

2018 University of Arizona Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Consistent with higher education and community outreach all across the country, we continue to do more with less. Despite limited appropriated financial support, we continue to make a difference, and are working to better balance our program areas with support.

- Arizona Cooperative Extension engages with people through applied research and education to improve lives, families, communities, the environment, and economies in Arizona and beyond. With offices in all 15 counties and on five tribal reservations, we bring knowledge to people every day to enhance their work and enrich their lives.
- The Arizona Agricultural Experiment Station stimulates learning through exploration and discovery to enhance agriculture, the environment, our natural resource base, family and youth well-being and the development of local communities. We accomplish this mission by the integration, dissemination, and application of knowledge in the agricultural and life sciences. Research is conducted in the various departments and schools on campus, as well as at Agricultural Centers throughout the state. Research generated through the Experiment Station underlies and supports the academic and extension programs.

Arizona's Cooperative Extension System has eight programmatic areas:

1. 4-H Youth Development
2. Agriculture & Food Safety
3. Children & Families
4. Gardening
5. Health
6. Natural Resources
7. Nutrition & Physical Activity
8. Water

The College of Agriculture and Life Sciences (CALS) Research has six programmatic areas:

1. Environment, Water, Land, Energy and Natural Resources
2. Plant Systems
3. Human Nutrition, Health and Food Safety
4. Family, Youth and Community
5. Animal Systems
6. Marketing, Trade and Economics

Environment, Water, Land, Energy and Natural Resources **Environment and Sustainability**

- Reached nearly 1,000 Arizona community members with the curriculum and presentations on climate and the impacts on the environment, society, and economy.
- 90% of surveyed individuals responded positively that they've received adequate information about climate change and how it's shaping their perception.
- Comments concerning key issues such as the greenhouse effect and climate science communication demonstrated genuine learning and a desire to take action.

Volunteer Rainfall Monitoring to Support Drought Planning and Monitoring

- By the end of 2018, Rainlog.org had over 3200 volunteers reporting either daily or monthly precipitation totals as well as other environmental information (eg. drought impacts, extreme meteorological events).
- The site has been featured in numerous newspaper articles and several TV and radio news stories across Arizona.
- Observations have been used in monthly drought monitoring discussions by the Governor's Drought Task Force monitoring subcommittee.
- Rainlog is used extensively across rural Arizona by ranchers, farmers and resource managers to share and track localized rainfall patterns for drought monitoring.

Plant Systems

Plant Disease Diagnostic Program

- We have analyzed over 106 plant samples submitted by ADA for confirmation of microbial pathogens for phytosanitary clearance.
- This project requests testing of over 70 phytopathogenic fungi and bacteria, which enable my lab to establish many reliable molecular detection protocols that allow us to detect low levels of these target organisms.
- We implemented both PCR procedure and ELISA assays for survey of FOV race 4 pathogen that is responsible for Fusarium wilt of cotton. We have received and processed more than 200 cotton samples by the end of August 2018. These samples were collected from several cotton fields per township across the state.
- During the last 27 months, I have made 40 visits to production fields (2017: 21; 2018: 19) and several visits to home residences to aid in solving plant health problems.

Viticulture

- All participants of the symposium indicated they felt the information presented was helpful and they learned something new from the program.
- Many program participants indicated they will use some common field diagnostics learned through the symposium to apply in their planning.
- Growers have reduced yield losses and improve their overall profitability and sustainability of their grape production by implementing what they learn through the symposium.
- Many participants indicated they plan to attend the symposium again and will recommend it to their colleagues.

Human Nutrition, Health & Food Safety

Diabetes Prevention Program

- There are currently 81 program participants from half the counties in Arizona taking steps to reduce their risk for Type 2 Diabetes.
- Program participants have lost an estimated total of 233 pounds and about 3.6% of the weight they carried.
- The program focuses on moderate weight loss and program participants are developing sustainable habits to continue weight loss and reduce their risk of Type 2 Diabetes.

Food Safety

- 332 people completed the CPFPM class and exam (194 in Prescott and 134 in Cottonwood).
- CPFPM participants had a 36% average increase in knowledge about food safety practices.
- 241 eligible licensed food establishments in Yavapai County received the Golden Plate Award in 2018, indicating they had no critical violations during inspections. This is an increase from 215 in 2017.
- Participants participating in one or more of a series of 90-minute community workshops indicated increased knowledge on topics related to home kitchen safety, culinary skills and safe home canning

principles.

Family, Youth & Community

2018 Water Scene Investigations Program

- The WSI program (since its inception in all communities) has collectively saved a projected 48,752,187 gallons of water through student actions.
- In 2018, the WSI program engaged 840 6th grade students in 31 classes in the home water audits producing a total projected annual water savings of 1,539,437 gallons of water per year due to water efficient aerator installations.
- The WSI website enables participants to input their data from home water audits and calculate a water savings online. The site also graphs their data so that they can share and compare with other participants.
- A total of 840 WSI students entered data and compared their savings with their peers. Behavioral sciences research suggests seeing what your peers are doing is one strong predictor of behavior change.

