2019 Annual Report of Accomplishments and Results

Arizona
The University of Arizona

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.

1. Executive Summary (Optional)

Like all organizations around the world, Arizona Cooperative Extension will be dealing with the impacts of COVID-19 for many years to come. The pandemic has forced us to re-think how we deliver our programming, content, and other offerings to our stakeholders across the state. Fortunately, we're already skilled in delivering and communicating science and bringing it to bear on practical problems. We're also an organization that has been responsive to changing environments and adapting to challenges. We anticipate many challenges in addressing our critical areas of helping to build sustainable, profitable, and competitive food and fiber systems; natural resource conservation; health, safety, and economic security; quality youth engagement and programming; and preparation of future solutions.

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Process	Updates
1. The Merit Review Process	Arizona Cooperative Extension will utilize a multi-pronged approach to the merit and scientific peer review processes. These include updated software to facilitate the workflows, meeting with internal and external university panels, an improved onboarding process for new faculty/staff, and overall better communications. Our goal is to streamline the process and ensure consistency across the state with general expectations and criteria. This has been an issue in previous years under previous administration and we're still seeing impacts. But as many of the more-senior faculty age out of the system, we are shifting our focus to the newer personnel and getting them acclimated to our updated processes. As for our merit process, much of that continues to be dependent on the activities of the college and the university - not to mention our continued funding. Because we're on a separate line item on the state budget, being able to provide merit packages is highly dependent on us securing that state and federal funding every year. Once those are secure, we have to work within the guidelines of the college and university as well as faculty advisory councils to ensure our process is adopted and equitable. We do this in two ways: 1. we solicit names from our leaders on who in their departments they feel should be considered for merit and, 2. we run salary analyses to determine who should be considered for merit. Once we have names, we present to other Extension leaders and make decisions.
2. The Scientific Peer Review Process	Utilizing newer technology platforms is one of the ways we will deliver on this. It's been done with disconnected forms and spreadsheets in the past, but updated platforms will allow us to drive consistency. Many of our publications go through a very thorough vetting from peer reviewers. The current software is limited and only allows for solid data entry. But in order to be able to facilitate better communication and quicker responses, we're incorporating a second platform. This will help with the after-submission processes to track reviews, approvals, printing, and publishing documents. We hope to expedite the process so that our faculty can have their work out to the public faster, especially during times of immediate need – such as pandemics where scientific information is sought out from the state.

III. Stakeholder Input

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA's attention.

Stakeholder Input Aspects	Updates
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	This plan will continue the long-standing integration between research and Extension with appropriate input from stakeholders and these are some of the actions planned: Use of media to announce public meetings and listening sessions; Targeted invitation to traditional stakeholder groups; Targeted invitation to traditional stakeholder individuals; Targeted invitation to non-traditional stakeholder individuals; Targeted invitation to selected individuals from general public Survey of traditional stakeholder groups; Survey of traditional stakeholder individuals; Survey specifically with non-traditional individuals
2. Methods to identify individuals and groups and brief explanation.	We will use the following methods to identify groups and individuals to collect input: Use Advisory Committees; Use Internal Focus Groups; Use External Focus Groups; Open Listening Sessions; Needs Assessments; Use Surveys
3. Methods for collecting stakeholder input and brief explanation.	Below are a few methods we plan to use for collecting stakeholder input: Meeting with traditional Stakeholder groups; Survey of traditional Stakeholder groups; Meeting with traditional Stakeholder individuals; Survey of traditional Stakeholder individuals; Meeting with the general public (open meeting advertised to all) *careful consideration with new social distancing; Survey of the general public; Meeting specifically with non-traditional groups; Survey specifically with non-traditional groups; Meeting specifically with non-traditional individuals; Survey specifically with non-traditional individuals; Meeting with invited selected individuals from the general public; Survey of selected individuals from the general public; Other (real-time assessment of programs and offerings)
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	Stakeholder input is used by Cooperative Extension as well as the Arizona Experiment Stations for determination of priorities and establishment of programs. Here are a few ways we plan to use and incorporate the feedback: In the Budget Process; To Identify Emerging Issues; Redirect Extension Programs; Redirect Research Programs; In the Staff Hiring Process; In the Action Plans; To Set Priorities

