES-APO, the goal is to lead the College by our own examples. This comes in many forms, including promoting an atmosphere of servant leadership and commitment to excellence. An effort to develop a team approach to the Academic Programs Office continues. This entailed integration of the Ag Ed/FFA office and Rodeo Team Coach as part of the ACES-APO team. For 2021, hiring a state leader for Ag Ed/FFA1 and a Rodeo Coach, both of whom are excellent, represented key accomplishments.

The College continued its commitment to student success through its ACES courses: ACES 1120 Freshman Orientation, ACES 1210 Financial Fitness for College Students, ACES 1220 Academic Excellence, ACES 301 Agricultural Leadership Development (ACES Mentors), and ACES 305 Advanced Leadership and Communication (ACES Ambassadors). These courses provided a means to develop students' personal and professional success skills.

Even as we still see effects of the pandemic elsewhere, 373 total ACES students earned their degrees in 2021. This speaks highly of the resolve and grit of our students and faculty.

Financial support is also critical to the retention of many ACES students and to that end, the ACES-APO maintained a strong scholarship program. In 2021, the College provided scholarships to 601 students, many receiving multiple scholarships, totaling $610,137. This continues to one of the strongest scholarship programs at NMSU.

2022–2025 Goals

In support of ACES Strategic Goals 1.1, 1.2 and 1.3, the ACES-APO will continue to work to improve student success and professional growth. We are continuing to enhance our ACES Student Success Center space and the equipment provided, as it has provided a great study area for many of our students.

The ACES-APO will continue to develop its use of new NMSU databases, namely Ad Astra to optimize course scheduling/rotations and Curricular Analytics to reduce degree complexity resulting in enhanced student success, including retention and graduation rates. Ultimately, achieving solid student learning outcomes that support degree completion by our students is a primary goal of the ACES teaching mission. In support of this goal, the ACES-APO will work closely with each ACES academic department to improve its academic assessment process and make appropriate improvements in developing class schedules and registration.

Additional goals will include making improvements in the graduate student experience through timely progress reports; and continuing to strengthen our support of College- wide professional development courses (ACES courses).

EID Initiatives Related to Student Retention

Consistent EID messaging is critical to current and potential students. The ACES-APO continues to work deliberately to ensure that consistent positive EID messages are provided during all College-wide student programs (Orientation, Recruitment, etc.). The goal of this consistent messaging is to welcome each and every ACES student and help them feel respected and valued, as well as provide an environment in which they can thrive and achieve personal and professional aspirations. Additionally, we have begun exploring the opportunity to charter an NMSU chapter of Minorities in Agriculture, Natural Resources and Related Sciences (MANNRS) and the establishment of a NM JR MANNRS (grades 7–12) chapter through school ag programs.

2021 Career Placement Accomplishments

The ACES-APO continued to work with potential employers, but with centralization of Career Service/Experiential Learning, interaction was primarily via NMSU career events and not directly with employers at the College level. Individual departments did host career fairs, including Hotel, Restaurant & Tourism Management, and Animal Science.

Our office also continued assisting students in attaining needed knowledge and skills, achieving their personal educational goals, developing professionally and advancing into rewarding and meaningful careers. Notably these efforts are being supported by establishing a proposal with the goal of hosting an ACES Career Fair at the beginning of the Spring 2022 semester.

2022–2025 Goals

Many traditional employers of ACES students are seeking a stronger connection at the College level; therefore, in the future the ACES-APO will take a leadership role in establishing career fairs at the College level. This goal will support ACES Strategic Goal 1.1, specifically by increasing internship opportunities and the awareness of these opportunities through the establishment of career fairs, Alumni and Stakeholder connections, and promoting faculty grant proposals. To this end, the College has already begun working with NMSU Career Services/Experiential Learning, ACES departments and potential employers.

In addition to these career placement efforts, the ACES-APO will continue to support efforts to enhance the preparation of our students for lifelong career mobility and success. Specific tactics related to this goal will include using the NMSU system for tracking Social Mobility and setting benchmarks for ACES; and offering workshops to students relevant to workplace preparations.

EID Initiatives Related to Student Placement

Given NMSU's status as an HSI, ACES already works well with a variety of government agencies related to internships and permanent placement. We are now focused on determining how to best align our EID efforts with those of Non-Governmental Organizations and Industry, primary employers of our graduates. Chartering a MANNRS chapter at NMSU would allow our students to tap into the many employment opportunities provided at the national level. The possibility of partnering with emerging programs such as Together We Grow, a consortium of ag/food companies, NGOs, and academia, centered at Colorado State University, will also be explored. The goal of the latter organization is to help build a skilled, diverse and inclusive workforce to support American agriculture. Alignment of ACES efforts with the goals of our employers will assist in insuring good placement and mobility of ACES graduates.

2021 Alumni Accomplishments

Since 2020, the ACES-APO has continued facilitating ACES Alumni Relations (Sam Steel Society/Council). Together our groups have developed goals and activities designed to engage ACES alumni with the students in ACES, as well as helping with recruitment efforts.

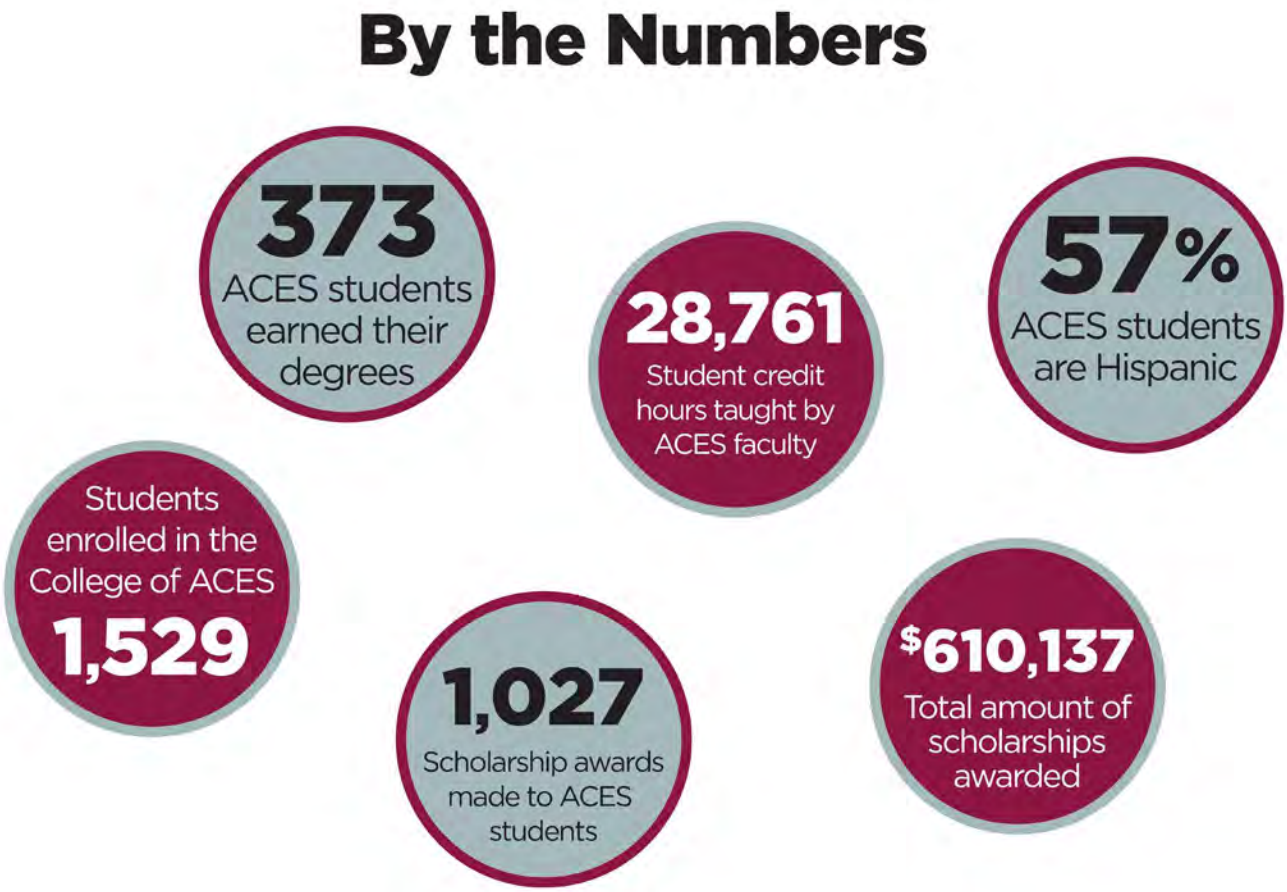
2022–2025 Goals

By developing a strong working relationship between the ACES-APO and the Sam Steel Council, achievement of ACES Strategic Goal 1.3 will be facilitated.

Specifically, the ACES-APO will continue to meet monthly with the Council and provide updates related to achievement of recruiting and placement goals. The ACES-APO plans to engage alumni in specific student recruitment and placement events. A particular activity will be to engage ACES alumni in hosting NM regional recruiting events. Alumni will be very effective in promoting the College and career opportunities to students and potential students.

EID Initiatives Related to Alumni Engagement

Given that alumni know and represent the "traditions" associated with the College of ACES, alumni will be engaged in a conversation on how to improve the College's ability to attract and include a broader representation of students from diverse backgrounds. These conversations will focus on ensuring that the College continues to meet the educational and workforce needs in New Mexico and beyond.



Introduction

The Agricultural Experiment Station (AES) is the principal research unit of ACES. The AES system consists of scientists who work on facilities 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 under 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.

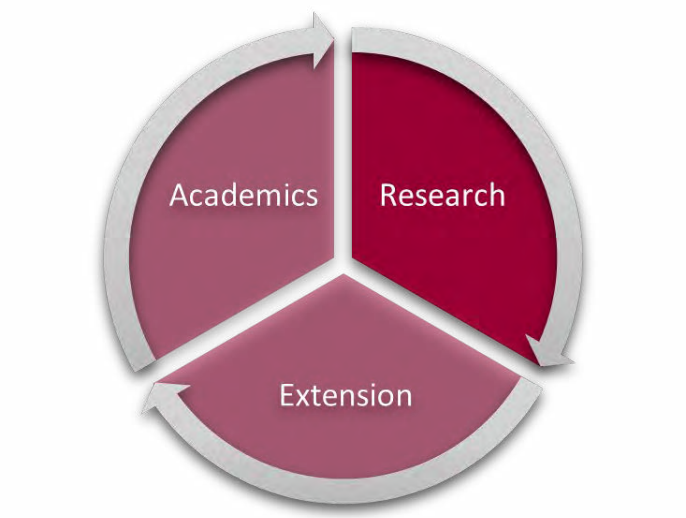


Figure 1: AES is part of the NMSU land-grant tripartite system with a mission to teach, conduct research, and provide extension and outreach to communities.

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

Figure 2: NMSU AES consists of 12 agricultural research and science centers, VERL, and eight academic departments within ACES.

AES was created by the federal Hatch Act of 1887 and was constitutionally mandated in New Mexico in 1915. In 2021, the AES total amount of operating revenue was $38.2 million (see Figure 3 for a complete breakdown of operating revenue sources). The College of ACES continues to lead NMSU in grants awarded and expended; ACES faculty, staff, and students work hard to ensure New Mexico's investment in AES is matched by more than a 1:1 ratio.

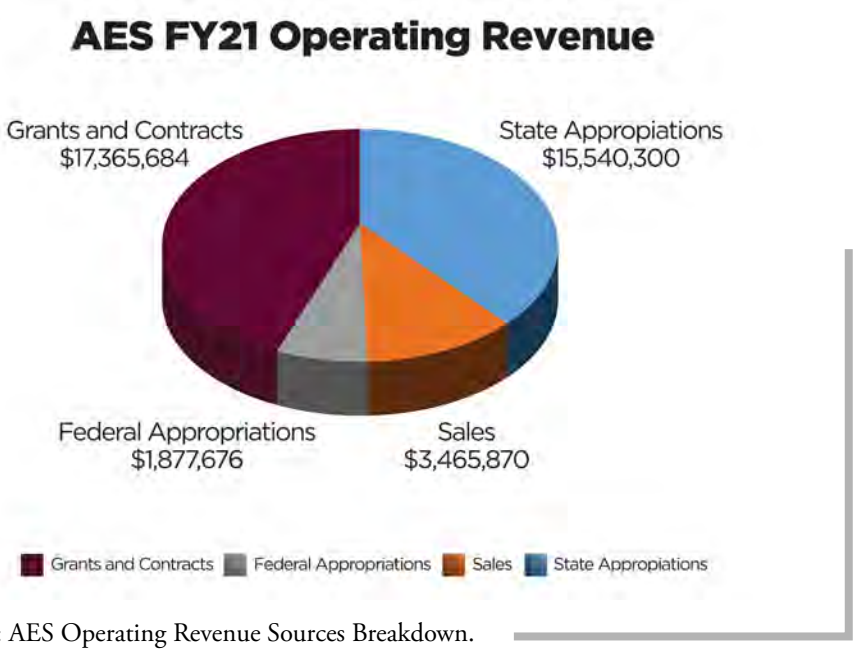


Figure 3: AES Operating Revenue Sources Breakdown.

Special Initiatives Update

The NMSU AES will receive funding from the $1.5 trillion omnibus bill President Biden signed. AES received $1.8 million for the ZiaMet Mesonet Weather Monitoring Network Expansion efforts and $995,000 for the Carbon Management and Soil Health in Arid and Semi-Arid Environments initiative. The omnibus bill includes a total of $4.3 million in congressional directed spending requests for NMSU.

ZiaMet Mesonet Expansion

NMSU's current weather monitoring network consists of 31 weather stations around the state. With expansion funds (a combination of state and federal funds) the total number of weather stations will increase to 215 around the state. Data from these stations are used by farmers for crop irrigation, crop planting, and determining optimal conditions for pesticide applications. The data also help support gaps in National Weather Service data, which often leave out parts of rural New Mexico. AES is preparing an additional request to be submitted for FY24, at the state level, to assist with maintenance and operations for this expanded network of weather stations.

Carbon (C) Management and Soil Health in Arid and Semi-Arid Enviroments

This initiative will engage farmers, ranchers, and minority and Native American communities on carbon management and soil health research, outreach, and extension activities. The impacts include improving knowledge of carbon sequestration and soil health in arid and semi-arid regions, enhancing climate resilience in the Southwest, and developing climate change mitigation practices applicable to 40% of the globe (arid and semi-arid regions of the world). The Clovis ASC serves as the hub for carbon management and soil health activities for the AES, while the Los Lunas, Mora and Corona Research Centers are also involved in the initial stages of this project.

Sustainability Initiatives

Creation of Center for Dryland Resilience

This Center was submitted as part of the Established Program to Stimulate Competitive Research (EPSCoR) and would transform understanding and management of natural capital in drylands under environmental change, a critical challenge at the interface of science and society. This initiative for a Center of Drylands Resilience was sponsored as a bill in the 2022 legislative session and would allow for research on and promote the sustainability of New Mexico's ecosystems through enhanced monitoring efforts, data mobilization, and sustainable solutions that improve the resilience of ecosystems statewide while training the next generation of environmental and data science professionals. This initiative has been integrated into the state-wide efforts of the New Mexico Northern Rio Grande Corridor Collaborative (NRGCC).