ASPIRE: Self Determination Training

- UACE ASPIRE Training reached 119 disabled youth participants and 72 adults with the ASPIRE Curriculum developed by UA Cooperative Extension. The curriculum consists of 8 standalone lessons on self-awareness, goal setting, communication skills, public speaking, advocacy, decision making, maturity & relationship building, and financial literacy.
- We have developed a 6-hour 6 module train the trainer curriculum (Presentation, speaker notes and lesson plan).
- The ASPIRE educator hosted 107 pieces of training consisting of 214 hours of face-to-face education.
- Four regional conferences were held throughout summer 2018 for 200 program participants.
- Fliers were distributed to 1002 enrollees in the program, e-mails and phone calls were made to confirm enrollment into the training.

Animal Systems

Rangeland Management and Livestock Production

- We collaborated with Utah State University Extension (USUE) through a signed MOU to provide AZ Strip coverage and three annual workshops relating to rangeland, livestock, and weeds.
- VGS, a rangeland monitoring software program, was incorporated and is an integral piece of the ACRMP and testing.
- Monthly or bi-monthly (during growing seasons) drought impact surveys developed and administered through Qualtrics are sent to producers to capture current local drought conditions. Data summaries and analysis are conducted and recommendations are communicated to the authors of the US Drought Monitor.
- At least 10 workshops/meetings/townhalls were conducted throughout Arizona in 2018 with medium-to large-scale audiences ranging from 30 to 400 at each event.

The Informed Arizona Equestrian

- Increased collaborations on our efforts to include Reata Equine Veterinary Group, Adobe Veterinary Center, Arizona Cattle Grower's Association, AZ Farm Bureau, Vetera Vaccines, Henry Schein Animal Health, Purina Animal Nutrition, and Patterson Equine.
- Communications and other awareness campaigns have been launched to increase the consumption of information about the program and the Southern Arizona Equine Health Care Symposium (SoAZ EHCS).
- More work is being created to help in delivering additional topics to communities interested in equine health, which include additional peer-reviewed publications.
- Two social media sites (Facebook) have been launched and their impacts are engaging approximately 20,000 Facebook users each week.

Marketing, Trade & Economics

Management and Contribution of Arizona Rangelands

- Over \$250,000 in funding was secured in 2018 from outside contracts, grants and endowments to deliver the programming across the state.
- Extension outputs during 2018 consisted of five (5) workshops/field days attended by over 100 participants representing nearly 30,000 range cattle.
- The publication, "Guide for Co-Developing Drought Preparation Plans for Livestock Grazing on Southwest National Forests," was published in 2018 and the team received an outstanding achievement award from the Gila County Cattle Growers.
- The Livestock Loss Board approved the distribution of \$100,000 to ranchers for wolf depredation losses. Current funding procedures for mitigation of wolf-livestock conflicts were developed and approved in 2018. Extension is leading the efforts demonstrating various conflict avoidance methods.

Turfgrass Management

- Of approximately 40 participants in the pesticide applicator licensing exam, 90% passed the exam earning 6 continuing education units (CEUs).
- Student interns in 2014 - 2018 from the USDA-NIFA program have generated relevant and impactful information for turfgrass clientele. Poster displays have been presented at professional society meetings and data have been useful to determine utility of weed control practices. Students gained new knowledge and experiences about turfgrass science and Cooperative Extension.
- In 2018, we spent considerable time disseminating the golf economic impact report that described and touted the contributions of the golf industry to build awareness by state and federal legislators, government agencies, and public. The document is being used in support of golf courses for the 2019 Drought Contingency Plan development.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	250.0	0.0	400.0	0.0
Actual	250.0	0.0	400.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel
- Combined External and Internal University Panel

2. Brief Explanation

All new proposed Hatch projects are reviewed by an ad hoc review panel of 3 qualified faculty with no conflicts of interest. All renewal projects are reviewed by a panel of 2 similarly-qualified faculty. The Associate Dean oversees this process and ensures that any suggested changes are made to the satisfaction of the reviewers and the Associate Dean. External review of programs and projects is obtained from County Extension Advisory Boards who meet on a regular basis. Programs, whether continuing or new, are circulated around Extension and Research leadership to ensure they fulfill the mission of Arizona Cooperative Extension and are set up to deliver on our overall goals and

objectives. We also ensure that all stakeholders are considered when implementing the programs. Faculty and their programs are reviewed anonymously by peers initially, then by their supervisors with input from those peer reviews. For review period 2018, faculty adopted new criteria for the peer review portion and removes numeric scores. This enables more constructive and subjective feedback which turns to action.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- 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

Brief explanation.