IV. Planned Program Table of Contents

V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

No.	Title or Activity Description	Outcome/Impact Statement	Planned Program Name/No.
1.	**Determining abiotic stress tolerance of plants in a semi-arid climate**	- Schumaker: Understanding the mechanisms by which plants modify their development in unfavorable environmental conditions will be critical for developing methods to maintain and improve crop productivity. This research contributes to future economic value and efficiency by increasing agricultural productivity to feed the growing world population. Environmental quality is addressed by allowing currently non-arable land to be used for agricultural production - Woodson: Further analysis of the genes we have identified will teach us how plants respond to stress, how these stresses are turned into signals, and how these signals ultimately affect plant health and growth. This should be fundamental knowledge that may allow us to manipulate energy capture in crops or help us in designing synthetic photosynthesis machines that can self-repair. Ultimately, we hope that such work will aid our abilities to manipulate plant growth and development, which is crucial to our quest for an abundant food supply and cheap, dependable sources of energy. - Ray: The alternative crops guayule and guar that are economically viable (e.g., use less water) for this area will help growers as concerns about water availability continue.	A sustainable, profitable and competitive food and fiber system in Arizona

		- Schuch: The results of this research inform landscape managers and policy makers about the efficacy of mandatory rainwater harvesting systems and how their correct implementation can save water. However, businesses that do not adjust their supplemental irrigation to account for water capture from rain often over-irrigate, thus wasting water. The study will summarize best management practices to optimize rainwater harvesting, use of the captured water, and tree health. - Andrade: The economic value of agricultural outputs in semi-desert areas is very high and this is a source of financial wealth that needs to be protected as it impacts a large sector of the local economy. The high value is due to the combination of high yields coming from fertile mineral soils, the abundance of heat units and ambient conditions that promote growth, and the opportunity value of production in times of high market demand. Advances in breeding of agriculture crops provide water savings and secure production under reduced water availability which foster increased sustainability of the agriculture production in semi-arid areas.	
2.	**Integrated Systems Research and Development in Automation and Sensors for Sustainability of Specialty Crops**	Although the high speed, 1-centimeter scale resolution spray has not been commercialized, we are in discussions with several start-up companies who are developing precision and robotic in-row weeding machines. Should the device become commercialized and successful, labor costs for hand weeding vegetable crops would be reduced substantially. As an example, in lettuce crops, it is estimated that hand labor costs would be reduced by $50 per acre. If used on the roughly 200,000 acres of lettuce produced in the US, growers would save an estimated $10 million annually. Although it is reasonable to assume that the device could be used with almost any vegetable crop that is traditionally hand weeded, it is premature to try and estimate potential cost savings.	A sustainable, profitable and competitive food and fiber system in Arizona

3.	**Onsite Wastewater Treatment Systems: Assessing the Impact of Climate Variability and Climate Change**	1) 105 professionals know how to inspect an onsite wastewater treatment system for the Arizona Transfer of Ownership Inspection Program. Without taking this course, these professionals would not have been eligible to participate as an inspector for the statewide program. Thus, 105 professionals either expanded their business model or were able to continue conducting business in this area. An exam is required to demonstrate knowledge. (2) 35 practitioners (both regulators and in-the-field professionals) know more about conducting soil and site evaluations for onsite wastewater treatment systems and can use the Arizona code to conduct the evaluations. Without attending this class, these practitioners would not be able to conduct these evaluations as part of their jobs. An exam, that includes both a written portion and a practicum, is required to demonstrate knowledge and the ability to texture and color a sample of soil. (3) 19 practitioners have increased knowledge for designing residential, gravity-distributed septic systems using Arizona rules. A homework assignment was used to provide practical application of material learned in the workshop. This class is not required by Arizona law, so those attending really want to learn best practices. (4) 20 practitioners (both regulators and in-the-field professionals) have increased knowledge about designing systems using pressure distribution and pumps. The course covered installation, inspection and operation and maintenance issues regarding pumps. This class is not required by Arizona law, so those attending are interested in improving their life-long skills. (5) 29 practitioners have increased knowledge on laying out a system hydraulically with special attention to absorption widths, mounding, how	Enhance natural resource conservation and management

