2014 University of Arizona Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

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, 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.

The College of Agriculture and Life Sciences has six programmatic focus areas:

- Environment, Water, Land, Energy and Natural Resources
- Plant Systems
- Human Nutrition, Health and Food Safety
- Children, Youth, Family and Community
- Animal Systems
- Marketing, Trade and Economics

Environment, Water, Land, Energy and Natural Resources

Water Investigations Program

• In 2014, WIP was accepted as a promising program in the nationwide **Change the Equation** STEMworks database established by President Obama and the President's Council of Advisers on Science and Technology. This distinction made WIP a vetted STEM program for funding and implementation nationally.

• An Indoor Water Audit was conducted by 1,537 students around the state resulting in a projected savings of 2-million gallons at school faucets.

• Post-program data indicates that 92% of teachers found students now have the ability to think through a scientific problem and analyze data to be improved or significantly improved. 100% of teachers found students' understanding of water resources and interconnection of water resources to be improved or significantly improved.

• In identifying their surface water supply as the Salt/Verde and Colorado Rivers, WIP graduates' overall knowledge gain is 92%. Also important is knowing where their water supply DOES NOT come

from: 30% of students identify oceans on the pre-test and only 1% on the post test.

• The update of Cochise County's Comprehensive Plan now includes a new policy to use the Renewable Energy Opportunity Analysis (REOA) in their deliberation over proposals for the installation of new utility-scale solar facilities in the County. REOA was used by planners in 2014 in their analysis and support of the Red Horse II solar facility west of Willcox. Approved by the county in April 2014, the project entails the installation of 250,000 solar panels over a section of land, and--as reported in the Arizona Range news (November 26, 2014)--will hire a total of 150 laborers/installers, electricians and heavy equipment operators.

Sustainable Economic Development: Solar Energy

The data and maps from the Renewable Energy Opportunity Analysis (REOA) for southern and central Arizona have been incorporated into city and county Geographic Information Systems (GIS) to provide planners and decision-makers with immediate access to maps showing areas of low, moderate or high opportunity for the construction of utility-scale solar facilities throughout their jurisdiction. In Pima County, regarding their use of the REOA results, a senior planner noted that, "We recently created a Solar Incentive District (REID) in Pima County, which identifies specific properties that are considered nearly 'shovel ready' for photovoltaic development and provides certain streamlined development processes. Your landscape-level analysis covering SE Arizona certainly corroborates our REID methodology and may inform our new Energy Element language as well."

Plant Systems

Incorporating Key Pest IPM into Horizontal Contexts of Multiple-Pest IPM

• Despite recent outbreaks of various pests, over $451-million has been saved from 1996-2014 in insecticide spray costs and crop yield savings.

• More than 21,000,000 pounds of insecticides' active ingredient was prevented from entering the environment during the same time period.

• Even with the recent uptick in insecticide use, broad-spectrum and broadly-toxic insecticides in use in cotton are down more than 93% since the early 1990s - all insecticides are down more than 82%.

• The Faculty's Crop Pest Losses & IPM Assessment program is a model for collecting, organizing and reporting and is a potential multi-state collaboration to capture and report on better than 90% of the U.S. supply of fresh lettuce production, something never achieved for any other food crop.

Improving Desert Agricultural Production and Produce Safety

Increased Wheat Production Efficiency: In 2014, over 38,000 acres were planted to wheat in Yuma County, all following a winter vegetable crop. As an outcome of this program, 22 percent of Yuma area wheat producers have now incorporated a form of minimum tillage practices in their production schemes with significant savings on fuel, labor and time, with no apparent reduction in durum wheat yield or quality. No wheat producers were conducting minimum tillage practices in 2005.

Greater Lettuce Production Productivity: Field studies conducted during the 2008-2010 winter growing seasons to evaluate bed size, and three irrigation methods for romaine and iceberg lettuce resulted in enhanced production efficiency and water conservation. During the 2014 produce season, approximately 55 percent of romaine and 10 percent of iceberg lettuce was grown using the condensed growing strategies.