Creation of New Mexico Reforestation Center (NMRC)

This Center will help meet reforestation needs by producing five million seedlings per year, establishing programs to support the reforestation pipeline (from seed collection to planting), and helping to develop and support forest-based economic growth. The NMRC will also support climate-smart tree planting projects in urban environments to assist with carbon management, air quality, provision of shade to cool urban surfaces, and support education, research, and outreach activities about reforestation.

Corona Energy Initiatives–Wind Turbines and Commercial-Scale 2mw Solar Array with Battery Storage

Corona Energy Initiatives—Wind Turbines and commercial-scale 2MW Solar Array with battery storage: In January 2022, 39 wind turbines were moved into full operation at NMSU's Corona Range and Livestock Research Center (CRLRC) as part of Pattern Energy's Western Spirit Transmission area project, which consists of 377 turbines, or a total of 1,050 megawatts. Additionally, we are investigating opportunities for a public/private partnership to develop a solar array that benefits central NM renewable energy needs within proximity to the wind farm at Corona, complementing outreach programming in renewable energy at the Southwest Center for Rangeland Sustainability.

Digital Agriculture: Preparing Farms/Ranches for the Future

US agriculture and ranching systems are on the cusp of major changes driven by climate, socioeconomic, and demographic changes in rural communities. Our goal is to increase agricultural efficiency using multiple-source digital information (MSDI), data science, sensor development, and artificial intelligence (AI). Building capacity in drone development, as well as utilization and optimization for agriculture, is one of our focus areas.

Heritage Farm, the Path toward the Future

Heritage Farm, the Path toward the Future: Increasing agricultural literacy and hands-on learning are combined in this initiative to develop an on-campus platform that connects communities of learners to the modern agricultural enterprise. This initiative will develop on-campus lands to engage the public in the origin of their food through curated demonstrations of the many facets of agriculture while providing students with the opportunity to engage in emerging agricultural technologies.

Agricultural Science Centers

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). New Mexico is unique, with three crop production regions, 11 plant hardiness zones, 5 defined watersheds, and 126 distinct soil types. Therefore, 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.

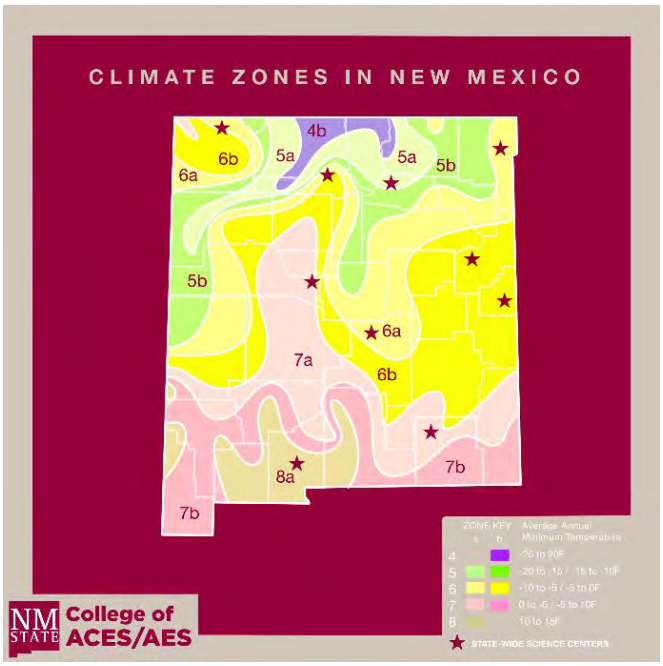


Figure 4: Diversity of geography in New Mexico.

Agricultural Science and Research Centers

Sustainable Ag Science Center at Alcalde: Located in north-central New Mexico to serve as a resource for small-scale producers (most farms in the area are under 100 acres). Research programs focus on jujube cultivars, cover cropping in winter and spring, and acequia irrigation.

Artesia Ag Science Center: With a unique location in a heavy agricultural production area of New Mexico, research focuses on high-value crops, entomology, and crop performance testing.

Chihuahuan Desert Rangeland Research Center: A near-campus research facility used for demonstrations of long-term grazing methods, range forage, and sustainable management of natural resources and environmental ecosystems.

Clayton Livestock Research Center: Research focuses on improving the health of newly received cattle and conducting finishing studies. This center is the only feedlot research facility in the western US.

Clovis Agricultural Science Center: The ASC Clovis focuses on dryland crop varieties to improve water use efficiency in semi-arid lands, while also serving as the hub for carbon management research at NMSU.

Corona Range and Livestock Research Center: A working ranch research facility with a focus on sustainability. In 2021, 39 wind turbines were installed in a partnership with Pattern Energy.

Farmington Ag Science Center: Weather in the Four Corners region is variable, and research at this center focuses on crop varieties and growing season. A unique partnership with the Navajo Agricultural Products Industry (NAPI) provides a strong connection to local agricultural producers.

Fabian Garcia Research Center/ Leyendecker Plant Science Center: A wide range of plant breeding research takes place at these NMSU main campus experimental farms, including New Mexico chile pepper variety research.

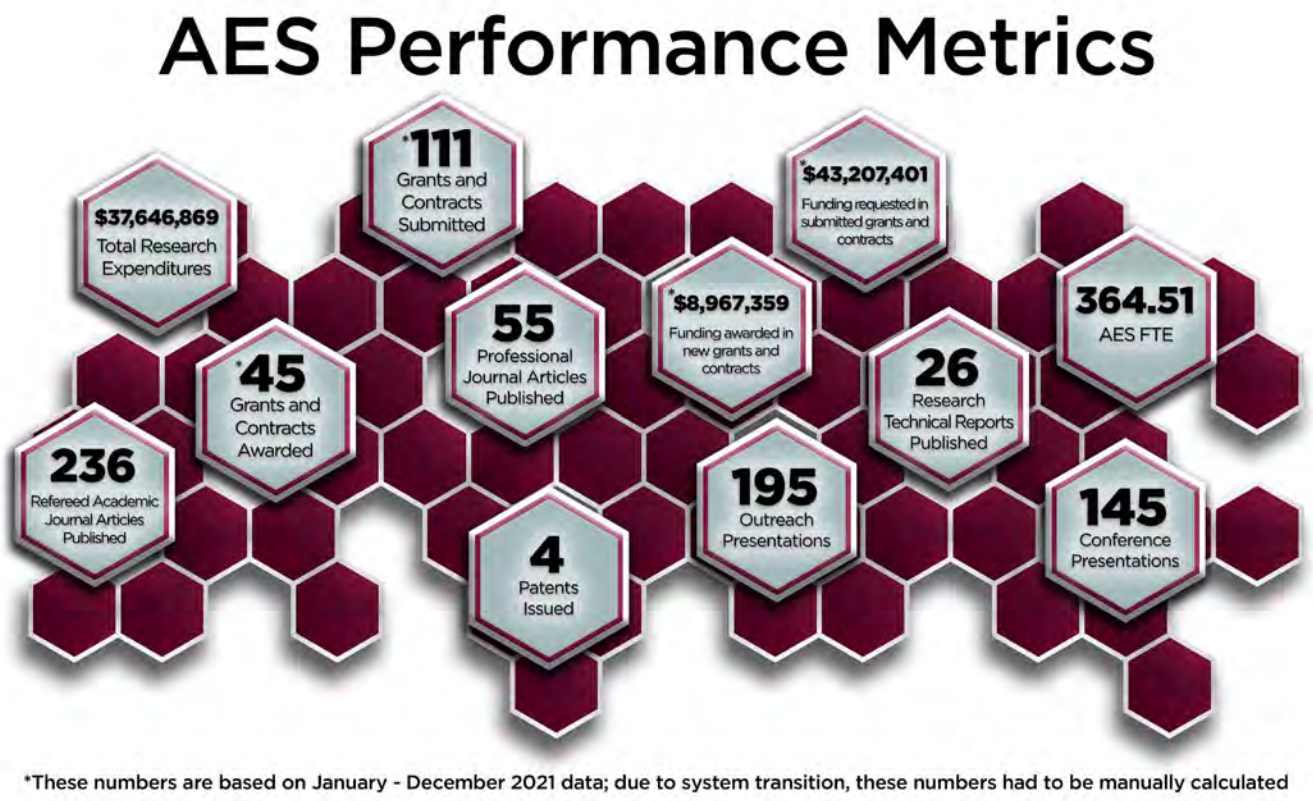
Los Lunas Agricultural Science Center: Located centrally in New Mexico near Albuquerque, which allows for specialized urban horticulture programming. The research focus is on backyard gardens, guar varieties, and experimental wine making.

John T. Harrington Forestry Research Center at Mora: The only research center in the southwest US focusing on forest nursery technologies, tree improvement, and ecophysiology of young forest trees to facilitate ecological restoration.

Rex E. Kirksey Ag Science Center at Tucumcari: One of the few centers with the capability to conduct both crop and livestock research. Research focuses on dryland cropping systems and bull tests to improve beef herd genetics.

Veterinary Entomology Research Laboratory: State-of-the-art large animal research facility on the NMSU main campus with a focus on pest management for livestock, including insecticide resistance in the horn fly.

AES Performance Metrics



*These numbers are based on January - December 2021 data; due to system transition, these numbers had to be manually calculated

AES 2021 Impact

New Mexico State University's College of Agricultural, Consumer, and Environmental Sciences (ACES) has a mission to improve the lives of New Mexicans, the nation, and the world through research, teaching, and extension. AES research programs focus on four identified critical issues for New Mexico. These critical issues are the ACES Pillars which help guide planned programs and research focus. These pillars are Food & Fiber Production and Marketing, Water Use and Conservation, Family Development and Health of New Mexicans, and Environmental Stewardship.

With the support of Sarah Harris, a graduate student from the Agricultural Extension and Education Department, a full analysis of 2021 AES impact statements has been completed. This analysis indicates an overall theme of AES impacts from the past year and breaks down each impact statement into the ACES pillars. Those results are indicated below, followed by specific impact highlights.

2021

Operating on the premise of innovative, sustainable agri-environmental involvement while incorporating risk and crisis mitigation strategies amidst the COVID-19 pandemic.

50.32%
Food and Fiber Production and Marketing

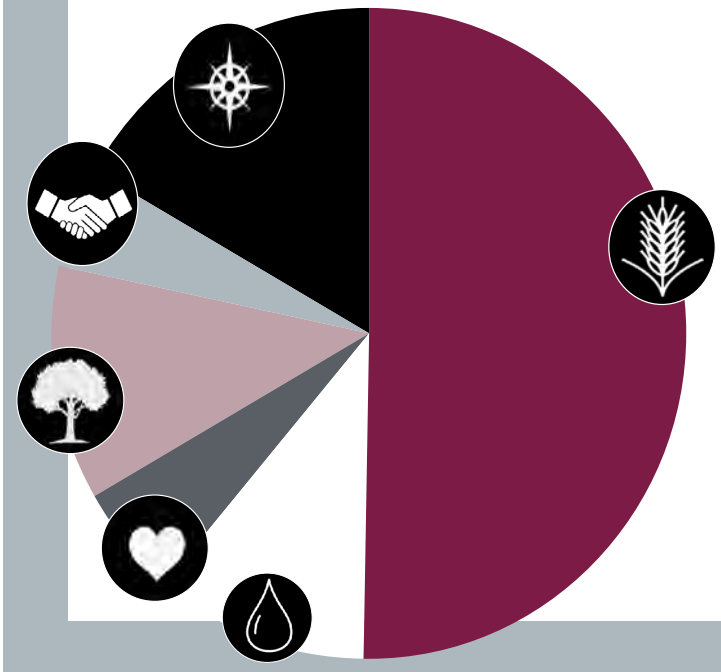
11.04%
Water Use and Conservation

5.52%
Family Development and Health of New Mexicans

11.69%
Environmental Stewardship

4.87%
Foundational Education and Training

16.56%
Innovative Outlier Growth



A special thank you to Sarah Harris, AXED Graduate Student, for the AES Impact Statement analysis and graphic creation.

Impact Highlights

Food and Fiber Production Marketing

In 2019, New Mexico's cattle and calves accounted for 40.5% of all livestock total cash receipts of $2.45 billion—a significant source of income for the state and its ranchers. Drought can impact ranchers' net return. But the impacts were not clearly quantified. Ranch net return data were combined with a new drought monitoring tool to quantify drought impacts on ranch income. Our findings indicated that the net return of a ranch can increase (or decrease) by $62.29, $60.51, and $64.07 per head if drought increases (or decreases) by one unit in all, large, and medium ranch sizes, respectively.

Hatim Geli (Animal and Range Sciences Department)

The U.S. foreign-born population is nearly 45 million. Today, immigration accounts for more than one-third of the U.S. population growth. The U.S. has been described as a "melting pot" or a "salad bowl" that represents various ever-changing cultures, including "foodways" or habits. Increased diversity and changes in foodways provide new opportunities for agricultural stakeholders. Research related to spicy pepper consumption, including New Mexico's iconic chile pepper industry, is providing insights into consumer preferences, demand, and behavior. Better understanding this demand will allow the industry to capitalize on changes and grow the state's $52 million industry.

Jay Lillywhite (Agricultural Economics and Ag Business Department)

Roundup-resistant weeds such as kochia and pigweed are difficult to control in corn-producing areas. These weeds not only reduce yield by competing with the crop, they also produce more seeds, increasing infestation. Several studies are underway at the Clovis ASC to evaluate kochia and pigweed control and corn response to several herbicides that differ from glyphosate in mode of action. Results showed excellent control using pre-plant followed by post-emergence herbicides applied early in the season. Results show corn yield losses due to kochia and pigweed competition were reduced by 90%. Local growers use this information to increase income and reduce infestations.

Abdel Mesbah (Entomology, Plant Pathology, & Weed Science Department)

Water Use and Conservation

Water management is one of the most pressing issues turfgrass managers face in the arid regions of the world and periodically in temperate regions. Field and greenhouse experiments were conducted to determine commercially available herbicide efficacy to turfgrass weeds and the herbicide injury potential to desired turfgrass species. The results of these experiments support a $1.5 billion New Mexico green industry and 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.

Ryan Goss (Plant and Environmental Sciences Department)

Significant brackish groundwater (BGW) reserves in the southwestern U.S. can lessen agriculture's dependence on the declining freshwater supplies. Salinity increases beneficial secondary metabolites in traditional crops; thus, we are evaluating BGW irrigation on the growth and secondary metabolism of three native halophytes, *Lepidium alyssoides*, *Atriplex canescens*, and *A. lentiformis*. Thus far, salinity up to 8 dS/m has not increased total phenolics in these species, with results at higher salinity pending. The results of the 2-year project will aid greenhouse and nursery growers seeking salt-tolerant crops, provide a value-added use of brine concentrate, and strengthen water conservation efforts.