		wastewater moves through the soil, and general hydraulic movement of wastewater in soil. (6) 58 contacts in UA Extension, Arizona County Health Departments, and ADEQ received timely educational materials from ACE Onsite Wastewater Education Program and are more aware of the services that the program can and does provide.	
4.	**W-3188 Soil, Water, and Environmental Physics Across Scales**	One major accomplishment was publishing 5 peer-reviewed journal articles and 3 book chapters on climate change impacts on tribal water resources, which were non-existent prior to this program. This includes co-authoring the first tribal chapter in the Southwest Climate Assessment and two publications in a special issue in Climatic Change focusing on tribes. As part of this assessment, listening sessions were held across the country to ask tribal communities their perspectives and experiences with climate change. This effort developed nationwide interest and momentum at the educational, state, and congressional level to discuss and address how tribes and their homes and infrastructures are being impacted by climate change. However, tribes voiced a need for researchers to understand the sensitivities of incorporating traditional knowledge in climate initiatives. As a result, I joined a national working group where we developed a guide for university, federal and state researchers working with tribes on how to protect traditional ecological knowledge in climate initiatives. Also, I learned that decision tools can be too complex for practical use, so my approach was to develop decisions tools that tribal managers could understand and manipulate using a common platform like Microsoft Excel. For example, for PLPT, we developed a water balance for Pyramid Lake where tribal managers can manipulate climate parameters to discuss future scenarios and to consider tailoring water management and plan to address climate change impacts. Through the mining impacts extension	Enhance natural resource conservation and management

		program, 4 learning modules on mining were developed for tribal colleges and two Native American graduate students received their masters through the development of these modules. As part of the development of the learning modules, the modules were piloted at tribal colleges approximately 30 times (an average of 6 pilots per year for 5 years) as well as piloting it at Native American camps ranging from elementary to college students). Within a month of the Gold King Mine Spill, I led in authoring an 11-page factsheet that answered frequently asked questions from concerned Navajo farmers. Through the research and outreach, Navajo farmers are beginning to farm again. The first Tribal Leaders Climate Adaptation Summit, and wrote a report detailing the adaptation efforts and plans by tribes across the U.S. As part of this consortium, I participated in securing $561K to UA with $58K directly funding the water management and policy extension program. As a result of this extension program, there is increased knowledge and awareness of surface and groundwater hydrology, hydrologic modeling, and climate change impacts in efforts to change or create better water management practices and policies and create climate adaptation plans.	
5.	**Parental practices supporting positive eating behaviors during independent eating occasions among early adolescent children**	Identification of food-related parenting practices associated with healthful dietary intake during independent eating occasions and healthy weight status among low-income, multiethnic early adolescents from both a parent and child perspective Identifying associations between positive parental practices and obesogenic behaviors will provide a rationale for the development of digital communications that encourage the use of those parenting practices.	Improve the health, safety, and economic security of Arizona communities