Greater Adoption of Advanced Agricultural Technologies: In 2005, only about 20,000 acres of agricultural production utilized advanced agricultural technologies in the Yuma area, and producers desired a greater understanding of on-farm GIS mapping and data conversion training. As an outcome of the program, producers now have greater proficiency in precision agriculture technologies resulting in a 5-fold increase in precision crop acres within the region since 2005.

USDA-Certification for Good Agriculture and Handling Practices: Arizona leafy green producers adopted a new collection of production standards, the Arizona Leafy Greens Shipper Marketing Agreement (AZLGMA), in spring 2008. The agreement is a 100 percent commitment among Arizona growers to produce leafy greens within a strict set of unprecedented compliance guidelines developed in collaboration with university and industry scientists, Yuma County Cooperative Extension, food safety experts,

producers, processors and shippers. In Yuma County, 100 percent of fresh produce growers are AZLGMA compliant. In 2011, a series of USDA Good Ag and Handling Practices (GHP/GAP) workshops were initiated in Arizona. The food safety protocols include all fresh produce and not just leafy greens as outlined by the AZLGMA. As a result of the GHP/GAP workshops in Arizona, there has been a 7-fold increase in number--7 in 2010 to 50 in 2014--of USDA-certified Arizona GHP/GAP growers.

Human Nutrition, Health and Food Safety

Healthy Lifestyles - Teens Advocating for Sustainable Change Program

- Douglas High School freshman (300) logged 11,240,501 steps - or 5,620 miles in 2014 for the Walk Across Arizona program. An average of 18.73 miles per student or 1,249 steps per 30-minute class.
- 4-H Bicycle Club participants rode 12 times as a group in the fall semester for a total of 1,036 miles - or an average of 3.2 miles per ride. The group plans to double their rides during the Spring 2015 semester to increase their activity output.
- One teacher commented, "Students have really responded to the walking program because they can all be successful. No one is embarrassed that they can't run the entire distance of the football field, because everyone is able to walk. I wouldn't have thought about a walking program, but this has been a great way to engage some of our less-fit youth who usually opt out of P.E."
- Year-end evaluations of club members show 4-H is influential in developing responsibility, confidence, communication, and subject matter skills.

Campylobacter Vaccine for Poultry Targets Human Foodborne Illness

Ongoing research trials show the vaccine has significantly reduced the pathogen's ability to colonize young chickens' intestines. Risk assessment indicates that a 99 percent reduction of the Campylobacter load on chickens, such as that supplied by the vaccine in development at the UA, would reduce the incidence of campylobacteriosis associated with chicken meals by a factor of 30 (e.g., 2013 CDC reported incidence rate from Campylobacter infection of 13.82 per 100,000 would be reduced to 0.46 per 100,000). The vaccine's effect would be significant, as the U.S. has the largest broiler chicken industry in the world, producing approximately 8.52 billion broiler chickens in 2013 (50.6 billion pounds), with a value of production at $30.7 billion, according to USDA figures. Europe has similar broiler production figures. Successful vaccination of chickens would lead to compliance with the new USDA performance standards for Campylobacter in chickens by improving the safety of poultry meat, thereby resulting in significantly reducing the number of human illnesses.

Family, Youth & Community

Healthy Lifestyles: Launch Into Life Program

- 10 high schools in Southern Arizona participated in the program in 2014 and demonstrated an overall increase in skills learned of 42% over prior years. The program has doubled in size each year it's been active.
- Participants in the program commented on how they felt "more prepared" for life after high school. They went on to mention that they "have a better grasp of their income-to-expenses and what they should prepare for after they've completed their education."
- The program experienced growth in the number of volunteers and their knowledge of financial literacy before and after the program. When asked if they had learned a new skill during their experience as a community volunteer, 72.45% acknowledged they did - a 9.45% increase since 2012.
- The Launch into Life Career and College-Readiness Program realized a 3.33% increase in overall effectiveness and scored a 94.33% in post-program surveys.