A major rewrite of the College's Strategic Plan that covers the research, extension, and academic programs of the College was completed in 2013. This effort involved review and comment by all faculty and staff, all advisory boards, major commodity organizations and selected stakeholders across the state. The major input was obtained from our advisory boards and meetings with major commodity organizations and with Extension knowledge.

In addition, Extension conducted its own stakeholder survey to audiences that may not know what Cooperative Extension is, or have only some small idea. The survey instrument was finalized and we continue to implement some of the suggestions while maintaining community engagement to review progress and opportunities.

Again this year, an internal Climate Survey was conducted to gauge the climate of Extension personnel and whether they feel we're hitting our marks as we deliver for our communities. This is the third year that we've incorporated this mechanism. The survey was so successful, the college adopted the practice and is in the process of generating a larger-scale version to capture the entire division. This includes contracting an external vendor to conduct the survey. However, we continue to use the feedback and results to drive programming, operational procedures, and other initiatives for Extension and college personnel.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

Over 100 county advisory board members provide input and priorities to county programs on an annual basis. Input for the research program is provided by advisory boards for our outlying Agriculture Centers. These groups, plus numerous meetings with commodity organizations, provide input annually for both Extension and Research programs.

We've also beefed up efforts to collect contact information from program participants and reach out to them to gauge their interest(s) in being involved at a more connected level with Extension to help shape future programming.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods 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)
- 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)

Brief explanation.

This is normally done by faculty meeting with the stakeholder groups throughout the year and providing them with written materials for their review and input. This may be expanded to a web-based survey available to all interested.

We also utilize past data and experiences to drive participation and create communication and outreach mechanisms/strategies to position Extension as a partner of the Arizona community and drive interest to our programs and offerings.

We've also incorporated an online mechanism to capture data from a clientele that had gone underrepresented for several years in our new Client Relationship Management (CRM) tool. This will enable Extension faculty to document the outreach they do online as well as in-person - in the past, online clientele had not been accurately represented.

3. A statement of how the input will be considered

- 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

Brief explanation.

Input is collected, categorized, filtered, and then disseminated to the appropriate team members to begin incorporating into strategic planning - from program to administrative activities. We see feedback as a gift and welcome all opportunities to obtain the information so we know what we're doing well and where our opportunities are.

Brief Explanation of what you learned from your Stakeholders

All input is considered in all our planning and reporting. We're learning that not everyone wants the same type of information we've provided in the past. And if they do, they don't want it in the same fashion. We're reaching out to younger audiences and the information they're looking for is not the same as what we've provided to earlier generations. So, by soliciting their input, we can fully understand what information is valuable to them and what will initiate further action to be involved. In addition, we're maintaining our relationships with traditional audiences and listening to their pain points in being involved with Extension. We're looking at making things easier for them to be involved. One of the biggest pain points is our Volunteer process. We HAVE to follow all rules set forth by the University, but sometimes, those processes can be lengthy and not easily navigable. So, we're working within the system to deliver training. We have on-boarded a Volunteer Coordinator to help with navigating all processes while maintaining compliance.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	2019509	0	2557649	0
Actual Matching	2019509	0	2457649	0
Actual All Other	0	0	0	0
Total Actual Expended	4039018	0	5015298	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	ENVIRONMENT, WATER, LAND AND NATURAL RESOURCES
2	PLANT SYSTEMS
3	HUMAN NUTRITION, HEALTH & FOOD SAFETY
4	FAMILY, YOUTH, AND COMMUNITY
5	ANIMAL SYSTEMS
6	MARKETING, TRADE, AND ECONOMICS

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

ENVIRONMENT, WATER, LAND AND NATURAL RESOURCES

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	35%		44%	
111	Conservation and Efficient Use of Water	30%		25%	
112	Watershed Protection and Management	15%		10%	
121	Management of Range Resources	20%		21%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	20.0	0.0
Actual Paid	9.7	0.0	802.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
871014	0	826638	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
871014	0	826638	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Environment and Sustainability

Issue

Indeed, the quality of the elements air, water, earth (and plants) and fire (ie, energy), directly affects our society and economy. Climate change impacts (such as intensified drought, wildfires and flooding), due to anthropogenic global warming, have been identified as significant threats to society by the University of Arizona and International Panels on Climate Change. Cooperative Extension has an important role to play in developing integrated education programs to help clients and society to adapt to a changing climate and mitigate its long-term effects.