Geno Picchioni (Plant and Environmental Sciences Department)

Coupling socio-economic and physical models leads to improved management of systems that benefit water users and environmental resources. Efforts are ongoing to assess the net socio-economic benefits of using agricultural biomass in electricity generation, in collaboration with Colorado State University, to assess the risk benefits of improved watershed management, and to evaluate agricultural opportunities to enhance water-use efficiency. This research contributes to an improved understanding of these cross-connections and the benefits of designing effective, efficient, and sustainable water system plans and policies.

Brian Hurd (Agricultural Economics and Ag Business Department)

Family and Health of New Mexicans

There is little data on how agricultural producers were affected by the pandemic. ASC Alcalde researchers collaborated with public health researchers to conduct a cross-section survey of certified organic operators/producers, assessing COVID-19 prevalence and preventative behaviors. The infection rate among producers was 6.4%. Women reported more use of prevention methods. Farms of ≥50 certified organic acres reported less use of prevention methods. Study results can inform public health interventions and policies as well as general Extension programming for farmer audiences. To our knowledge, this is the first study reporting on effects of COVID on certified organic producers.

Steve Guldan (Alcalde Agricultural Science Center/Plant & Environmental Sciences Department)

Despite New Mexico having agricultural resources to successfully produce vegetable crops, 30% of NM counties are food deserts, resulting in a need to provide more local and nutritious foods to its residents. The Farm-to-Cell research program indicates that there are numerous NM chile varieties with increased nutritional value. Additionally, a study showed that when the hemp medicinal compound cannabidiol (CBD) is digested with oil, CBD's absorption increases to 23% compared to 0.1% when it's digested alone, thus having a drastic impact on hemp products and consumers.

Ivette Guzman (Plant and Environmental Sciences Department)

Contemporary food systems are prone to a wide range of failures. Even before COVID-19 exposed their fragility, we faced myriad challenges. These challenges can be managed by engineering resilient food networks. To do so, the Appreciative Inquiry and Community Capitals Summit will convene stakeholders to (1) create a shared vision of resilient food systems; (2) seed the formation of new food networks; and (3) rally participants to action. In collaboration with support from USDA and NSF, we have established national partners and will host the joint conference with ACES and the College of Engineering in June 2022.

Shannon Norris (Agriculture Extension and Education Department)

Environmental Stewardship

Why do species become invasive? This issue has puzzled humanity for decades. In 2021, the Director of the NMSU herbarium, Dr. Sara Fuentes-Soriano, started a new genomic project to identify the genetic basis behind several mechanisms driving plant invasion in drylands. Dr. Fuentes-Soriano will harvest DNA from century-old herbarium specimens and gather experimental greenhouse data, in collaboration with Tel Aviv University, Israel, and the NSF-funded Consortium for Plant Invasion Genomics Initiative. Results may help mitigate the detrimental effects of invasive species and could reduce the $36 million annually spent on invasive plant control in the U.S.

Sara Fuentes-Soriano (Animal and Range Sciences Department)

The value of freshwater fish is difficult to estimate; however, recent evaluations suggest recreational fishing generates roughly $125 billion annually in North America. In addition to their economic value, freshwater fishes have important ecological, societal, and cultural significance. This research brings together state and federal agencies in Idaho, Utah, Mississippi, Georgia, Florida, Kansas, Washington, and Wyoming and partners in New Mexico to conserve species in the southwest U.S. To date, research efforts are addressing knowledge gaps associated with conservation of endangered Chihuahua Chub in the Mimbres Basin and are helping to refine suppression techniques to aid the conservation of Rio Grande Cutthroat Trout in northern NM and improve the management of recreationally important species such as Hybrid White Bass and Rio Grande Cutthroat Trout. Collectively, this research, service, and outreach directly affects the conservation of North American freshwater fishes and contributes to a deeper understanding of the ecological processes influencing fish populations.

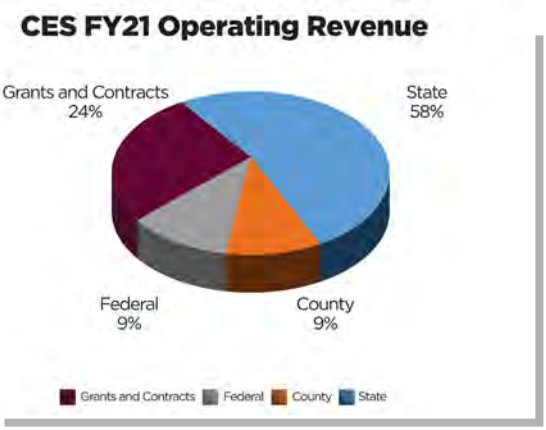
Zach Klein (Fish, Wildlife, and Conservation Ecology Department)

Soil is foundational to the sustainability of New Mexican societies. Managing soil for social and natural ecosystems requires knowledge of baseline soil properties and conditions. We have pioneered methods to produce relevant soil information rapidly and accurately in the field using a geographic information systems approach. This research is foundational for federal and state land managers, agricultural producers, private ranchers, and foresters by providing the information necessary to assess site-specific land management decisions such as grazing intensity, brush management, or livestock rates.

Colby Brungard (Plant and Environmental Sciences Department)

Introduction

The mission of NMSU's Cooperative Extension Service (CES) is to deliver practical, research-based knowledge and programs that improve New Mexicans' quality of life. A part of NMSU's College of Agricultural, Consumer and Environmental Sciences, CES is a unique federal, state, and county partnership. CES has staff in all 33 counties and many Tribal areas in New Mexico and collaborates with over 1,000 organizations, state and federal agencies, other universities, and 10,000 volunteers.

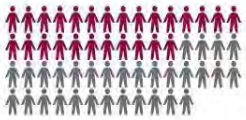


Every year, Extension faculty reach over 400, 000 New Mexicans-more than one-third of the state's population, who benefit from a wide range of CES educational programs in areas such as economic and community development, human nutrition, agriculture, environmental stewardship, and family and child development.

It's all about the data

CES Performance Metrics

Faculty and Students



More than **250** faculty have Extension appointments. CES employs **31** undergraduate and **26** graduate students.

Publications and Presentations

CES faculty and staff generated **547** Extension publications, **220** conference presentations, and facilitated **2,573** workshops and presentations.

Grants and Expenditures

CES faculty and staff were awarded **69** grants and contracts totaling **$17,873,700**. In addition, cash and in kind donations offset total expendiutes of **$24,208,037**.

Contacts

CES provided educational programming to more than **700,000** New Mexicans while reaching **11,814,386** through various social media outlets.

Food and Fiber Production and Marketing

Supporting Southern and Northern Pueblos in New Mexico

There are over 8,500 self-identified Native American producers in New Mexico. Among these Native producers, 11 producers from the Southern Pueblos are considered beginning farmers and ranchers, with a total of 100 producers from the Southern and Northern Pueblos. These producers are active and need support beyond grant programs. NMSU CES (Cooperative Extension Service) Pueblo Extension works in collaboration with community leaders to provide education and technical assistance to producers in the area.

In 2021, A total of five educational workshops focused on range management, soil health, and beef genetic selection were offered to the producers from the Southern and Northern Pueblos. A total of 155 producers attended the workshop series. With a focus on environmental stewardship, producers identified new skills and strategies to improve their farming and ranch operations. County agents partnered with the Southern and Northern Pueblos to provide educational and technical assistance programs to their community members. Program participants engaged in agricultural and natural resources education to increase their skills, knowledge and awareness of best practices.

Overall, the community is the center of Pueblo life, as the community offers history, culture, language, and core values, which shape members and communities. This understanding will take the traditional concept of community development further by implementing culturally appropriate programming in communities. NMSU's identified components of leadership, economic development, and community service will be received well, whereas public policy will need to be tailored to include Indigenous perspectives as Pueblo dynamics involve traditional knowledge and sovereignty. Pueblo leadership supports efforts to increase their tribal food sovereignty, promote positive stewardship of the land, teach youth about their cultures and language, and educate their members to return to their communities to lead and strengthen their Han-Nu (Keres word for "the people").

New Mexico Dairy Workforce Development and Training

Herd size of New Mexico dairies is more than ten times the U.S. average. With limited educational opportunities, effective training of current and future employees is imperative. The program seeks to raise safety awareness and improve job performance. Safety awareness training will be provided to about one-third of the NM dairy workforce.

Approximately 3,500 employees have directly been trained in dairy safety and animal handling. Training is provided in employees' preferred language, if available (English, Spanish, or K'iche). Training effectiveness is a key evaluation metric. NMSU's dairy workforce development program is now considered a leading example, with program details being utilized on some of the largest dairy operations in the U.S. For example, Idaho Dairymen's Association (IDA) adopted the program with significant processor and co-op support. Due to processor and customer demands, National Milk Producers Federation (NMPF) created a Workforce Development Task Force (2017), which developed a Dairy Safety Reference Manual in English and Spanish.

Genetic Improvement in the NM Cow Herd

The New Mexico beef industry contributes 900 million dollars to the gross state product annually. Drought is a significant risk to this economically important industry. Optimizing genetics and animal efficiency can help minimize losses due to drought.

The Tucumcari Bull test has doubled its capacity in efficiency testing bulls since 2015, reaching over 1,000 producers from 5 states. The average value of bulls sold through the Tucumcari Bull Test has increased by $500 per animal, improving the profitability of New Mexico purebred cattle producers. The genetic selection seminars coupled with the Tucumcari Bull Test has improved the profitability of New Mexico purebred cattle producers.

NM Bull Survey

New Mexico beef production contributes over 16,000 jobs, $1.68 billion in output, and $448 million in labor annually. Nationally, bovine respiratory disease remains the largest challenge facing the beef industry, with costs exceeding several billion dollars annually. Anecdotal evidence through communication with cattle buyers suggests NM calves are more prone to cases of bovine respiratory disease. However, it remains unknown why some calves are predisposed to bovine respiratory disease. Moreover, despite billions of dollars spent on research, improved vaccines, and improved utilization of vaccines, bovine respiratory disease rates continue to increase. Using blood samples from feedlot calves, NMSU Extension in collaboration with NMSU Animal Science identified serum components that identified calves that were predisposed to severe or fatal cases of bovine respiratory disease. The novel blood test could be a method to identify calves that are predisposed to severe cases of respiratory disease to manage those calves more intensively. In addition, the test may provide a means to identify animals in the herd that are predisposed to severe cases of respiratory disease, allowing ranchers to cull them from the herd, potentially saving billions in economic losses to bovine respiratory disease.

Aquaponics: Efficient and Sustainable Use of Aquatic Resources

Interest in aquaponics, an integrated sustainable food production system that combines aquaculture–the cultivation of aquatic animals, such as fish, shrimp, crayfish, or prawns, in tanks–and hydroponics–the growing of plants in water, has grown in New Mexico. The fish and plants are cultivated together in a recirculating ecosystem that utilizes natural nitrogen-fixing bacteria to convert fish/aquatic animal wastes into plant nutrients. The waste products of the aquaculture system serve as nutrients for the hydroponic system. Compared to soil-based agriculture, aquaponic systems use much less water (90% less), which is especially attractive in arid regions such as New Mexico, where water and arable soils are scarce.

In response to a growing demand for information and training about aquaponics, a 4-part online seminar series was developed and held in collaboration with NMSU Cooperative Extension Office and Santa Fe Community College's Controlled Environment Agriculture Program. Each week covered different topics, including types of systems, fish culture, plant culture, pest management, water quality, and food safety. A total of 110 participants attended the webinars from 19 counties in New Mexico, 9 other states and internationally. Overall, 85.7% of those surveyed strongly agreed and 14% somewhat agreed that the information in the sessions increased their knowledge about the subjects. 72% strongly agreed that the knowledge they acquired made it more likely that they would either build and set up an aquaponics system or make changes and improvements to their existing system. 85.7% strongly agreed that they would like to see other aquaponics-related workshops/courses in the future. The online seminar series has resulted in 3 new speaking engagements on aquaponics to diverse audiences and the planning of a hybrid workshop for summer 2022.

Aquaponics is a sustainable food production system that provides fresh locally grown produce and fish, creating access to nutritious food and providing greater food security, an issue in many areas of New Mexico that experience food deserts. It has the potential to increase economic, social, and environmental sustainability of New Mexico agriculture. These systems can enhance local economies and provide green job opportunities. The multiple crops produced allow small-scale farmers to diversify their incomes, which reduces risk of crop failure and increases revenue by providing products for multiple markets. The number of aquaculture permits issued in New Mexico (an indirect indicator of growing interest in aquaponics) increased by 100% from 2020 to 2021.

Undercover Tomatoes Managing Stress, Pests, and Disease

Beet curly top virus (BCTV) is a familiar problem affecting multiple crops in New Mexico and other semiarid regions of the world. BCTV has been known to affect more than 300 plant species from 44 different families. Heat, water, and disease stressors are among the biggest hurdles for commercial and backyard tomato growers in the southwestern US.

Shade cloth may help growers overcome hurdles by either protecting plants from the tiny, jumping insect vector that spreads BCTV (the size of a skinny grain of rice) or by reducing sun and heat stress on the plants and thereby reducing water requirements. This program aims to increase knowledge and agricultural literacy of sustainable growing practices, including the development of IPM (Integrated Pest Management) strategies for BCTV control.

In 2021, over 20 volunteers helped grow 153 tomato plants, totaling more than 350 hours (about 2 weeks) of volunteer service and over $4,100 in equivalent wages. Volunteers harvested a total of 5,444 pounds of tomatoes. Volunteers shared fresh tomatoes with families and neighbors, and donated to local food banks. Volunteers (average age >70) reported they enjoyed the outdoor work and learning about the NMSU Agricultural Science Center system, research methods, beneficial and pest insects, and common tomato diseases. Tomato-related problems are among the most commonly fielded questions from the public. Results from this study on strategies for supplying shade and avoiding death-by-disease may increase the productivity and sustainability of this wildly popular crop. These programs can be used to engage the public, share sustainable methods, and improve agricultural literacy in the urban sector.

Ready, Set, Grow!

In response to the public demand for gardening classes, especially for at-home food production, a collaboration of Extension Agents and the State Urban Horticulture Specialist created the "Ready, Set, GROW!" online gardening series. The series provided pre-recorded gardening videos alongside live virtual classes from October 2020 through December 2021. The series continues to be popular, with 16,066 viewers on Zoom, Facebook, YouTube, and the Desert Blooms website. In 2021, 27 classes were offered to 4,140 registrations and 13,662 live viewers. With the use of online technology, the class attendance increased by 2,430%, from an average of 20 to 506 program participants. Of the 418 survey respondents, 99.5% would recommend the series and 90% of participants reported they would change their current practices or implement a recommended gardening practice based on information learned from a class.

Developing Alternative Crops for New Mexico

Agricultural production in New Mexico is facing diverse challenges. Some of these challenges are crop production and cost-of-operation related. The increasing cost of inputs has been accompanied by a non-matching increase in product prices, leaving farmers to make tough decisions on whether to stay in farming or quit. Additionally, crop production has faced recurrent droughts and reduced availability of irrigation water in recent years. Farmers are seeking solutions that can keep them engaged in profitable farming in New Mexico.