Developmental and Sensory Screening for Youth

The goal of the developmental and sensory screening program is to increase the number of children from 0-5 who are screened and to improve access to early intervention for vision, hearing, and developmental issues for young children. Approximately 6,500 screenings were conducted through the program in 2013. In 2014, that number increased to 10,197 screenings completed on children 0-5 to detect developmental delays or vision/hearing problems, with 1,129 referrals made to medical homes.

Animal Systems

Animal Foraging Behavior and Distribution

• Studies show that sensory cues associated with positive or negative reinforcers can be used to direct livestock toward or away from selected rangeland areas - depending on where the biggest need for grazing or foraging is.

• The feasibility of favorably altering grazing pressure on rangelands without having to build expensive, static fences has the potential to produce economic and ecologic advantages for rangeland managers in Southern Arizona.

• Safer wildlife ranges can potentially be created by directing grazing and foraging animals into other areas so more research and analysis can be obtained.

Smartphone Biosensors for Food Safety, Animal Diseases and Human Health

1. The smartphone-based paper microfluidics technology is even easier to carry and operate, and extremely cheap. The total assay time is less than 2 minutes. By comparison, other "fast" microfluidic assays are typically very insensitive (with a detection limit of greater than 1,000 cells), while "sensitive" microfluidic assays require a long assay time of more than 4 hours.

2. DOTS qPCR device is the smallest in size among all portable PCR (polymerase chain reaction) devices developed by the Biosensors Laboratory, extremely inexpensive (no need for a photomultiplier tube - just a CMOS camera), and potentially handheld. In addition, the device works best with "dirty" samples (e.g., blood or tissue). In DOTS qPCR, the proteins and lipids in blood or tissue samples spontaneously move to the water-oil interface, effectively separating them from the center or a droplet (where the PCR occurs). This is not possible with conventional PCR techniques. DOTS qPCR technology enabled UA to secure an NSF grant, where the detection of Ebola virus will be attempted. This award received some media attention as well as interests from several different industry corporations. **Biosensors Laboratory:** http://biosensors.abe.arizona.edu

Marketing, Trade and Economics

Improving Vegetable Production through Utilization of Spike Wheel Liquid Injection Technology

• It was found that applied nitrogen rates could be reduced by at least 25% through use of point injection systems as compared to conventional means without negatively affecting crop yield, saving Arizona lettuce growers approximately $30/acre. If utilized on the roughly 50,000 acres of lettuce in Arizona, that could lead to an increase of farm profits of approximately $1.5 million annually.

• Awareness campaigns have shown that more participants are willing to adopt new technology to aid in their soil health while maintaining or increasing their net yield - some are "seriously considering" purchasing a spike wheel liquid injection mechanism after seeing the results of the field studies.

• In corn, sugar beet, and wheat, the spike wheel liquid injection mechanism improved nutrient uptake and crop yield.

Geothermal Cooling For Cows to Increase Milk Production

For the dairy industry, geothermal cooling would represent significant cost reduction in reducing heat stress on dairy cows and offers the additional opportunity of using the same approach to warm cows during cold winter months in northern dairy locations. Field testing of this concept is currently underway. It has been estimated that a 3,600-cow dairy, using 180 fans at 1.2 kW/hr per fan and paying 9¢/kW/hr would save close to $26,500 for the summer in energy costs to cool cows if the farm had access to geothermal cooling for the dairy cows to reduce the use of fans and coolers-a savings of more than 75 percent in electricity costs.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2014	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
- 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 established under Arizona state law and from Agricultural Center Advisory Boards who meet on a regular basis.

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 selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder 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.

Our County Extension Director's Visioning Group is in the midst of sending out a broad reaching survey to audiences that may not know what Cooperative Extension is, or have only some small idea. The survey instrument was finalized, and we are currently collecting the data. It is part of the stakeholder input process and will help CE program directions in the future.

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 Agricultural Centers. These groups plus numerous meetings with commodity organizations provide input annually for both Extension and Research programs

Our County Extension Director's Visioning Group is in the midst of sending out a broad reaching survey to audiences that may not know what Cooperative Extension is, or have only some small idea. The survey instrument was finalized, and we are currently collecting the data. It is part of the stakeholder input process and will help CE program directions in the future.