		An intervention will be developed and pilot-tested to determine the effectiveness of the digital communications to impact obesogenic energy-dense and low-nutrient dense food choices and unhealthy eating behaviors of early adolescents during independent eating occasions. Papers published in 2019: Food Parenting Practices That Influence Early Adolescents' Food Choices During Independent Eating Occasions. Gunther C, Reicks M, Banna J, Suzuki A, Topham G, Richards R, Jones B, Lora K, Anderson AK, da Silva V, Penicka C, Hopkins LC, Cluskey M, Hongu N, Monroe-Lord L, Wong SS. J Nutr Educ Behav. 2019 Sep;51(8):993-1002 Development of Parent and Adolescent Questionnaires to Assess Food Parenting Practices That Address Adolescent Consumption During Independent Eating Occasions. Reicks M, Banna J, Anderson AK, Da Silva V, Gunther C, Hongu NK, Jones B, Lora K, Monroe-Lord L, Richards R, Topham G, Wong SS. J Nutr Educ Behav. 2019 Nov 25 pii: S1499-4046(19)31095-4	
6.	**Diabetes Prevention Program**	Newly trained lifestyle coaches learned facilitation techniques that will be helpful in other Extension programs they deliver In participants, increased knowledge/understanding of: - risk factors for diabetes - risk factors for comorbidities such as cardiovascular or renal disease - importance of increasing physical activity - importance of moderate weight loss	Improve the health, safety, and economic security of Arizona communities

		Average risk reduction of 50% of developing type 2 diabetes (Hamman, et al. Diabetes Care. 2006;29(9)) in our participants, due to ~7% risk reduction per lb lost and average of 6.9 lbs lost in our participants	
7.	**4-H Healthy Living Ambassadors**	The outcomes of each programmatic area are correlated to the number listed in outputs. **1.-3. 4-H Healthy Living Ambassadors:** This year, three Pima County HLA's submitted a video to National 4-H Council. They became finalists in the national contest and won $1,000. Instead of spending the money on themselves they opted to create a 4-H Healthy Living Ambassador Training Day where they design, implemented and facilitated a full day training and opened it up to everyone. They provided lunch and incentive items through their contest winnings. Youth from 3 counties participated and new 4-H volunteers from the Hopi Reservation attended. The teens even created an intensive evaluation of the program. In addition to the aforementioned outcome, In all 3 counties this program was evaluated with the 4-H Common Measures Evaluation tool. 94% Reported learning about healthy foods in 4-H 88 % Reported that they felt like 4-H is a place where they can take on leadership roles 99% Reported that 4-H is a place where you can learn to help your community. In addition to Common Measures, in Pima Co we facilitated our "evaluation skillathon". Working with Montclaire University's PACE evaluation program and under the supervisor of an outside evaluator we created, designed and implemented an "evaluation skillathon" with our teen participants with great success. Using this style of participatory	Arizona youth focus and preparation

		evaluation youth in the Pima program spent the entirety of the last community club meeting engaged in evaluation and analysing the data. Our group of 32 was divided into 2 groups, one group did activities 1-7 while the other did activities 8-14. Once the activities were complete the youth swapped and then analyzed the results of the set of activities that they didn't do. The youth were engaged in evaluating the program and reported back that by participating in the 4-H HLA Club: 88% felt that their self-confidence increased 94% said their ability to set goals increased 94% reported that their interested in taking on leadership roles increased **4. Grand Canyon Hike:** A short questionnaire was distributed to the youth once they were finished hiking. The questionnaire took vetted questions from the Thrive model. (n=53). Participants reported hiking a combined total of 2,294 miles and hiked a total of 1,943 hours in preparation. Some youth answered the question, "How might this experience influence the things you choose to do in the future" with statements like, "I will choose to do more hikes and push myself to do harder things." and "I can do things I set my mind to".	
8.	**Underwater ROV Program**	<u>*Underwater Robotics and Engineering Design Academy*</u>*:* According to self-rating on 10-point Likert scale pre and post surveys, teachers showed an overall **learning gain of: 127%** for the topics related to *understanding Central Arizona Project operations and the use of ROVs in the water industry,* **50%** on *engineering design topics* and **60%** in *Electrical Skills*. Post-academy, teachers evaluate the workshops utility and efficacy using a standard set of questions rated on a 5-point Likert scale. In this workshop, all the questions received **100% responses** of *Strongly Agree* or *Agree* to questions like: *The information, strategies and*	Arizona youth focus and preparation