What has been done

Our efforts resulted in being awarded a \$249,969 multi-state NIFA grant to explore a pilot Climate Masters program in conjunction with NMSU. We conducted a pilot Climate Extension Masters course in both Globe and Payson and partnered with UA's Water Resources Research Center (WRRC) to secure grant funding to continue with programming. We presented on firewise landscaping at Arizona Fire Adapted Communities Network (AZFAC)-sponsored events in Yarnell (the site of an Arizona forest fire which tragically took the lives of 19 Arizona firefighters). We enhanced our outreach and communication efforts to present and deliver community information at various workshops and conferences - collaborating with several groups and organizations. We also launched Project Harvest, a University of Arizona research project that incorporates citizen scientists to study the quality of collected rainwater in the area, its effects on the soils that are irrigated with harvested water and the effects that might be transferred to the plants being irrigated as well.

Volunteer Rainfall Monitoring to Support Drought Planning and Monitoring

Issue

Water scarcity is one of the hottest topics in Arizona these days. As we face the potential for continued drought status and water shortages, we find ourselves looking for ways to ensure we're tracking our supply and reserves accurately. One way to do this is to track rainfall and use that data in water planning for ranching, farming, education, and overall communication to help drive policy; but finding the mechanisms to track are just as scarce.

What has been done

We established an online interface and database system to collect, display, and archive volunteer rainfall observations. This included developing a training program to ensure data quality and to provide background science on rainfall measurement/observation and precipitation processes as well as designing a "train-the-trainer" program which allows current volunteers to recruit new volunteers and assist with site instrument installations. The program received funding from the TRIF Water Sustainability Program and the Bureau of Reclamation and received additional funding from Salt River Project and private donations in 2018. The data collected by the volunteers is used by decision makers to make more highly resolved assessments of precipitation patterns across Arizona in support of water resources and drought management. Additional planned features include a web data API developed in 2018. This is paving the way for the development of an iPhone app and is allowing access of the historical dataset for applied research purposes.

2. Brief description of the target audience

Natural resource managers, Governor's Office and state agencies, municipal organizations and leaders, households, consumers, youth, master gardening and master watershed programs.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	47377	72139	13455	26136

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	16	50	66

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2018	59627

Output #2

Output Measure

- Number of individuals adopting new technology

Year	Actual
2018	1550

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Effectiveness of research programs will be based on publications, external grant support, and integration into existing extension programs
2	Number of individuals gaining knowledge by participating in educational programs
3	Volunteers completing Master Gardening training
4	Create awareness and increase knowledge

Outcome #1

1. Outcome Measures

Effectiveness of research programs will be based on publications, external grant support, and integration into existing extension programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

Outcome #2

1. Outcome Measures

Number of individuals gaining knowledge by participating in educational programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

Outcome #3

1. Outcome Measures

Volunteers completing Master Gardening training

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Master Gardener program is an important component of our Cooperative Extension program.

What has been done

1,400 volunteers donated their time to teaching others.

Results

Master Gardener volunteers donated over 100,000 hours in 2018.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

Outcome #4

1. Outcome Measures

Create awareness and increase knowledge

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

All recipients of our programs care about increasing their knowledge.

What has been done

1,400 Master Gardener volunteers shared information directly with 23,596 program participants.

Results

The majority of the recipients consistently indicate a change in knowledge resulting from our programs and materials.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Programs and personnel changes occur frequently and program impacts and contacts will increase/decrease frequently.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We've taken steps to conduct user experience evaluations. This gives individuals the opportunity to provide rich feedback about what they enjoy about the program(s) and what they feel we can do better at how we deliver on our mission. Much of the results are qualitative and commentary. However, we're optimistic about what we're hearing and how people continue to be excited about what we're offering.

Key Items of Evaluation

We are exploring ways to engaged and attract even more users to our Master Gardener programs which include new online methods. This is based on what we're hearing from new Master Gardeners, but we're not abandoning our tried and true methods our current Master Gardeners appreciate.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

PLANT SYSTEMS

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		30%	
205	Plant Management Systems	25%		15%	
206	Basic Plant Biology	25%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		20%	
212	Pathogens and Nematodes Affecting Plants	20%		15%	
215	Biological Control of Pests Affecting Plants	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	12.0	0.0	42.0	0.0
Actual Paid	4.0	0.0	7.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
289194	0	666163	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
289194	0	666163	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Plant Disease Diagnostic Program

Issue

Plant diseases are a perpetual threat to the health and productivity of agricultural crops, urban or natural forests, rangelands, and natural plant ecosystems. This threat is increasing due to a rise in emerging and re-emerging plant pathogens. For example, citrus HLB, or greening, is an emerging disease that is devastating citrus production in Florida and other parts of the world, and if it arrives in Arizona, such as on contaminated nursery stocks or seeds, it has the potential to devastate Arizona citrus production. The extensive global trade of agricultural products is fueling opportunities for short-, medium-, and long-distance movement of plant pathogens as well as insects that transmit pathogens. In addition, new plant pathogens are emerging when organisms adapt to new plant hosts or cultivars, and old pathogens are re-emerging following the development of chemical resistance or changes in agricultural management practices, plant varieties and climatic conditions.