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)
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

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.

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 requested from a variety of sources and considered when developing annual plans. We are currently in the process of reassessing all our programs.

Brief Explanation of what you learned from your Stakeholders

Stakeholders are very concerned about the federal debt, the national and world economy, and the lack of federal support and continued lack of state support for higher education.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
2019508	0	2557650	0

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	2557649	0
Actual All Other	0	0	0	0
Total Actual Expended	4039018	0	5115298	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

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

MARKETING, TRADE & 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
601	Economics of Agricultural Production and Farm Management	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: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	1.9	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	347507	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

Improving Vegetable Production through Utilization of Spike Wheel Liquid Injection Technology
Issue
Arizona farmers have a difficult task to produce high-quality vegetables while maintaining costs. Add to that the importance of applying safe chemicals to the vast acres of crops without negatively impacting yields, and the work is that much more difficult. Recently, many issues of pesticides and insecticides have spurred public debate on the safety and importance of healthy regulations to what goes into farming soils. In short, farmers are in a constant battle to balance economic and environmental factors while continuing to produce the high-quality vegetables demanded to meet the needs of the ever-growing population. There are emerging technological advances to help with addressing the issues, but few growers utilize them because they are unaware of their existence or potential benefits.
What has been done
In this study, new fertilizer applicator technologies, such as the spike wheel liquid injection technology, was tested and used to inject fertilizer into the soil with minimal root damage and soil disturbance. Through the use of trials in 2012 and 2013, then backed up with additional field trials in 2014, the study showed some significant gains and impacts on crop productions and potential annual cost savings. The results were disseminated to over 300 individuals through use of publications, presentations, guest lectures, press, and field demonstrations to address issues of new knowledge and awareness.
Geothermal Cooling For Cows to Increase Milk Production
Issue
Heat stress in dairy cows during the warmest months causes decreases in milk yield, increases in disease incidence and also increases in maintenance costs per cow. Research has shown that compared to winter months, dairy cows in Arizona produced 8.8 pounds less milk per cow per day during the summer months. At the same time, on-farm milk production has the greatest opportunity to affect the carbon footprint of a gallon of milk because dairy operations represent 80 to 95 percent of the dairy industry's carbon footprint, and 75 percent of its electricity and fuel use. Cooling systems utilized in the dairy industry to alleviate the negative effects of heat stress have been shown to be efficient but require considerable resources (water and electricity). The scarcity of these resources and the cost of running these cooling systems have created the need to look for more efficient alternatives and the optimization of the current cooling systems. Geothermal cooling using chilled ground water is a viable alternative for cooling dairy cows, but the effectiveness of this form of conductive cooling is not well understood.
What has been done?
A previous study carried out at the University of Arizona in the School of Animal and Comparative Biomedical Systems evaluated geothermal conductive coolers using heat exchangers buried 25 cm beneath the surface of the bedding material. Cooled water is circulated through the heat exchangers to remove heat from dairy cows. This study was followed with another to investigate effectiveness of a geothermal conductive cooler when the bedding material was reduced to 12.7 cm. In this experiment, sand and dried manure were utilized as bedding material and heat exchangers for both were buried at 12.5 cm below the surface. Reducing the amount of bedding material above the heat exchangers increased the effectiveness of the coolers and was demonstrated to be the most effective bedding material for reducing body temperature of conductively cooled dairy cows. The utilization of heat exchangers at 12.7 cm effectively reduced the temperature of both bed materials from the top of the heat exchanger to the surface of the beds. Results of heat flux sensors located in the different beds indicated that heat flow from cows to the bedding material was greatest for sand in hot dry, thermo-neutral and hot humid environments (28.11, 26.07 and 31.86 W/m2 respectively, $P < 0.05$).
Overall results of this study corroborated results of the first study that sand is the best bedding material for conductively cooled beds for dairy cows and that reducing the depth of the bedding material increased the heat flow from the cow to the bedding material. This further supports the utilization of cooled beds as a cooling approach for dairy cows exposed to thermal stress.