NMSU Cooperative Extension Specialists have identified guar and guayule as prospective alternative crops that can enhance the income of farmers in New Mexico. Guar is an annual legume with seeds that can be processed into guar gum. Guar gum is an industrial product that is in high demand, especially by the oil and gas industries. Guayule is a perennial crop in the sunflower family, that can yield natural rubber. Both crops are adapted to southwestern arid regions and are water efficient. These crops can serve as feedstock for processing plants that produce guar gum or natural rubber.

Best management practices arising from multiple years of trials with guar and guayule are being shared with producers in the state. Demonstration trials at various 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.

Water Conservation

Water Conservation: Home, Yard, Farm & Ranch

In a recent study published in "Nature Climate Change," climate scientists found the last two decades in the Southwest were the driest period in at least 1,200 years. As a result of the prolonged drought in New Mexico, the environment, economic stability, or health of many New Mexicans has been negatively impacted. To address the issue, NMSU CES partnered with the New Mexico Bureau of Geology & Mineral Resources to provide community education programs focused on water conservation best practices.

A six-part weekly online seminar series was developed to increase knowledge and use of water conserving techniques. Programming focused on xeriscaping strategies, alternative water sources, water harvesting and precision irrigation for homeowners. Water-wise vegetable gardeningand water conservation and management solutions were offered to farmers and ranchers. In addition, information about the hydrology, water cycle and geology of New Mexico was presented. All sessions were recorded and posted on the NMSU ACES Mora Water Conservation webpage along with relevant resources.

Of the 178 New Mexicans registered for this series, 65 participants responded to the survey.

- 96% reported the topics were strongly or somewhat relevant to their needs.
- 85% reported they would change a practice to save water based on what they learned.

Offering collaborative solutions, NMSU CES with the New Mexico Bureau of Geology & Mineral Resources delivers trainings on current research and issues relevant to New Mexicans. The partnership promotes water conservation education and water efficiency solutions to families, individuals from industry, and the commercial sector.

Environmental Stewardship

Rangeland Ecology, Monitoring, and Management Planning

There is an increasing need for land stewards to be trained in and collect quantitative, objective, scientifically based information to make proactive management decisions. Presentations and demonstrations are used to deliver scientific information in support of Beef Quality Assurance and Pesticide Applicators Trainings as well as Youth, Tribal, and independent events for all New Mexicans. New Mexico State University CES distributed 54 "getting started" monitoring kits. Program participants (76%) indicated intentions to begin monitoring while others (21%) requested further one-on-one assistance.

New Mexico State University, Cooperative Extension Service provides training to New Mexican rangeland professionals and producers to assess rangeland conditions, understand ecological function, interpret monitoring data, and develop management plans to maintain or improve rangelands for future use quickly and effectively.

Learning to Live with Fire

Every year, devastating wildfires burn across the United States. At the same time, a growing number of New Mexicans are living where wildfires are a real risk. Understanding fires will continue to happen, NMSU CES assists the community in protecting homes and neighborhoods while keeping families safe. The "Learning to Live with Fire" program attracted 134 homeowners, volunteer fire fighters, home association members, and employees from county, state, and federal government agencies. Ten months after the program, participants responding to the follow up survey reported (89%) developing immediate evacuation plans. In addition, 94% of participants safeguarded their property from wildfire.

The "Learning to Live with Fire" program has encouraged community members to thin dead, low down branches, add water cubes to property, participate in fire wise forest clearing, and developing a guide to accomplish goals to protect their families and property.

Family Development and Health of New Mexicans

ICAN – Ideas for Cooking and Nutrition

Thirty-eight percent of New Mexicans live at or below 185% of the federal poverty level. Over 72% of New Mexican students are eligible for free/reduced-price lunches, compared to the national average of 49.5%. Additionally, 17.16% of New Mexico households claim Supplemental Nutrition Assistance Program (SNAP) benefits. Poverty is a key driver of health, and it is vital to have programs that serve SNAP-eligible families. Helping families prevent chronic disease through the reduction of obesity reduces healthcare costs and improves quality of life. Thirty-six percent of youth in New Mexico's SNAP-eligible families are overweight or obese. Among SNAP-eligible adults, 69.3% are overweight or obese.

In 2021, ICAN education expanded into virtual settings across the state, reaching over 10,000 New Mexicans with live virtual cooking and nutrition classes, food gardening classes, and other educational activities. Adult graduates of ICAN series education claim several benefits. In 2021, 97% improved one or more diet quality indicators, 92% improved one or more food resource management practices such as cooking dinner at home, and 70% improved their food safety. With ICAN's expansion into virtual engagement, 140 cooking and food gardening videos were produced for platforms like YouTube and Facebook, with ICAN's Facebook posts reaching over 475,000 users. Significant strides were also made in community partnerships, with ICAN offering educational flyers to food pantries and other community sites, reaching over 214,000 clients with recipes and healthy lifestyle tips.

ICAN's mission is to help New Mexicans reach better health outcomes and enjoy a higher quality of life by providing evidence-based nutrition education that inspires healthy food and lifestyle choices. ICAN seeks to make those choices possible for SNAP-eligible families by creating a health-friendly environment. For clients, ICAN offers practical, money-saving skills and advice. For SNAP-eligible communities, ICAN facilitates the development of healthy public spaces. But this work helps everyone in New Mexico—through the reduction of healthcare costs stemming from obesity, through the strengthening of the labor force, and through the creation of communities that work for the people.

Kitchen Creations: A Cooking School for People with Diabetes and Their Families

It is estimated that over 12% of adults in New Mexico (NM) have diagnosed diabetes, 53,000 have undiagnosed diabetes, and 36% have prediabetes. Diabetes and prediabetes cost an estimated $2 billion in NM each year. Individuals and families affected by diabetes regularly struggle with diet modifications that would help them manage their health. Access to nutrition and diabetes professionals is limited, particularly among those without health insurance and those living in rural NM.

The NM State University Cooperative Extension Service in 30 counties partnered with many community organizations to provide Kitchen Creations diabetes cooking schools. Each series includes up to 12 hours of group nutrition and cooking education from Registered Dietitian Nutritionists, Diabetes Care and Education Specialists, and Extension Agents. Participants receive a manual with the information covered and diabetes cookbooks. The Kitchen Creation program attracted 235 adults who participated in 19 cooking schools, offered via Zoom. A total of 99% reported they understood the strategies to plan and prepare healthy meals. This period of Kitchen Creations programming has a potential cost savings of over $282,000.

Chronic Disease Self-Management Education Programs (CDSMEP)

About 80% of older adults have at least one chronic disease, and 68% have at least two. Many adults with conditions such as arthritis, asthma, diabetes, lung disease, heart disease, stroke, osteoporosis, and others, struggle to find ways to manage their condition. Adults with chronic conditions are the primary users of healthcare in the United States and account for two-thirds of total healthcare spending. Healthcare–related cost savings are evidenced through decreased hospitalizations, emergency room visits, and lengths of hospital stays. In New Mexico, 30% of adults aged 40 years and older, and 40% of adults aged 65 years and older, have been diagnosed with two or more chronic diseases.

CES and the NM Department of Health Diabetes Prevention and Control partnered to deliver the Chronic Disease Self- Management Education Program (CDSMEP) to increase participation in, access to, reach and effectiveness of evidence- based programs in our communities (offered in English and Spanish). With $90,000 in funding, face-to-face workshops were offered in Doña Ana and Otero Counties. Approximately 76 individuals participated in and graduated from the program.

Nationally, the CDSMEP has shown a $714 per person savings in emergency room visits and hospital utilization. This equates to $364 per person net savings after considering estimated program costs of $350 per participant. CDSMEP has been improving lives in New Mexico since 2011, graduating approximately 1,200 participants for a potential economic impact of $856,800 in reduced health care costs.

Know Diabetes by Heart

Cardiovascular disease continues to be a leading cause of death for people living with type 2 diabetes. The American Heart Association and the American Diabetes Association (ADA), along with industry leaders, have proudly launched the groundbreaking collaborative initiative Know Diabetes by Heart™ to reduce cardiovascular deaths, heart attacks and strokes in people living with type 2 diabetes.

Using KDBH curriculum, NMSU CES incorporated the lessons with current CES programming Kitchen Creations (KC) and On the Road to Living Well with Diabetes (OTR). Both programs seek to help individuals manage their diabetes. The combined initiative seeks to comprehensively combat the national public health impact of type 2 diabetes. Three hundred community members participated in the program. Of the 300, 92 participants made a commitment to make one change toward managing their diabetes and reducing their risk of cardiovascular disease. The program also connected 174 additional participants to ADA's "Living with Type 2 Diabetes" program, which offers additional resources and help with managing diabetes and reducing the risk for cardiovascular disease.

New Mexico State University Cooperative Extension Service received funding from the American Diabetes Association and American Heart Association as part of an initiative to decrease heart disease and strokes among people with type 2 diabetes.

Stress and Resilience in a COVID World

As a result of the COVID-19 pandemic, individuals and families have experienced significant amounts of stress which can negatively affect social, emotional, and physical health and wellness. A team of Extension agents and specialists developed an online seminar series trilogy to increase knowledge and use of stress management and resilience strategies. A total of 779 individuals registered for the webinars, which were recorded and posted on the ACES COVID-19 response website with resource material. Evaluations showed 92% expressed increased confidence in managing stress and building resilience. This project demonstrates Extension's ability to deliver information in innovative ways to address emergent issues.

Behavioral Health and Wellness Programming

Behavioral health challenges are critical issues in New Mexico, with state suicide rates 59% higher than for the U.S. as a whole, and suicide being the second leading cause of death for NM residents age 10-44 years of age (NM DOH, 2015). By February 2021, six faculty were trained as Youth Mental Health First Aid instructors, and 23 CES faculty, staff and community partners were trained as QPR instructors.

Both YMHFA and QPR are evidence-based programs. The YMHFA program teaches educators, family members or other caring adults how to help an adolescent who is experiencing a mental health challenge or is in crisis to get the help they need. Additionally, QPR focuses on teaching three simple steps anyone can learn to help save a life from suicide. Over 62 participants have gained knowledge and skills through attending these programs. Selected evaluation data included: 88% thought the program content was outstanding or above average; 94% thought the overall course was outstanding or above average; 100% thought the instructors demonstrated a thorough knowledge of subject matter; and 91% thought the course provided practical applications.

Mental health challenges and suicide are pressing issues in New Mexico for both youth and adults. The NMSU CES has a presence in every NM county and has a long history of being a trusted resource for communities on a variety of issues related to health and wellness. While behavioral health is a new topic area, CES is well positioned to help address these issues. This initiative demonstrates CES's ability to build capacity through multidisciplinary efforts to address emergent issues through delivery of evidence-based programs.

The 8 Success Habits Everyone Should Implement

In response to emerging concerns for the financial and emotional well-being of families in Chaves, Roosevelt, and Lea Counties, and across the state of New Mexico, NMSU CES identified "The 8 Success Habits Everyone Should Implement" as a workshop that could help individuals and families navigate the COVID-19 outbreak from a financial, emotional, and individual growth standpoint.

Mindfulness, gratitude, goal setting, and principles of positive self-improvement were used to help participants reflect on their current and future situation. Using a multi-site approach, the program has been used throughout New Mexico, reaching 124 participants.

With a total of 124 participants attending classes, the following outcomes were achieved:
- 100% learned specific strategies and tools to help them live a life of success.
- 97% were either likely or very likely to apply concepts learned.
- 93% felt motivated or inspired to make a positive change in their life.

Participants in New Mexico State University's self-improvement and life success program, "The 8 Success Habits Everyone Should Implement," increased in knowledge, attitudes, and skills regarding how to live a life of financial, emotional, and individual growth. Mindfulness, gratitude, goal setting, and principles of positive self-improvement lead to feeling less stressed and more in control of one's own life, especially amid a global pandemic and financial hardship.

Youth

Educating Youth in Agriculture in New Mexico

The average age of the New Mexico livestock producer is 60.5 years old (USDA NASS, 2017). Given this reality, youth education and involvement in agriculture is needed to sustain and grow this particularly important industry.

NMSU CES hosts a series of engagement opportunities for youth in New Mexico.

- New Mexico Youth Ranch Management Camp: five-day camp emphasizing all aspects of ranching.
- New Mexico Youth Quality Assurance: educational training focused on exhibiting livestock, health management, nutrition, and showmanship.

- New Mexico Youth Beef Project: program providing youth assistance in raising steers from weaning to finishing while being introduced to different strategies and approaches to supply chain management in the beef industry.
- Ag Tech Camp: three-day camp highlighting the use of technology in agriculture with the goal of improving yield, efficiency, and profitability.

Since 2010, over 400 New Mexican youth have participated in the series. Three New Mexico Ranch Management Camp participants are now veterinarians or studying to be a large animal veterinarian. In addition, 60% of participants decided to attend NMSU and major in an agriculture–related option, after participating in one of the listed programs. And of those who graduated, 90% have remained in the agriculture industry.

Youth Develop Career Skills for Agriculture

While employers in the field of agriculture value technical skills necessary for the job, they are also looking for graduates who are prepared with soft skills. The NMSU CES reinforces skill development by engaging youth in judging competitions and bowl tournaments. The program attracted 96 Horse Bowl Tournament participants, testing their knowledge of animal husbandry, veterinary science, and equine training principles. The TexMex Horse Judging Clinic trained 23 youth participants.

Horse Bowl participants were surveyed and 88 youth responded. Results indicated 98% increased their knowledge of horses, 92% reported using time management skills to prepare and participate in the contest, and 83% used technology to participate in the program. All TexMex Horse Judging Clinic youth reported improved confidence in their judging skills while also being more likely to participate in future judging competitions. It is important that today's youth have experiential learning environments where they can develop important business skills prior to entering the workforce. Programs like these are essential for developing the future generation of agricultural entrepreneurs in New Mexico.

4-H Youth Lead the Way: STEAM Innovators

The 4-H STEAM Innovator program is a virtual learning series for youth interested in Science, Technology, Engineering, Art, and Math (STEAM) with a passion for leading and teaching. Six youth were selected and have led the way. The mission is to provide youth driven STEAM education programs to all New Mexico youth. The objectives include promoting understanding of and making personal connections to STEAM education, keeping participation accessible for youth, and bridging the gap between opportunity and education.

A total of five workshops were delivered to 280 youth. Youth indicated participation in the innovator program provides an environment for them to communicate information to a larger audience, lead a group of youth to complete a project, work effectively with people they do not know, better serve their club, and improve their knowledge about STEAM and about a variety of STEAM activities. Participants have also indicated they enjoy connecting with other youth across the state and experiencing a shared interest in STEAM education.

The 4-H STEAM Innovators program enriched STEAM education through inquiry-based and experiential learning, improved understanding of STEAM interest by youth statewide with a multiplier effect and saved in costs by facilitating virtual training sessions.

Healthy Habits

Risk factors for childhood obesity include lack of or inadequate nutritious food and physical activity, lack of or inadequate support from the school and home environment to choose appropriate foods, and failure to make time to exercise. Poor nutrition and limited physical activity are risk factors for chronic diseases and play a role in a student's ability to learn, thereby affecting scholastic success. Childhood obesity has a significant impact on health care costs and quality of life, and may also result in the inability to produce a well-educated and prepared workforce.