What has been done

I now serve as the only disease diagnostician and I have dedicated a significant amount of my time in doing disease diagnosis and pathogen detection. In the process, I've provided the basic diagnostic skill training to Lab Technicians and Research Scientists in my lab. Currently, the program is supported through several sources of funds, including my startup funds, an annual budget of \$2,000 to \$6000 from Western Plant Diagnostic Network (WPDN) due to my role as the Co-coordinator for the AZPDN, an annual budget of \$3,000 from institutional grant EIP from APMC. In 2017, I also secured a project contract (\$34,436) with the Plant Pathology Team at the Arizona Department of Agriculture (ADA). The objective of this project is to safeguard the export of Arizona agriculture by enabling early detection of suspected exotic microbial pathogens at state, internal and international borders. This program is also subsidized by research dollars I secured from various funding sources because the support staff are involved in several research projects in my lab.

Viticulture

Issue

Viticulture, or the cultivation of grapevines, is a new industry still in its infancy in Arizona. In 2014 an Arizona Vineyard Survey conducted by the United States Department of Agriculture and National Agricultural Statistics Service, and sponsored by the Arizona Wine Growers Association, showed there are approximately 2,500 acres of grape vineyards in production in the state of Arizona. Forty-one growers indicated they were planning to plant additional acreage in the next 1 - 3 years which would increase total acreage by 350 acres. While still a young industry, wine grape production is increasing and contributed \$2.2 million in revenue for Arizona's economy in 2013. Due to the growing popularity and potential impacts to Arizona's economy, there is much interest in viticulture research in the areas of rootstock

performance and suitability, mineral nutrition, disease control, weather events and bird/animal control. Pruning methods of grapevine and water delivery management were of added interest as well.

What has been done

I finalized an educational program and venue, confirming seven University of Arizona specialists and one New Mexico State University Viticulture Specialist, to present in various topics in viticulture. A statewide Arizona Viticulture Symposium was held on 23 March 2018 with 40 participants at the Cochise College in Benson, Az. The program included a program folder and presentation topics on Pesticide Safety, Soil Chemistry, Viticulture Climates in AZ, Field Diagnostics of Common Disease, Viruses, Calendar of Events, Rootstocks and Cultivars for Arizona, Mineral Nutrition, Ag Chemical Company Updates, and Risk Management Strategies. The program was implemented through the resources of Southeast Arizona Agriculture Solutions, Arizona grape grower groups (i.e., Arizona Vignerons Alliance, Willcox Wine Country) and the Arizona Wine Growers Association. Other funding sources are contributed by chemical/fertilizer companies and agricultural product suppliers.

2. Brief description of the target audience

Commodity groups, state agencies, pest management advisors, pesticide applicators, youth, ag-ventures programs.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6400	19000	4000	12400

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	12	80	92

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2018	10500

Output #2

Output Measure

- Number of research projects conducted on all aspects of Plant Sciences, and Agriculture and Resource Economics

Year	Actual
2018	200

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of better management practices for crop production
2	Adoption of alternative crop technologies
3	Adoption of more cost effective means for controlling plant diseases along with insect issues

Outcome #1

1. Outcome Measures

Adoption of better management practices for crop production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #2

1. Outcome Measures

Adoption of alternative crop technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #3

1. Outcome Measures

Adoption of more cost effective means for controlling plant diseases along with insect issues

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

With more and more community members seeking ways to create their own gardens, we've experienced an increase in contacts for information and resources with Plant Sciences. This has led to more robust outreach and engagement with the community. Using this feedback as well as data analytics from our web site(s), we're able to capture the topics that stakeholders are seeking and can adapt our planning as such.

Key Items of Evaluation

In addition to our Plant Diagnostics center, we're looking at other online methods to support community members with the plant questions. In the past, much of the support would be a "one-and-done" exchange. Now, we'll be able to collect the responses from our experts and recycle the information to use for other online visitors.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

HUMAN NUTRITION, HEALTH & FOOD SAFETY

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	10%		40%	
703	Nutrition Education and Behavior	75%		20%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	15%		40%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	10.0	0.0
Actual Paid	3.0	0.0	2.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
201749	0	160679	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
201749	0	160679	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Diabetes Prevention Program

Issue

Chronic health conditions are a nationwide issue that effect every community across the nation. Being overweight or obese are tied to many chronic conditions including diabetes, heart disease and cancer. According to the CDC 36.5% of adults and 17% of youth nationwide are obese (CDC website Overweight and Obesity page: <https://www.cdc.gov/obesity/index.html>). Nationwide physical inactivity and poor nutrition are problematic. In Arizona, 28.9% of adults are obese (<http://stateofobesity.org/states/az/>) and it is estimated that 700,000 have type-2 diabetes (T2D). Before getting T2D, many people go through prediabetes - which is a reversible condition that, left untreated, may become T2D. Prediabetes affects approximately 1.8 million Arizonans.