		instructional methods presented during the workshop were helpful to me and *The workshop met my expectations and had an impact on me*. Percentages of participants that agreed or strongly agreed with statements that began with: *Because of my ROV project, ... were as follows:* ***82% on*** *I want to learn more about science, technology, engineering, and math*, **78%** on *I learned how to apply science, technology, engineering and/or math to solving real world problems,* **87% on** *I learned how to communicate my engineering design to other people*, **94% on** *I increased my skills and knowledge in engineering*, and **82% on** *I am a better team member*." *Diving into Task Assignment Bias: Engaging Young Women in STEM with ROVs: Based on pre-training surveys,* **44% of attendees** *had little to no experience implementing equity-focused strategies with students.* **77%** *reported little to no knowledge of the term task-assignment bias. After the training* **100% of coaches** *reported that they felt capable of implementing the tools and strategies provided in order to foster more equitable group dynamics.*	
9.	**Federally Recognized Tribal Extension Program**	Regarding Food and Nutrition the Hopi Organic Garden Class (10 classes) is now a program that can be offered to the community on a regular basis. This offers new knowledge, skills and results in a new backyard garden for every family (multigenerational) who takes the class. FRTEP continues to improve the curriculum with each class. The donation by the Hopi Tobacco Program of a greenhouse is based on an attitude that FRTEP can be viewed as a facilitator to assist programs who can no longer offer a service. We helped to re-establish this asset in another program so that our community can still benefit. Our partnership with the Hopi Tutskwa	Prepare Arizonans for solutions of the future

		Permaculture and the Hopi Food Co-op supported access to local foods by successfully administering 8 markets (2018 Hopi Farmers Market Season) reaching 1000+ community members with fresh local foods, education on local food access, growing, health and wellness. Regarding Agricultural and Natural Resources, a partnership with the Hopi Tribe's Office of Range Management and Hopi Veterinary Services has resulted in 2 Equine workshops attended by over 60 people, who gained new knolwege and skills resulting in better horse care and handling. FRTEP facilitated and documented a new NRCS EQUIP application for Hopi ranchers, funded and totaling $3 million. It was important to document this application process, which hasn't been done before, to make the re-application process (in about 4 years) easier and more efficient. Regarding Youth Development a new partnership with the Pima Country 4H Healthy Ambassaors Club and Tewa Village was established with support youth development at Tewa Village. This is a model for other villages within the Hopi community that FRTEP will facilitate. FRTEP-Hopi is new to the 4H so it is taking the time to build connections and trust with youth organizers to educate on a 4H process for future development.	
10.	**Prevalence and strain characterization of Xylella fastidiosa causing grapevine and pecan diseases in Arizona**	This project has greatly advanced the science and technology in a wide range of disciplines from Xylella diagnostics to vector biology and applied microbial ecology. These advancements support the hypothesis that leaf scorch can be mitigated by early detection of Xylella. They already have enabled early adopters to implement best disease management practices for improved profitability and sustainability while reducing their environmental footprint. These advancements are highlighted by two major discoveries. First, Improved Xylella diagnostics greatly increased sensitivity and reduced the probability of false negative and false positive	Prepare Arizonans for solutions of the future

		results. In pecan growing areas where valuable resources (i.e., water, fertilizer, and labor) have been used to raise a young seedling transplant for 3 – 4 years, and sometimes even in trees of 12 years of age and older, the tree decline due to Xylella infection makes a waste of these high cost resources. The value of loss in new transplants are upwards to $2,000 per tree. It was reported that thousands of immature trees were infected with Xylella. This is an estimated several million dollars combined loss. Early detection would save AZ growers hundreds of thousands of dollars. Second, low vector populations were detected in Az pecan orchards. Monitoring vector populations could easily reduce 5 to 20% of the pesticide usage that otherwise would have been lost. Arizona pecan and grape industries are estimated to apply pesticides annually at a direct and indirect cost of millions of dollars. This improved practice alone could save hundreds of thousands of dollars per year in Arizona.	