NMSU CES working alongside teachers promoted the Healthy Habits program to four area schools, reaching 583 youth. The 8-hour educational program incorporated nutrition, physical activity, and mental health awareness. To achieve program sustainability and reach underserved youth, CES agents train teen leaders to serve as Health Ambassadors.

The Pojoaque Valley Middle School was able to provide snacks/meals and instruct the students on how to cook safely. Students made pancakes, pretzels, hummus, and smoothies from the Teen Cuisine recipes. Approximately 500 meals/snacks were provided for this group. In total, the agent was able to provide the teacher with $1220.00 in school supplies to support the Pojoaque Valley Middle School Family and Consumer Sciences program. The Sierra Vista Elementary School opted to be taught virtually, with a total of 200 students participating in a Healthy Habits Field trip.

After participating in the 8-hour Healthy Habits program, youth participants reported knowing how to keep a cooking area clean to stop the spread of germs (81%), being able to use knives safely (87%), and following a recipe (74%). Regarding drinking water and exercising, 80% reported being aware of water intake and exercise per day.

NM Farm to School

Many New Mexico schools and institutionalized residences have limited access to nutritious, high quality, fresh produce. To address part of this issue, the New Mexico State Legislature has funded the NM Farm to School and Farm to Institution program, reimbursing schools and institutions for purchasing New Mexico grown fresh fruits and vegetables. In addition, farmers were required to attend food safety training and conduct risk assessments.

NMSU CES developed a three-pronged approach to assisting local farmers. Farmers were offered food safety training as well as the development of on-farm risk assessments and food safety plans. A total of 125 farmers completed produce and food safety training. Approximately 90 producers and food hubs submitted food safety plans. In 2019-2020, 64 producers and food hubs sold to schools and institutions, totaling $1.2 million in sales. Of those sales, $450,000 was reimbursed to schools.

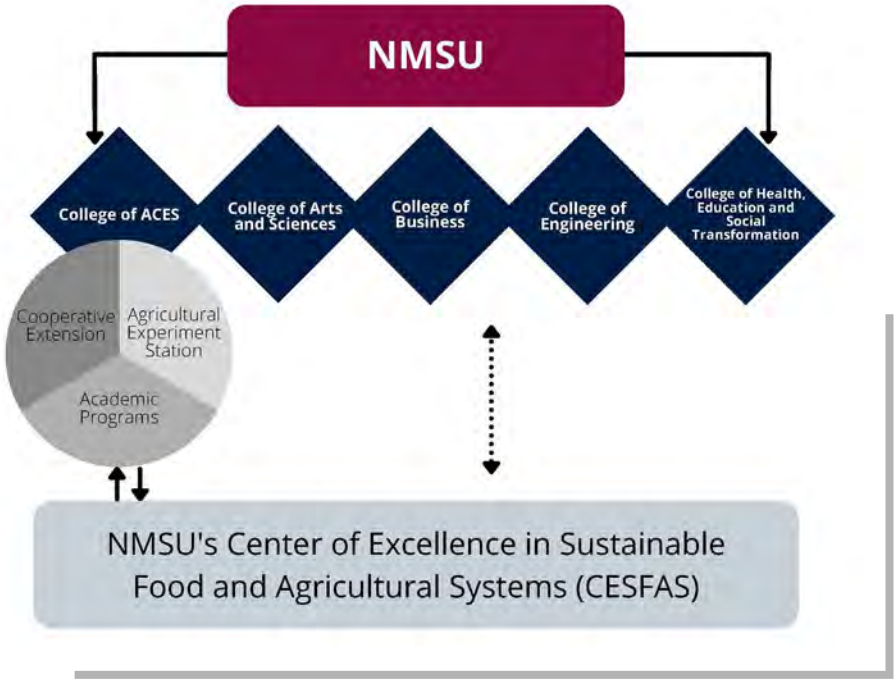
The reimbursement dollars help schools to purchase locally grown, quality produce while providing a market for local producers to sell their product. Aside from the NM Farm to School program, this program is now being recognized by Whole Foods, various co-op markets, and grocery stores who are purchasing NM grown produce from farmers who participated in food safety trainings and develop plans for market.

Introduction

The Center of Excellence in Sustainable Food and Agricultural Systems (CESFAS) was established in 2019 by Governor Lujan Grisham and the New Mexico Legislature. It is one of four university-associated centers of excellence to emerge from the Governor's initiative, each associated with emerging disciplines or needs:

- Center of Excellence for Sustainable Food and Agricultural Systems, New Mexico State University
- Center of Excellence Renewable Energy & Sustainability, San Juan College
- Bioscience, University of New Mexico
- Cybersecurity Center of Excellence, New Mexico Institute of Mining and Technology

The CESFAS is housed within the College of Agricultural, Consumer, and Environmental Sciences at New Mexico State University. A primary goal of CESFAS is to coordinate and encourage interdisciplinary teaching, research, and outreach (Extension) activities that support sustainable food systems, develop and expand value-added agriculture, create jobs and prepare workforce-ready graduates.



The College of Agricultural, Consumer, and Environmental Sciences

The College of Agricultural, Consumer, and Environmental Sciences (ACES) is broadly organized into three interrelated functional areas: Academic programs, the Agricultural Experiment Station, and the Cooperative Extension Service. Teaching, research, and Extension efforts within the College are centered on four primary pillars, with a foundation of education and training. The four pillars are (1) food and fiber production and marketing, (2) water use and conservation, (3) family development and health of New Mexicans, and (4) environmental stewardship.

2021 Center Efforts

The Center of Excellence in Sustainable Food and Agricultural Systems is virtual in that it does not have one central location on campus. The Center's primary role is to coordinate the expertise and efforts of faculty and staff throughout the NMSU system and other stakeholders in developing solutions to problems facing New Mexico's food and agricultural systems. Coordination efforts include developing and supporting transdisciplinary "roadmap" teams, providing seed funding for innovative research projects, and collaborating with other New Mexico centers of excellence and other stakeholders. Center directors and staff conduct outreach efforts with various New Mexico stakeholder groups. These presentations and interactions highlight the importance of sustainable food and agricultural systems and share how New Mexico State University is working to solve critical issues in the state's food and agricultural systems.

Roadmap Teams

What is a "Roadmap Team?"

The Center directors, in collaboration with College administration, affiliated faculty members and stakeholders, identify food and agricultural research areas (1) where University faculty have expertise, (2) that are important to New Mexico, and (3) where there are opportunities for external funding. Once strategic research areas are identified, the Center directors work with affiliated faculty to build "roadmap" teams. These transdisciplinary teams work together to better understand issues within the research area and develop a roadmap that outlines how NMSU faculty can contribute. Roadmaps team output may include a whitepaper that outlines the issue or issues addressed by the team, potential solutions, and resources needed to implement solutions. The teams are encouraged, with the support of Center directors and stakeholders, to seek external funding that can be used to provide resources needed to address the issues identified by the team.

Current Roadmap Teams

Eight roadmap teams have formed and done work over the last two years, including:

- Artificial intelligence
- Carbon management
- Hemp production and utilization
- Controlled-environment agriculture
- Food, water, and energy
- Sustainable agricultural systems – dairy
- Conservation
- Healthy soils, plants, and people

By encouraging and facilitating the development of roadmap teams, CESFAS is breaking down silos that commonly occur in higher education. The connections made by faculty, staff, and students via the roadmap development process will have long-lasting benefits for the University and the state of New Mexico.

Roadmap Team Outcomes

Several roadmap teams were successful in obtaining external funding and developing new or expanding existing research efforts. For example, the controlled-environment agriculture team was successful in obtaining external funding for a three-year project that placed a container farm on the NMSU Grants campus. Researchers will explore various aspects of controlled-environment agriculture, including horticulture-related questions, energy use questions, and socio-economic questions. Researchers will coordinate researchers at the Electric Power Research Institute (EPRI) on a national-level project that compares production from various regions throughout the United States.

The carbon sequestration team was successful in obtaining federal earmark funding that will allow team members to proceed with critical research related to carbon sequestration in arid and semi-arid environments. The research team, composed of Agricultural Experiment Station funded faculty, will explore different ways in which carbon can be successfully sequestered in a variety of different scenarios, e.g., croplands, rangeland, forests and urban landscapes. Their work will include training students via participation in the research team's research and outreach efforts.

Executives from Tri-State Generation and Transmission and the Electric Power Research Institute (EPRI), with NMSU Chancellor Arvizu with other NMSU administrators, welcomed the public, including local legislators and community leaders invited them to tour the container farm and learn more about the work that the industry and NMSU are doing related to controlled environment agriculture, September 10, 2021.

Project Seed Funding

The Center has supported faculty engagement by providing small seed grants. The grants allow transdisciplinary faculty research teams to explore potential research areas related to sustainable food and agricultural systems. The work associated with the seed grants can be (and has been) leveraged in obtaining external funding. Three grants have been awarded over the last three years related to:

- hemp production and processing.
- energy savings during dairy product evaporation.
- robotics in chile harvesting.

2021 Seed Grant Summaries

Hemp Field Trials as a Foundation for Hemp Production and Processing in New Mexico

PIs: Catherine Brewer, Chemical & Materials Engineering (CHME), cbrewer@nmsu.edu
Kevin Lombard, Plant & Environmental Sciences, klombard@nmsu.edu

The goals of the project are improving hemp cultivars for different regions of the U.S., recommending crop management practices, quantifying and characterizing crop yields and properties, and developing molecular genetics tools. The purpose of the project is to help develop a strong researcher and Extension hemp program in New Mexico. The expected benefits of the seed grant are:

- Provide preliminary data to strengthen the grant proposals that combine hemp biomass production (agronomy) and value-added processing (engineering).
- Develop Extension field workshops and resources for outreach and education.

Pioneering Guided-Ultrasound-Enhanced-Evaporation (GUEE) method for Reduce Energy Consumption During Evaporation of Dairy Ingredients

PI: Sergio Martinez-Monteagudo, Family and Consumer Sciences, sergiomm@nmsu.edu

The dairy industry represents the number one agricultural activity in New Mexico, and it contributes to the well-being of many New Mexicans. Jobs related to the dairy industry range from cattle nutrition and herd management to the manufacture of dairy products. Annually, New Mexico produces about 7 billion pounds of milk, accounting for 4% of the national milk production (Cabrera & Hagevoort, 2007). Although most of the milk produced in the state is used for cheese production, New Mexico is missing the revenue generated from emerging dairy ingredients, such as protein concentrates and other powders. The global market of dairy powders had increased from about $27 billion U.S. dollars in 2017 to over $30 billion in 2019, and it is expected to exceed $38 billion by 2025 (Allied Market Research, 2019).

This project aims to reduce the energy needed to concentrate liquid by coupling guided ultrasound within a falling film evaporator. Our approach consists of the generation of ultrasonic waves and guides them along the evaporation tubes. The research will help improve the sustainability of dairy powders' manufacture. The results will be presented to stakeholders through scientific journals, a symposium at a professional meeting and technical meetings with industry. NM and U.S. dairy processors will directly benefit from energy-efficient evaporation, which will help them to remain nationally and internationally competitive. The project will also promote the development of innovative technology and help advance education and public awareness of technological platforms for sustainable food production. The proposed research effort will promote the vision and stewardship of CESFAS in sustainable engagements.

2020 Seed Grant Update

Investigating Robotic Technology for Sustainable Chile Production and Harvest in New Mexico

PIs: Stephanie Walker, Extension Plant Sciences, swalker@nmsu.edu, Manoj Shukla, Plant and Environmental Sciences, shuklamk@nmsu.edu, and Mahdi Haghshenas Jaryani, Mechanical Engineering, mahdihj@nmsu.edu

Summary:

This project was funded $69,968 for the period of June 1, 2020 through June 30, 2021 through NMSU's Center of Excellence in Sustainable Food and Agricultural Systems (CESFAS) Seed Grant Program.

"Investigating Robotic Technology for Sustainable Chile Production and Harvest in New Mexico" involved collaboration between the ACES and Engineering colleges to explore robotic technology in the production and harvest of New Mexico-type green chile. Robotic applications included (1) investigating the use of specialized robotic manipulators for mechanized harvest and pedicel removal of green chile fruit, and (2) the use of sensor-equipped mobile robots for crops and soil monitoring in chile fields to optimize irrigation.

Robotic Harvesting

The team carried out a series of feasibility studies on the use of robotic systems for chile pepper farming. In a preliminary work on the robotic harvesting of chile pepper, 5-degrees-of-freedom (DoF) (Fig. 1a) and a 6-DoF (Fig. 1b) robotic arms with a customized cutter end-effector have been investigated in a laboratory setting (Masood and Haghshenas-Jaryani, 2021). The end-effector of the manipulator, a scissor-type cutting mechanism, which cuts the chile stem to detach the fruit, was designed, prototyped, and experimentally tested in a lab setup. A simple and easy-to-develop 3-D location estimation system was developed and can be efficiently used for various research application which involve data logging. This is done through a MATLAB-based program through which the location of the chile pepper is estimated in the robot's reference frame, using Intel RealSense Depth Camera. The harvesting robot showed promising results with high localization, detachment, and harvest success rates, low damage rate, and a cycle time comparable to the performance of other harvesting robots and human harvesters. The overall results have demonstrated the feasibility of using robotics approaches in harvesting chile pepper.

Figure 1: a) 5 degrees-of-freedom (DoF) robotic arm with a cutter end-effector harvesting green chile peppers in an indoor setting, b) a 6-DoF robotic arm with integrated wrist camera and an cutter end-effector identifies the location of the stem and ha green chile peppers, c) robotic soil moisture and temperature measurements at the NMSU's Heritage field, and d) image capturing and visual remote sensing using an autonomous ground mobile robotic arm in chile pepper testing field at the NMSU's Leyendecker Plant Science Center

Impacts

Students

Three graduate students and four undergraduate students were recruited and worked on the robotics research over the period of project. The students received training in designing, prototyping, and programing robotic systems and integrated sensors for operating in the laboratory setting and outside fields. Additionally, students received opportunities for hands-on experience and real-world research applications.

Dissemination of the Outcomes

The outcomes of the robotics' tasks were disseminated through a journal publication and a conference paper (which is under review), two presentations at the Chile Pepper Conference in 2021 and 2022, and two undergraduate posters and one graduate student presentation at NMSU Research and Creativity Week. A press release of the project was published in the Las Cruces Sun-News on June 28, 2020 entitled "NMSU Researchers Examine Robotic Chile Harvesting."

Initial research findings and collaboration from this project were instrumental in the submission and successful funding of the project "Robotic Harvesting System for Green Chile Peppers" through USDA-NIFA Agriculture and Food Research Initiative for $199, 948 (Oct 1, 2022 through Sep. 30, 2022) by Drs. Haghshenas-Jaryani, Boucheron-Spence and Walker.