What has been done

In 2018, the University of Arizona Cooperative Extension begun offering the Centers for Disease Control (CDC) National Diabetes Prevention Program (NDPP) aimed at preventing type 2 diabetes in people at risk for the disease. The CDC oversees the program and provides an evidence-based curriculum free of charge, in English and in Spanish, on their website. The DPP is a year-long program that emphasizes lifestyle changes and moderate weight loss.

Food Safety

Issue

Each year, 1 in 6 people in the US get sick from eating contaminated food. Foodborne illness causes about 48 million illnesses each year in the US. Most outbreaks are reported from a single location of food preparation, specifically, restaurants with sit-down dining. All food establishments in Yavapai County are mandated to have a Certified Professional Food Manager (CPFM) on site during all hours of operation. Food safety programming needs are identified using an annual report of the most common violations in Yavapai County as identified by Environmental Health Inspections by Yavapai County Community Health Services, evaluation results from CPFM classes, and by the Yavapai County Food Safety Industry Council (FSIC) membership.

What has been done

Yavapai County personnel developed and delivered other curriculum to certify several food-serving establishments using English and Spanish versions of the National Environmental Health Association CPFM Handbook, Prometric, Inc. exam, USDA Complete Guide to Home Canning, Fight BAC! Program Curricula for elementary school grades, and the CPFM Training PowerPoint. A thorough review of guidelines for food establishments in the Yavapai County food recovery program was conducted. Several community outreach efforts were initiated to help stakeholders recognized and correct potential violations of food-safety standards.

2. Brief description of the target audience

General public, educators, health professionals, extension educators.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	217500	414000	136500	258700

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	5	25	30

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Effectiveness of the research program will be based on publications, external grant support, and integration into existing extension programs

Year	Actual
2018	0

Output #2

Output Measure

- School districts, youth, and adults will address obesity issues

Year	Actual
2018	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Create awareness and increase knowledge
2	Number of individuals adopting recommendations for nutrition and health
3	Reduce childhood obesity

Outcome #1

1. Outcome Measures

Create awareness and increase knowledge

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	354000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of individuals adopting recommendations for nutrition and health

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	342000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Reduce childhood obesity

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

There is a strong sentiment that constant and social media are having a factor in people wanting to learn more about human health and nutrition. The health industry is a billion-dollar industry and people are tired of throwing money at it. Instead, they're looking to resources like Extension to fill that gap of scientific-backed information.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We are learning that more and more individuals are using the power of technology to be at the forefront of the health and nutrition revolution. Wearable technology and smart phones are making information and data on health and nutrition easily accessible. The issue is how much is too much data and information and who is showing people what to do with that information.

Key Items of Evaluation

There continues to be increases in how we recognized food-borne illnesses and how we address opportunities. We are finding better ways to stay in front of the issues while still providing community members the information they need to make better choices.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

FAMILY, YOUTH, AND COMMUNITY

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
802	Human Development and Family Well-Being	20%		80%	
806	Youth Development	80%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	22.0	0.0	5.0	0.0
Actual Paid	6.0	0.0	2.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
380475	0	101201	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
380475	0	101201	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

ASPIRE: Self Determination Training

Issue

According to the Arizona Department of Economic Security, there are 35,000 individuals enrolled in the Developmental Disabilities program statewide. Youth with differing abilities in Arizona include epilepsy, cerebral palsy, cognitive/intellectual disability, autism, and health issues. With disabled youth being more at-risk for the economic and educational disparity, a self-determination program was needed to improve educational and employment outcomes of child Supplemental Security Income (SSI) recipients and their families.

What has been done

We launched the ASPIRE program in Arizona, a statewide program to acquire new work and family life skills and become the vehicle through which to maximize youth development through self-determination.

Disabled youth who experience positive youth development become adults who contribute to the family, work, home and community. ASPIRE is a six-state consortium that is made up of Arizona, Colorado, Montana, North Dakota, South Dakota, and Utah. Under the federal PROMISE initiative, ASPIRE: Self Determination Training is part of the national group conducting a 5-year case study with youth between the ages of 14 and 16 who receive SSI. The mission of this program is to provide services to this youth and their families to study what interventions will be most beneficial for future youth with disabilities.

2018 Water Scene Investigations (WSI) Program

Issue

As the conversation around water in Arizona continues, so does the necessary training of our youth to understand all the components of the conversation, including collection and conservation. There is a huge need to help teachers and other educators in Arizona to deliver research-based curriculum on ways to collect, audit, and investigate water use in Arizona.

What has been done

The Water Scene Investigations (WSI) program was adapted from the School Water Audit Program for a shorter water audit learning experience. APW recognized two community needs for this program: 1) the WSI assists teachers in developing critical thinking skills and water companies in ensuring that water efficient hardware is installed, and 2) STEM programs that generate exciting results, but don't require large amounts time are needed by teachers. The program has grown in funding as more and more organizations are seeing the value of the training and behaviors. Additional program resources include volunteers, technology, curriculum, and hands-on training.

2. Brief description of the target audience

Parents, educators, youth, community groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1050	259000	117000	52000

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	11	50	61

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2018	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of essential life skills by Arizona's youth that leads to a responsible, productive, and healthy life-style
2	Adoption of life building skills including self-discipline, responsibility and leadership

Outcome #1

1. Outcome Measures

Adoption of essential life skills by Arizona's youth that leads to a responsible, productive, and healthy life-style

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #2

1. Outcome Measures

Adoption of life building skills including self-discipline, responsibility and leadership

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We have learned that we can no longer attempt to reach our audiences through solely traditional methods. For example, within 4-H, using a 4-H listserv or newsletter is not the most efficient way to attract and engage children of the Gen Y or iGen categories. They prefer to have their information reach them in the palm of their hand. So, based on our evaluations, we need to become creative with our outreach and reach children where they want to be contacted while still maintaining traditional methods.

Key Items of Evaluation

We have finally added a new 4-H Associate Director to help in guiding 4-H programming and service delivery throughout the state. The new position will be key in driving a comprehensive strategy and building the right team to address the needs of youth in Arizona.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

ANIMAL SYSTEMS

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	30%		15%	
302	Nutrient Utilization in Animals	20%		15%	
305	Animal Physiological Processes	15%		20%	
306	Environmental Stress in Animals	15%		30%	
311	Animal Diseases	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	15.0	0.0
Actual Paid	1.0	0.0	4.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
57556	0	455461	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
57556	0	455461	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Rangeland Management and Livestock Production

Issue

Rangelands occupy approximately 75% of the United States' land surface (globalrangelands.org) and are extremely important to society for the goods and services they produce and ecological services they provide (Society for Range Management). Rangelands provide the principal source of forage for the livestock operations on thousands of American farms and ranches. As human populations increase and demand for food and energy expands, the need for forage and the other range resources will increase (USDA). There is a need to balance livestock grazing with natural resources, particularly as livestock producers have been reducing and managing herds as a consequence of drought conditions for the past two decades.

What has been done

A stakeholder Needs Assessment survey was distributed to producers in Mohave and Coconino County. Results indicate a critical educational need for: range cow nutrition, emergency veterinary skills for ranchers, estate planning, plant identification, livestock reproduction, range plant nutrition and toxic plants. Thus, the Arizona Cooperative Rangeland Monitoring Program (ACRMP) was developed in conjunction with BLM. Educational workshops/presentations were conducted covering natural resources, rangeland management, and livestock production topics. Several of the workshop topics and presentations were developed as team efforts. One-on-one education is provided through ACRMP. Surveys and the Arizona Range and Livestock News newsletters are sent out quarterly, monthly, or bi-monthly.

The Informed Arizona Equestrian

Issue

According to the 2012 US Census of agriculture, Sales of equines (horses and ponies) and equids (donkeys, mules, and burros) in Arizona was valued at \$31.8 million (10th highest in the nation). There are approximately 92,384 total equines in the state, up 35% from 68,745 in 2007 (US Census of Ag 2012). Arizona Cooperative Extension equine programming has been fairly inactive (with the exception of county 4-H activities) for the last several years, making it necessary to develop relationships with professionals and clientele as well as identify stakeholder needs and methods for delivery.

What has been done

A statewide livestock and equine survey was developed and distributed in cooperation with A. Wright, D. Faulkner, and D. Diaz. This needs assessment provided a foundation for equine-related extension programmatic planning for the next several years. Programs will be designed to address "popular" topics and still incorporate "unpopular" but important subjects which support good business practices, land and animal stewardship, and horse health, safety, and welfare. Identification and planning will continue to develop through discussions with agents and stakeholders as well as more formal program evaluations from extension events.

2. Brief description of the target audience

Commodity groups, state agencies, pest management advisors, pesticide applicators, youth, ag-ventures programs.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	3100	100	1650

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	3	50	53

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs
 Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of research projects conducted on all aspects of Animal Sciences, and Agriculture and Resource Economics
 Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of better management practices for animal production
2	Adoption of alternative animal technologies
3	Adoption of more cost effective means for controlling animal diseases along with noxious plant issues

Outcome #1

1. Outcome Measures

Adoption of better management practices for animal production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals

Outcome #2

1. Outcome Measures

Adoption of alternative animal technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals
311	Animal Diseases

Outcome #3

1. Outcome Measures

Adoption of more cost effective means for controlling animal diseases along with noxious plant issues

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals
311	Animal Diseases

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Through evaluations, we're seeing that not only are our efforts making an impact on the animal systems, but our actions within the human behaviors and how they impact animal systems can be implemented. With adequate training and communications, we have the ability to make a positive difference on how our animal systems are set up for success. We're seeing a bigger need for more of this training in large groups, which adds

tremendous value to the systems.