Community Outreach

Center management is working with Navajo Technical University and New Mexico Tech to host a water symposium in April 2022. The symposium will be held in Farmington, New Mexico and focus on water issues related to the Four Corners region. The symposium will include a high school student water challenge where teams of high school students will be presented a water-related challenge facing tribal communities within New Mexico and be asked to outline a creative solution to the challenge. Teams will present their findings during the water symposium to a team of judges consisting of researchers, professionals, and community leaders. The symposium will also offer graduate students the opportunity to present their water-related research during a poster presentation/competition. The poster presentation/competition is unique in that it targets an audience of high school students in an effort to share with them the types of research and outreach that can be done to solve water-related issues in the Southwest.

CESFAS Faculty Impacts

The Center assists in supporting two full-time faculty members, Luis Sabillon (Microbial Food Safety) and Sergio Martinez-Monteagudo (Food Bioprocessing). Additionally, the Center has more than 120 affiliated faculty members who have indicated an interest in collaborating on agricultural-based research initiatives. Affiliated faculty are working in the areas of Plant and Environmental Sciences, Food Science, Management, Agribusiness management and marketing, Industrial Engineering, Chemical Engineering, Biology, and Mechanical and Aerospace Engineering. Example impacts of the work conducted by center faculty are provided below.

Photodynamic Inactivation of Foodborne Pathogens

PI: Luis Sabillon

Relevance: Fresh produce that is handled and packed in dry environments is often implicated in foodborne outbreaks due to Salmonella contamination. This enteric pathogen survives under harsh, dry conditions and colonizes food-contact surfaces for lengthy periods of time, thus increasing the risk of cross-contamination during processing. Therefore, there is a real and urgent need for the development of alternative technologies to enhance the antimicrobial efficacy of existing sanitation protocols. In recent years, antimicrobial photodynamic treatment (aPDT) has emerged as an innovative method for microbial inactivation. This water-less, chemical-free, light-based treatment uses a combination of visible light, a photosensitizer, and molecular oxygen, which further react with multiple targets within microbial cells and eventually cause cell death.

Response: The antimicrobial efficacy of aPDT has yet to be studied on a wide variety of food matrices and processing-related surfaces. The overall goal of this research program is to design, develop and optimize effective aPDT treatments for food and surface disinfection in industrial settings. The antimicrobial efficacy of aPDT is being tested against several foodborne pathogens and agricultural commodities of great economic importance to New Mexico.
Results: This research program is generating novel experimental data to better understand the impact of visible light and photosensitizer on the inactivation of enteric pathogens. The aPDT technology may play an important role in eliminating persistent pathogen reservoirs, thereby reducing the risk of food safety incidents. This research program will not only complement and expand on existing research but also will serve as a foundation for the design and validation of suitable aPDT that could be coupled with conventional sanitizing strategies to enhance microbial inactivation across the entire landscape of agri-food products and food-contact surfaces. This cutting-edge technology has gained much attention from funding agencies during the last decade as a promising technology with the potential to improve the safety and sustainability of food production. The program has a diverse funding portfolio that includes federal competitive grants and private entities being targeted to secure external funds to develop this cutting-edge research.

Food Bioprocessing Studies on Food Quality and Process Sustainability

PI: Sergio Martinez-Monteagudo

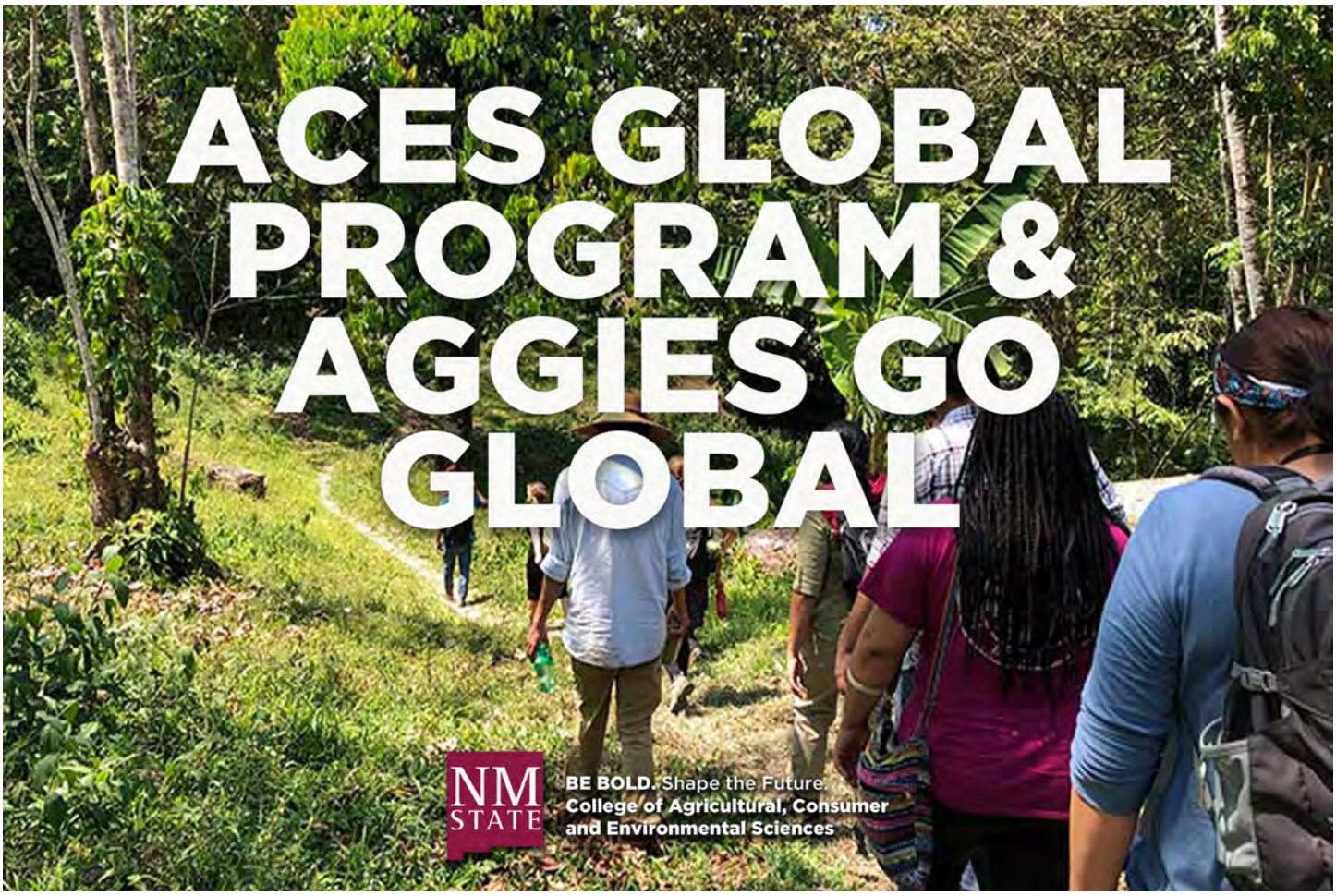
Relevance: Consumers are increasingly interested in healthy, natural foods as well as in the sustainability of food manufacture. This has prompted the food industry to investigate alternative thermal and nonthermal technologies. While advanced thermal-based technologies (such as Ohmic heating and microwave heating) employ volumetric heating, nonthermal technologies use lethal agents other than heat (such as pressure, high voltage or UV light as examples) to minimize thermal impact on nutrient and product quality.
Response: The food industry ranks fourth in energy use after the chemical, mining and paper industries, and uses around 9% of the total energy in the United States, with costs ranking third in overall production costs after raw materials and labor. Any reductions in energy usage will have a significant impact on reducing greenhouse gas emissions and improve long-term sustainability. Though new technologies are gaining widespread acceptance within the food industry, very little is known about the energy efficiency of the process. Research will be conducted to develop models to estimate energy expenses of various components (pump, pressure intensifier, pressure vessel, among others) of a processing system. Such efforts can help equipment vendors to design and develop systems with improved energy efficiency.
Results: This research investigates the impact of emerging technologies on food quality. Examples of such technologies are high-pressure processing (HPP), high-pressure homogenization (HPH), ultrasound, vacuum impregnation, and hydrodynamic cavitation. Of prime interest is the work done in beverages, where Sergio developed a mathematical model to predict the inactivation of the enzyme responsible for quality defects in coconut water subjected to HPP. He also investigated the simultaneous application of high pressure and temperature to produce a shelf-stable dairy beverage with reduced thermal damage. In addition, Sergio has conducted research in HPH, where a reduction of 80% of the stabilizer was obtained during the formulation of infant formula without affecting the stability of the emulsion.

Introduction

As part of its commitment to equity, inclusion and diversity (EID), the college of ACES began its EID initiative in August 2021. The initiative's two co-directors are charged with coordinating and managing strategic activities within the college of ACES as well as serving as liaisons to campus-wide EID initiatives. Goals of this initiative are to (1) review, evaluate, and recommend policies and programs promoting diversity and inclusivity for ACES faculty, staff, and students and (2) collaborate with the NMSU Vice President for EID, ACES Dean, Associate Deans, and unit leaders on efforts to foster equitable and inclusive environments within the college as well as externally with community stakeholders.

Accomplishments (August 2021–April 2022)

- EID initiative directors met with administrators from ACES Academic Programs, the Agriculture Experiment Station (AES), and the Cooperative Extension Service (CES) as well as with four department heads to discuss needs for EID resources and professional development training.
- The co-directors are part of a team of four CES faculty who are trained as facilitators of a national CES program called Coming Together for Racial Understanding (CTRU). This program is a dialogue-to-change process for working together across racial/ethnic lines that seeks to foster understanding and build trust in order to take informed collective action for meaningful change.
- Professional development opportunities using the CTRU program were provided for ACES faculty, staff, students and community stakeholders, reaching over 170 individuals.
- The co-directors also participated in EID professional development opportunities in order to become better informed about best practices for promoting EID throughout the college of ACES. Professional development was provided by the following NMSU entities: the Borderland and Ethnic Studies Program, the Teaching Academy, Training Central, Chicano Programs, the VP for Equity, Inclusion and Diversity Office, and the College Assistance Migrant Program, as well as the following non-NMSU entities: Association of Public and Land-Grant Universities; National Academies of Sciences, Engineering and Medicine; and the Michigan State University Office of Diversity, Equity, and Inclusion.
- As part of serving as liaisons to campus-wide EID activities, the co-directors serve on committees such as the faculty senate EID committee and the NMSU EID committee.



Introduction

The mission of the College of ACES Global Program (GP) is to provide every student in the College of Agricultural, Consumer and Environmental Sciences an opportunity to have an inspiring international experience prior to graduation. The ACES GP supports LEADS 2025 goals of social mobility (Goal 1) and amplifying impact of research findings by addressing local needs that align with global challenges (Goal 2.3; 2.4). The program supports ACES strategic Objective 4.1: recruiting students globally and Objective 4.5: continued targeted involvement in international programs. ACES GP has initiated several new MOUs with international universities and institutions, and has contributed to enhancing NMSU's global vision. The mission of ACES is to establish and streamline new opportunities for faculty global activities, especially teaching short courses abroad, organizing or participating in international workshops, and creating new opportunities for enhancing NMSU students' global experiences in collaboration with the Aggies Go Global program. The ACES GP also participates in large (USAID) and small (100,000 Strong; Cochran) grant proposals (LEADS objective 2.4) to amplify the impact of research on society and the economy and to promote international collaboration by accelerating technology and knowledge transfer. Global Programs also collaborates with international companies, including three Israeli companies, Ndrip, Tal Ya and Cropx,

on projects related to increasing water conservation and crop water use efficiency for the specialty crops of New Mexico. To encourage global activities, including recruitment of faculty and students, ACES GP has also initiated an annual Outstanding Global Work Award as well as travel awards. In order to further its mission and expand outreach to ACES alumni, ACES GP also gives an International Distinguished Alumni award.

Buffy Charley, Anna Benally, Reyaun Francisco, Elijah Harry, Chantelle John
Copal AA, Coban, Guatemala for the Indigenous Exchange Program, Spring Break 2019

Actions

- Make Globalization an important part of LEADS 2025 strategic plan and work closely with Provost and Chancellors initiatives.
- Sign MOUs with interested foreign universities and institutions.
- Participate in grant proposals related to research, teaching, training, and capacity building.
- Create opportunities for faculty and student travel abroad for joint teaching, advising, career building, research, and noncredit experience related activities.
- Contact ACES Alumni in foreign countries to build on existing and new partnerships and provide visibility to the NMSU, ACES, ACES departments, and majors.
- Visit foreign universities to build collaborations and recruit high quality students.
- Reward international work of the faculty and students.
- Host faculty, students, administrators from foreign countries.
- Fund raising activities to enhance NMSU students global experience.
- Communicate the importance of international activities for the economy of the state to NM citizens and legislators.

Key Performance Indicators (KPI)

1. We will continue to propose changes to LEADS 2025, improve travel advisory, and document NMSU's global efforts
2. We will continue to make contacts with foreign universities and increase collaborations including MOUs and joint grant proposals by 2% by year 3 and 3% by year 5
3. We will increase by 2% by year 3 and 3% by year 5- number of new students enrolled in the Global Student Alliance (GSA) consisting of students who have travelled abroad with AGG support
4. We will increase number of students- first time travelers outside of the USA through AGG/ GP by 2% by year 3 and 3% by year 5.
5. Maintain number of faculty going abroad through Global Programs
6. Increase by 2% by year 3 and 3% by year 5 the number of international visitors to NMSU

Specific Tasks Performed During 2021

NMSU Initiatives During 2021

NMSU LEADS 2025 can include additional tasks on Globalization. Revisions are suggested to make international travel more safe and productive. In addition, a detailed inventory of global work at NMSU was done. The knowledge of current and past NMSU International Collaborations is important for maintaining continuity as well as increasing NMSU's global footprint. The specific activities were:

- A new task group suggested additions related to NMSU international activities to the LEADS 2025 strategic plan (Delano, Cindy, Ignacio, and Manoj). Group has submitted comments and edits to the current NMSU LEADS 2025 document.
- The International Travel Policy & Risk Oversight Committee is working to update the policy. A section on Non-Credit Group Travel (mostly by AGG and AWL) was added to part 5. The report is under further review.
- International Travel Policy & Risk Oversight Committee revised the 16.69 University Related International Travel document.
- The Chair of the sub-committee, with the help of other members, prepared the inventory of all international activities at NMSU.
- A Task Group is working on a proposal for reestablishing the International Office at NMSU. Data collection from our peer institutions is in progress, and a tentative structure is proposed.

LEADS 2025 Objective 1

ACES Global programs supports the LEADs 2025 objective 1 to enhance student success and social mobility

- The Aggies Go Global program sends NMSU students abroad on short trips to increase their awareness of global problems and their solutions. Ten NMSU students were trained for a trip to Costa Rica in 2022.
- AGG values diversity and inclusion, and is working with Black program and Indian Resource Development program at NMSU for a group trip for minority students in 2022.