Key Items of Evaluation

More and more of our newer faculty are incorporating technology to drive better decisions and focus on the needs of Animal Sciences within Arizona. Doing so provides richer data and allows us to be proactive about issues that may be on the horizon.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

MARKETING, TRADE, AND ECONOMICS

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
603	Market Economics	40%		40%	
605	Natural Resource and Environmental Economics	40%		40%	
608	Community Resource Planning and Development	10%		0%	
610	Domestic Policy Analysis	10%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	6.0	0.0
Actual Paid	2.0	0.0	3.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
219521	0	347507	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
219521	0	247507	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Management and Contribution of Arizona Rangelands Issue

Range livestock production and ranching is a primary land use in Arizona, providing more than \$800,000 in revenue annually, and is a basic sector of the economy in rural counties. Only about 13% of Arizona is private land while the remainder of the state is comprised of state and federal lands. Because so many ranches depend on state or federal grazing allotments, the future of ranching in Arizona is tied to agency regulations, so knowledge of and compliance with these regulations is critical. This requires a working knowledge of ecological and policy aspects of livestock grazing as well as some abilities related to collaborative processes.

What has been done

The Extension educational program, Management and Contribution of Arizona Rangelands, requires developing and facilitating complex networks of participants, identifying fundamental issues, and providing research and educational elements that empower identified communities to solve specific resource management problems. My approach has been to focus efforts on capacity building among local ranchers, agency personnel and other community leaders to identify and address issues related to livestock production, environmental regulations and economic development.

Turfgrass Management Issue

Issue

There are over 300 golf courses in Arizona that are central to a \$3.9 billion industry in Arizona. Around Phoenix, there are 11 professional baseball complexes that host year-around baseball including the spring Cactus League that reported an economic impact of \$373 million to the state's economy in 2018. The Arizona Diamondbacks and Arizona Cardinals annually attract 2.1 million and 487,000 fans to their games, respectively. Sports and recreational fields are components of 20 community colleges and in 150 public school districts in Arizona. Residential, commercial, and municipal landscapes have turfgrass for aesthetic and recreational purposes that also require and demand technology transfer to optimize water and resource inputs and integrated pest management strategies to ensure safety to human health and the environment. The most important turf management issues and concerns are: irrigation management, soils and fertility, and turf pest management.

What has been done

Dynamic programming is continuously adjusted and planned to address the most important concerns and includes designing field experiments to investigate and adapt turf management practices for local conditions and then presenting results to the clientele for eventual adoption of these new and/or improved practices. Current economic conditions warrant conducting and demonstrating research that seeks alternatives to previous "same old ways" of managing turfgrasses. Much of my programming addresses allied agrochemical industry needs to develop local research data to support new product registration and market technical support for turf managers to adopt new products. Using pesticides in a safe, efficient, and economical manner are critical for turf management. The turf managers and applicators that implement turf management practices require up-to-date information to obtain continuing education units (CEU) for state regulated and licensed pesticide applications. Many turf managers and employees who apply pesticides are licensed by the Arizona Department of Agriculture or its Pest Management Division and require initial testing and continuing education to renew their licenses annually.

2. Brief description of the target audience

Commodity groups, ranchers, farmers, government agencies.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3000	7800	13000	26000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	9	20	29

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of economic analysis publications completed
 Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of individuals participating in educational programs.

Year	Actual
2018	16000

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of better management practices for crop and animal production
2	Adoption of alternative technologies
3	New community gardens or farmers' markets

Outcome #1

1. Outcome Measures

Adoption of better management practices for crop and animal production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis

Outcome #2

1. Outcome Measures

Adoption of alternative technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis

Outcome #3

1. Outcome Measures

New community gardens or farmers' markets

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our evaluation results indicate that there is a huge need for cost-cutting, but not quality-cutting, measures on agricultural entities within the state. Individuals and small farms need assistance with developing new methods and technologies to reduce their costs and other overhead. By delivering our scientific research and other behavioral shifts, we're seeing how these communities are able to save on certain costs and apply them to alternative areas to see their bottom line improve.

Key Items of Evaluation

A study done by Extension's Economic Impact Analysis team stated the Arizona Golf industry is worth \$3.9B to Arizona's Economy. Couple that with our other sports and recreation in our highly-desirable climate, and that brings many stakeholders to the topic of turf management. And the need for more information will continue to grow.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes with climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.