- AGG hosted five students from local school districts for the summer internship program of the city. These students were immersed in the existing global programs at NMSU and how they can avail themselves of those opportunities should they enroll at NMSU as undergraduate students.
- To increase the opportunities for ACES faculty and student travel abroad and establish meaningful cooperation, ACES Global Program Director visited Universidad de La Salle, Colombia, Utopia and Bogota campuses. During the meetings with provosts and directors at both campuses, it was agreed to start a new study abroad program between the two universities. University of La Salle Colombia's Utopia campus will provide free accommodation to NMSU students for up to two weeks.
- A presentation was given to the NMSU Board of Regents on Dec 9, 2021. Regents were pleased to know the activities of AGG for all NMSU students. Chair Dr. Devasthali has asked to prepare a business plan to look for funds/donations. These fund raising efforts will further global exposure of NMSU full time students.
- During 2021, IALC promised to provide $10K to Aggies Go Global to support their mission. These funds will support NMSU students, global travels for noncredit programs.
- During 2021, AGG also received a donation of $50K from Walker family.

LEADS 2025: GOAL 2. Elevate Research & Creativity

College of ACES Global Program is supporting goal 2, which recognizes that all disciplines advance research, scholarship and creative activity, and along with the assets of the state of New Mexico, create a strong foundation for teaching, learning, education, training, innovation, and economic development. Following is the specific work done by the College of ACES towards achieving LEADS 2025 goal 2.1 related to facilitating the convergence of research and creative activity to address local and global challenges, integrated with undergraduate and graduate student education during 2021.

ACES continue to identify foreign universities where NMSU faculty can teach condensed courses during their summer or winter academy (programs) during summer and fall, respectively.

- ACES has established regular summer teaching at China Agricultural University, Northwest Agricultural and Forestry University, and Inner Mongolia Agricultural University, China; University of La Salle, Colombia; and Consejero de la Universidad Tecnológica (UTEC), Uruguay. A similar agreement is being advanced in 2022 with the University of San Carlos, Paraguay (Mario Allegri) and University of Guadalajara, Mexico.
- COVID–related travel restrictions did not allow faculty to travel during most of the 2021. However, the ACES Global Program Director taught at the University of La Salle, Bogota, Colombia during Nov 28- Dec 10, 2021, offering a course on "Digital Agriculture." NMSU faculty are invited to participate in the Summer and Winter Academy at La Salle.

In China, Mexico and some Latin American countries, some ACES (and NMSU) faculty are working with graduate students and faculty on research, mostly through virtual platforms.

- During 2021, more than six papers were published jointly with NMSU and Universities in China.
- Areas of collaborations were identified between the College of ACES, Engineering, and the University of Montevideo, Uruguay. In collaboration with NMSU Alumnus from Uruguay Mario Allegri, interested-faculty from each institution were identified for three areas of research collaboration through a series of meetings. Three areas identified to move our collaboration forward are: Application of AI in Agriculture, Water resources and environment, and Energy (renewable and nonrenewable) efficiency and innovation.
- The ACES Global Program Director continues to serve as Visiting Professor for China Agricultural University.
- College of ACES faculty members extensively collaborating with universities in Mexico. Several NMSU (and ACES) faculty are serving on graduate student committees and participating in conferences/workshops and as coauthors on refereed journal articles.

April Beauchemin, Kaitlin Marry, Noel Braudt, Saralee Ramirez, Thelma Solis, Kenneth Duran, Rashel Lopez, Abby Nayra, and Dr. Gabriela Moreno–Centro Panamericano de Idiomas Spanish School in Monteverde Costa Rica, Spring Break 2022

Through ACES efforts, NMSU has signed several new MOUs with universities in several countries. The goals of MOUs with international institutions is to fulfill the vision and mission of ACES Global Programs and NMSU LEADS 2025. Some of these efforts are supported by NMSU Alumni (Mario Allegri in Latin America and Juan Pedro Margez in Mexico)

- NMSU has signed an MOU with the Ministry of Agriculture and Livestock, Paraguay. This is the first time ever that MAG, Paraguay has signed an MOU with a foreign university.
- Another MOU was signed with University of San Carlos, Paraguay. The MOU will provide opportunities to NMSU faculty to travel to Paraguay to teach during the summer, carry out joint research, and write peer reviewed journal articles.
- The College of ACES, NMSU jointly organized the 3rd International Congress with University of San Carlos and Ministry of Agriculture, Paraguay; University of the Empresa (UDE), Uruguay; and others. Three College of ACES faculty and the Director of Global Programs participated in the workshop as joint keynote speakers and panelist. Dean ACES opened the conference with the Rector of USC and the Minister of agriculture and livestock, Paraguay.
- The 2nd International Food Research Workshop in the Chihuahua Desert Region of North America (IFRW) took place in Chihuahua on April 7 and 8, 2022. With the aim to create a broader network, the Centro de Investigación en Alimentación y Desarrollo (CIAD), Cuahutemoc, Mexico has joined NMSU and Universidad Autonoma de Chihuahua (UACH), Mexico as organizers of the IFRW 2022.
- A 3-day international workshop was held from Oct. 27-29 in Uruguay, organized by UTEC and NMSU. The title was "Higher education and development: strategies and opportunities for international cooperation in science, technology, and innovation." ACES Global Program Director was the panel member and gave a talk on advancing agriculture sustainability and efficiency through digital agriculture in semi-arid areas.

College of ACES has established close cooperation with Inter America Institute for Cooperation on Agriculture (IICA), Costa Rica.

- A virtual workshop on Digital Ag and AI for livestock management was held on 07/27/2021. NMSU faculty gave oral presentations. Topics were livestock management, Drone application, and Digital Ag at Leyendecker. Other presenters were from INIA and COPROFAM (National Confederation of Rural Agricultural Workers).
- A conference on "Application of AI technologies in agriculture: towards a digital agricultural revolution" was organized jointly by IICA and ACES on Nov 24. IICA Director General Manual and Dean ACES inaugurated the workshop. Several NMSU faculty and Director Global Programs gave presentations during the conference.
- IICA supports conducting a case study not only in Uruguay but other at Institutions and work towards improving digital skills of the users and stakeholders
- ACES will collaborate on Center for tomorrows Ag, a collaborative program between IICA and Microsoft.
- Carbon Sequestration and soil health collaboration was discussed among IICA, INIA, and NMSU during meetings in Nov and Dec 2021. A virtual conference on identifying short and long-term goals is scheduled for year 2022.

- College of ACES is also involved in developing further collaborations with Jordan through International Arid Lands Consortium (IALC) and with ACES Alumni Ismaiel Naser.
- College of ACES is actively pursuing collaboration with University of Sonora, Mexico. Two students have applied for graduate program in Animal and Range Sciences. A delegation of ten students and two faculty members from the University is scheduled to visit the College of ACES in April 2022.
- A new study abroad program for NMSU students is signed between NMSU and Perrotis College, Greece. Another study abroad program is agreed upon between NMSU and University of La Salle, Colombia.

Melissa Grijalva Hernandez
Cairo, Egypt for the Womens' Economic Forum, Spring Break 2020

LEADS 2025 Objective 2.3

Amplify impact of research findings by addressing local needs that align with global challenges
With regard to supporting the LEADS 2025 Objective 2.3, to amplify impact of research findings by addressing local needs that align with global challenges, the College of ACES is engaged in the following specific work during 2021.

- The College of ACES continued to work with graduate students and faculty in China and Mexico on water use efficiency, water scarcity, conservation, and salinity (common problems in all three countries), particulate matter emissions (a major border issue with Mexico), and food science.
- ACES faculty are serving as graduate committee members on some student committees in Mexico and China. Many joint research papers were published (more than 10 with China and Mexico), and some joint research funding opportunities were explored.
- Grant proposal writing is an important component of leads 2025. The College of ACES has collaborated with the following international agencies and universities to write grant proposals together during 2021.
    - Establishing contact with the Institute for Global Agriculture and Technology Transfer (IGATT). IGATT is active in India, Israel, and Central American Countries.
      We established contacts with DEHAT (Developmental Association for Human Advancement) in India, started by a graduate from IIT Delhi, an NGO and a one-stop shop "seed to market" for growers.

- Bill and Malinda Gates foundation seed grant on "User Friendly Cellphone Application for Tracking Crop Water Use and Increasing Crop Yields" was developed with ACES Faculty as lead. Another proposal submitted was "Scaling Digital Climate Smart Small Agro-Livestock Farm for Prosperity", with IGATT, CUNY, and Agriculture University in India.
- A proposal "Climate-smart water technologies for sustainable agriculture and rural development" was submitted in April 2021 to the US Consulate in Montevideo, Uruguay with UTEC, Uruguay.
- The 100K strong proposal "Training the farmers of the future" with University La Salle, Colombia was submitted on Monday (03/15/2021).
- College of ACES and CAPECO (The Paraguayan Chamber of Exporters and Marketers of Cereals and Oilseeds, NGO for farmers) participated in a joint proposal for the Farmer-to-Farmer- Agricultural Volunteer Opportunity Project (AVOP) Small Grants Program. The program was for $200K for 16 months and the proposal was submitted on June 8, 2021.
- A 100K strong proposal between ACES and UACH, Mexico, "Cooperation for the Chihuahua-Desert Region Academic Exchange Program", was submitted in May 2021.
- ACES has recently submitted a proposal to USAID with Deloitte Consulting LLP as lead. This proposal was for Jordan Water Governance, and primary responsibility of ACES were related to capacity building and organizing training, seminars, and meetings on water related issues.
- Another proposal with Deloitte Consulting LLP as lead on WADI II project of USAID has been selected for round 2 submission in 2022 ($25M).

LEADS 2025 Objective 2.4

Amplify impact of research on society and the economy and promote international collaboration by accelerating technology and knowledge transfer.

To support NMSU LEADS 2025 objective 2.4, the College of ACES has started/continued following new collaborations.

- A project on improving water use efficiency started with two Israeli companies continued in 2021. The research is important for New Mexico with scarce water availability for irrigation.
    - The Ndrip micro-gravity drip irrigation system for chile and pecan, research and demonstration site is located in NMSU's Leyendcker Plant Science Center.
    - ACES is testing a new Ndrip matric potential sensor and algorithm for predicting leaf N.
    - The Tal-Ya, Israel provided Mitra system was also tested on both crops for weed control and soil health enhancement.
    - During the field day, local growers visited the site to learn about the system.
    - Cropx Company has also installed a soil moisture sensor for testing in the pecan field.
- Two international students are expected in the College of ACES as part of the dual-degree on Food Science and Technology between ACES-FACS and University of Chihuahua, Mexico.
- Manual Schools System in Albuquerque, with NMSU support, is starting with pre-med, pre-ag and pre-vet courses. These courses will be offered to the students at their China campus. Some of them could be potential NMSU recruits for fall 2022.
- Two students from China Agriculture University were selected by China Scholarship Commission to visit NMSU as research scholars for one year during 2021 and 2022.
- College of ACES faculty is hosting a Mandela fellow, Dennis Chitowe. ACES is in the process of signing an agreement to help Mandela fellowship program fellows to come over to NMSU.

introduction

Indian Resources Development (IRD) is a statewide program that works to connect tribal nations, businesses, high schools, colleges and universities throughout New Mexico, building career pathways through economic development programs and experiential learning opportunities like internships and research experiences. The ultimate purpose of IRD is to support tribal nations in developing their own technical and managerial expertise in agriculture, natural resources, engineering, energy, tourism, and business.

IRD accomplishes its mission through collaborations and network building that promote self-directed and self-sustaining economic development and management of resources by tribal nations.

In 2021, IRD was able to advance its mission by providing research and internship experiences for high school and college students, offering emergency scholarships and financial aid information, supporting the participation of college students in professional development conferences and meetings, and – most importantly – by serving as a connector between partners and collaborators. In 2021, IRD also secured federal funding in collaborations with other high

education institutions to offer agricultural and entrepreneurial camps and professional development workshops, as well as internships that aid in keeping college students interested and focused on staying in college and graduating. Internally, IRD put together communications and fund development plans, published the first issues of its newsletter, added informational resources to its web site, hosted its first graduate student assistant, and continued the work of expanding tribal advisory groups for the program.

Goal 1: Enhance Student Success and Social Mobility

In collaboration with Indian Resources Development (IRD):

- The New Mexico Institute of Mining and Technology (New Mexico Tech) gave six scholarships to New Mexico Tech students.
- The Native American STEM program (NA-STEM) at the University of New Mexico (UNM) gave eight scholarships to UNM students and funded one internship opportunity in energy.
- The American Indian Chamber of Commerce offered two internship opportunities, one related to marketing and communications and the other to internship development for their members.
- Laguna Pueblo offered two internships, one related to wildlife and the other to range management.
- San Juan College offered seven apprenticeships for their students.
- Innovation and Commercialization for a Regional Energy Workforce group offered two internship opportunities related to clean energy.

IRD provided funding to support professional development opportunities of:

- Three Diné College students to attend US Beef Academy in Corona at the NMSU Corona Range and Livestock Research Center, by covering their transportation expenses. The Beef Academy is a week-long intensive training in all aspects of beef production. All lodging and meals will be provided.
- One NMSU student of economic development to attend the 2021 Reservation Economic Summit. From the contacts she made at the conference, she secured a job with the economic development department of the Navajo Nation.

Camps:

- IRD offered the 2021 Dream Keepers Online camp over 3 weeks for Native American high school students entering 10th, 11th and 12th grade. The camp introduced 14 participants to college and career opportunities in agriculture, natural resources, engineering, and business through virtual activities with the help of 31 partners.
- IRD, Navajo Technical University, Innoventure and American Indian Business Enterprise at Arrowhead Center offered two one-week career exploration camps related to sheep and beef management in which 30 high school students participated.
- Important website updates:
- IRD made frequent updates to the IRD Sources of Financial Aid booklet to keep it updated and compiled a list of undergraduate degrees in energy offered at various higher education institutions in New Mexico: https://ird.nmsu.edu/clean-energy-programs.html. IRD also created a page to capture testimonial accounts of how the work of IRD has impacted the lives of students in New Mexico: https://ird.nmsu.edu/ird-impact-stories.html.

Goal 2: Elevate Research and Creativity

In Collaboration with IRD:

- The New Mexico Alliance for Minority Participation, NM Institute of Mining and Technology, offered two research opportunities to Native American students of New Mexico Tech at the Navajo Technical University–New Mexico Tech Navajo Nation Water Purification Project. This is a joint endeavor to install water filtration equipment testing facilities on the Navajo Nation and to train students to test water quality and maintain filtration units to provide sustainable long-term water resources suitable for agriculture and livestock use, cleaning, and eventually clean drinking water.
- The NA-STEM program at UNM offered three research experiences, and the UNM Office of Equity and Inclusion offered five research experiences, for high school or undergraduate Native American interested in agriculture, natural resources, energy, engineering, or business.

IRD:

- Became a collaborator of Central New Mexico Community College together with the University of Colorado Boulder and Growth Sector for a National Science Foundation INCLUDES Alliance. The project intends to create academic and workforce pathways for Native American students across New Mexico to pursue careers in STEM. IRD also introduced Diné College to the Alliance.
- Established collaboration with the four tribal colleges in the state: Navajo Technical University for various efforts, Southwestern Indian Polytech Institute for internships, Diné College for internships and professional development opportunities for their students, and Institute of American Indian Arts for beekeeping and gardening for tribal outreach.

Goal 3: Amplify Extension, Outreach, and Economic and Community Development

IRD:

- Worked with five tribal education departments (Pueblos of Pojoaque, Acoma, Ohkay Owingeh, Zuni, and Isleta) to help them design and prepare educational offerings for their communities, establish internships, and develop a professional planning retreat for them and for other Pueblos.
- Assessed the need and interest from tribal communities about green and hoop houses in collaboration with two tribal organizations, Indian Pueblo Cultural Center and Flower Hill Institute. From there a series of workshops were developed related to extending the season production. This was a collaborative effort of IRD with Flower Hill Institute, Indian Pueblo Cultural Center, NMSU CES – Pueblo Extension, Pueblo of Jemez Natural Resources Department, Santa Ana Pueblo, and Dancing Butterfly Naturals. The series was composed of six workshops and included basics of greenhouses and hoop houses, planning and design, construction, management and maintenance, community panels, and hands-on demonstrations. An average of 28 to 30 participants attended each session.
- Attended six Jemez farmers meetings to offer information about IRD services, learn about topic of interest or concern to the group, and request feedback about economic challenges faced during the worse of the COVID pandemic.

- Delivered a presentation regarding supporting Tribal Nations in developing their own technical and managerial expertise via internships and research experiences for the Water Resources Research Institute workshop Building Tribal Capacity with Water Research Partnerships.
- Offered twenty presentations to high school tribal liaisons or Native advisors, and two presentations to groups of Tribal education departments regarding IRD services and offerings. IRD also met with the education director of Eight Northern Pueblos and with the All Pueblo Council of Governors regarding IRD and its Tribal Advisory Committee.

In collaboration with IRD:

- Santo Domingo Pueblo offered two career and college exploration workshops for middle and high school students, and parents. Each day was attended by 18 participants.
- Nambé Pueblo gathered the necessary contacts at higher education institutions in New Mexico to plan a trip to visits college.
- The NA-STEM program at UNM led two energy workshops for 26 students of Laguna Middle School.
- Dulce high school put together a college and career fair. The event was attended by approximately 170 high school students.
- Pueblo of Acoma offered the 2021 summer Pueblo of Acoma Community Forums.

IRD as convener and connector:

- From the connection IRD helped made between Pueblo of Acoma Department of Education (DE) and NMSU diversity programs, a presentation was delivered to Acoma DE. The goal of the session was to give members of the Pueblo of Acoma via their tribal education department an opportunity to learn about several programs and resources at NMSU. The presentation was recorded so it would be available to members who could not attend.
- IRD convened a meeting of faculty and staff from NMSU-ACES, Santa Fe Community College, and San Juan College to explore collaboration opportunities related to hydroponics. IRD is acting as the convener and facilitator of the conversation so more educational and work opportunities in agriculture are available for Indigenous people in New Mexico.
- IRD attended the presentations of 27 Native entrepreneurs who completed a course on Financial Basics offered by New Mexico Community Capital for American Indian Business Enterprise Center clients. IRD was invited to the event to partake in the accomplishments of the participants, to be recognized for serving as connector between the two organizations, and for partially funding the effort.
- In collaboration with the Business College and Arrowhead Center at NMSU, IRD presented at two meetings of Region 6 FEMA group about Tribal economic concerns and issues in NM.
- As an advisory committee member of the NM Alliance for Minority Participation, IRD is working with AMP in expanding their reach to tribal colleges in the State and increasing connections with higher education institutions in the state with large Native American populations.
- IRD began conversation with the NM Departments of Workforce Solutions and Public Education about offering summer internship opportunities for Native American high school students. Funding for these internships will come from those departments. IRD also discussed the need to update the job pool stats in natural resources and agriculture in NM, and invited ACES-AEAB to the conversation.

Goal 4: Build a Robust University by Implementing College-Wide, Mission-Supporting Strategic Initiatives

In 2020 IRD branched out to North Central New Mexico, where one of the IRD staff members was located, and in 2021, after finishing its first geographical expansion plan, IRD opened a second office in Albuquerque, NM. From the Albuquerque office it is easier to reach 22 of the 23 Tribal Nations, 32 of the 35 districts identified by PED as those serving the majority of Native American students in the State, and 11 of the 12 higher education institutions in New Mexico identified by HED as those serving the majority of Native American college students in the State.

IRD:

- Put together a fund development plan to create an endowment fund for the program with the support and collaboration of all higher institutions in NM.
- Produced its first and second issues of the IRD newsletter, which are broadly distributed to partners and collaborators in education, economic development, business, agriculture, and natural resources.

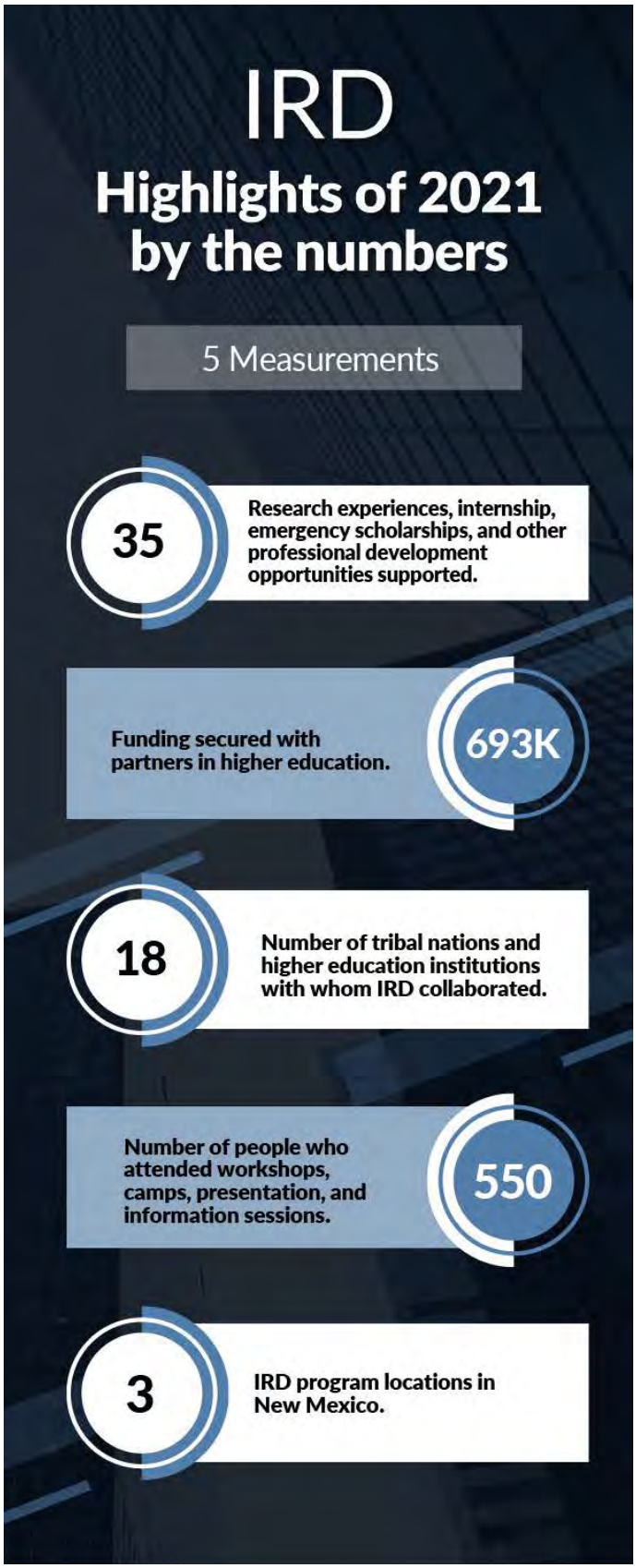
- Had a successful planning meeting with representatives of the Tribal Advisory Committee so IRD can be more effective in its outreach and in serving Tribal Nations and its members. IRD also welcomed the second Tribal Advisory Committee representative from the Navajo Nation. He served on the Navajo Nation Council as Chairman of the Health, Education and Human Services Committee from 2011 to 2019. He is a recent graduate of New Mexico State University with a Bachelor of Animal Science degree.
- Hosted the first graduate assistant IRD has ever had. He is pursuing a master's degree in curriculum and instruction with emphasis in multicultural education and a minor in Native American Studies.
- Via an internship, IRD is developing its first database with the help of a business/ information systems student, under the director of two faculty members from the NMSU Business College.

Funding received:

- In partnership with Navajo Technical University, IRD received a four-year, $372K grant from the United States Department of Agriculture's National Institute of Food and Agriculture to develop experiential learning opportunities to increase retention and graduation of Native American students at New Mexico land-grant institutions.
- In collaboration with the Agricultural Experiment Station, Cooperative Extension Service, and IRD, the Department of Agricultural Extension Education at NMSU received for a $271K grant titled "Impacting Career Engagement in Agricultural, Consumer and Environmental Sciences." The project will enhance post-secondary instruction for undergraduate students in agricultural degree programs by providing experiential learning experiences through research and extension-based fellowship opportunities while also developing needed agriculturally based workforce skills.
- In collaboration with Navajo Technical University, Innoventure, and IRD, the American Business Enterprise center at Arrowhead Center received 50K to offer two one-week career exploration camps related to sheep and beef management for high school students.

Funding which IRD applied for and did not receive:

- In collaboration with Cooperative Catalyst of New Mexico, Navajo Technical University, and Extension Beef Cattle Unit in the College of Agricultural, Consumer and Environmental Sciences at NMSU, IRD submitted a $200,000 dollar grant titled "Opportunities for Native beginning ranchers to build and access capital." The proposed project is a multi-faceted approach to provide specialized agriculture education and hands-on experiences for Native Beginning Ranchers. The project was not funded, but the team was invited to meet with the grantor for a feedback session.
- IRD, in collaboration with partners in California, Colorado, and New Mexico (San Juan College, Santa Fe Community College, Central NM Community College, Navajo Tech, New Mexico Tech, UNM, Dine College), applied for the NSF INCLUDES Alliance project to support STEM pathways for underrepresented and underserved student populations and New Mexico workforce partners with a diverse workforce. The NSF INCLUDES Alliance grant was not funded during this cycle; however, the reviews were very positive.


IRD
Highlights of 2021
by the numbers
5 Measurements
35
Research experiences, internship, emergency scholarships, and other professional development opportunities supported.
Funding secured with partners in higher education.
693K
18
Number of tribal nations and higher education institutions with whom IRD collaborated.
Number of people who attended workshops, camps, presentation, and information sessions.
550
3
IRD program locations in New Mexico.

Introduction

Approved by New Mexico voters through the GO Bond D in 2018, phase two has commenced to improve the modernization of New Mexico States University's educational facilities. Construction of the two-phase project started in August 2021 with a groundbreaking ceremony. Three new facilities – 1. Food Science, Security, and Safety; 2. Biomedical Research; and 3. Animal Nutrition and Feed Manufacturing – will provide central locations to teach and conduct cross-disciplinary biomedical research. With the right tools and facilities, NMSU research teams can continue their work to help the world understand, prevent, and manage disease outbreaks. Building and updating these facilities supports NMSU's mission to serve the people of New Mexico through teaching, research, and extension.


Agricultural Modernization & Educational Facilities
Phase 1 (2018 GO Bond)
Feed Mill and Processing Facility
Thank you to New Mexico voters for support of the
General Obligation Bonds for Higher Education
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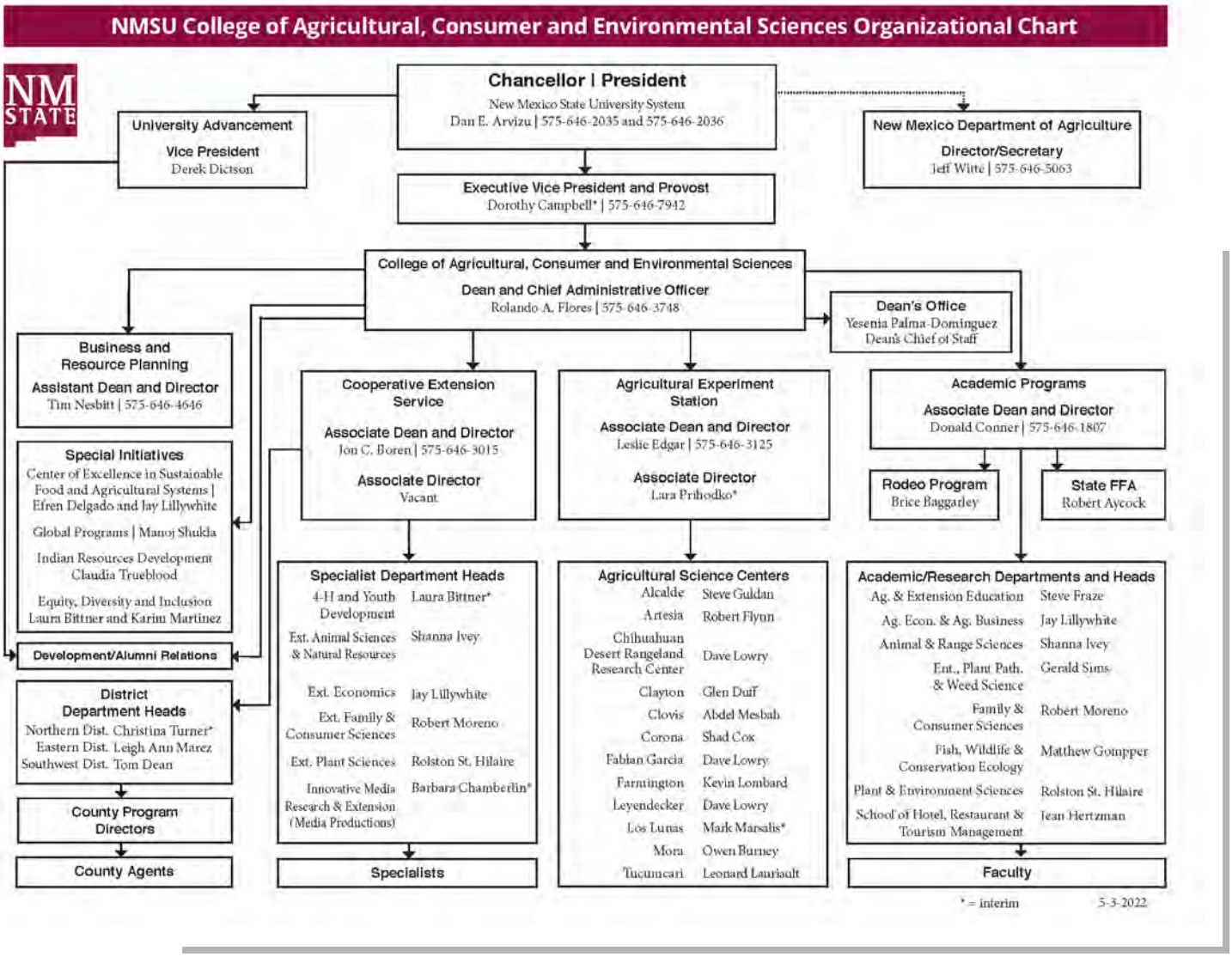
College of ACES Organizational Chart

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