Impacts reported in Report Overview

2. Brief description of the target audience

Commodity groups, state agencies, financial institutions, producers, marketing organizations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2862	7500	12520	25000

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

Patent Applications Submitted

Year: 2014

Actual: 1

Patents listed

Algae Accordion Photobioreactor

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	10	32	42

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Develop improved marketing and economic models
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

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

Year	Actual
2014	81

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Increased financial stability of Arizona's producers

Not Reporting on this Outcome Measure

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
2014	15382

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

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: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	22.0	0.0	5.0	0.0
Actual Paid	5.6	0.0	0.8	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

Healthy Lifestyles: Launch Into Life Program

Issue

Arizona was one of the hardest-hit states during the economic downturn in the early-2000s. Many Arizona residents fell on hard times and are still struggling to recover. According to Kids Count (2010), of the 1.6 million children living in Arizona, 24% under the age of 18 live in high poverty, ranking Arizona 37th in overall child well-being. The financial literacy of Arizona high school students has fallen to its lowest level, with a score of just 48.3% (Jumpstart Coalition, 2008). Notably, 66% of high school seniors failed the 2004 personal finance survey (Arizona School Standards, 2005).

What has been done

Arizona's 4-H organization, in conjunction with Cooperative Extension, initiated the Launch Into Life Program to address the needs of Arizonans. The program was designed to increase knowledge in workforce preparedness and financial/math skills for individuals, increase knowledge about healthy living practices, and foster financial security for youth and families now and into the future. The program also focused on career and college readiness for high school students. Collaborations for this program included Santa Cruz Valley Union High School, Mammoth-San Manual High School, First Federal Credit Union, State Farm Insurance, Eloy Hispanic Council, and the Salt River Project.

Developmental and Sensory Screening for Youth

Issue

The 2014 Pinal Region Needs and Assets report, a needs assessment regarding early childhood in Pinal County conducted by First Things First with participation by Cooperative Extension and other community-based organizations, found that children under age 5 comprise approximately 8 percent of the population. The Pinal rates for development screening of children ages 0-3 lagged behind the state rates for 2009-2012. FTF has identified the need for vision, hearing, and developmental screening to begin earlier in life than when a child enters school; current research has confirmed the efficacy of using assessments to assess and intervene when delays are beginning as intervention early on holds the most promise for positive resolution.

What has been done?

Cooperative Extension in Pinal County screens children aged birth to five and a half years of age for vision, hearing and developmental impairments that could affect their developmental growth and diminish their quality of life and success in school. Early detection of problems through these free screenings leads to referrals for further evaluations, to determine if there is impairment. In addition, Cooperative Extension provides education for parents, child care providers and the general public regarding developmental and sensory stages in children so that they can receive services early in life when conditions may be corrected or improved.

Impacts reported in Report Overview

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	34349	250000	112590	50000

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	46	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2014	0

Output #2

Output Measure

- Number of educational events, training workshops and clinics

Year	Actual
2014	575

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All who are interested in the well-being of Arizona's youth care about this issue.

What has been done
Military 4-H programs were implemented on all military bases in Arizona plus 5 bases in Japan and Korea.

Results
The positive aspects of a modern day 4-H youth development program were enjoyed by all youth who participated in the programs.

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
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Utilization of AmeriCorps personnel.

What has been done
We are partnering with US Military, e.g., Operation Military Kids.
A 4-H camp and outdoor learning center was purchased for youth & families.

Results
Utilization of AmeriCorps and Military individuals greatly increased capacity and outreach of the system. A new coordinator for the 4-H camp has been employed.

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

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

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: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	10.0	0.0
Actual Paid	2.6	0.0	1.5	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

Healthy Lifestyles - Teens Advocating for Sustainable Change Program
Issue
One of the biggest challenges facing our nation is the high prevalence of overweight and obese children, youth and adults. To improve the health of our nation, children and youth must move into adulthood without carrying the undue burden of obesity and its associated chronic diseases. Over 75% of freshmen at Douglas High School in Southern Arizona - a US/Mexico border town - report having a family member with diabetes. Due to the growing burden of chronic diseases related to the risk factors of overweight and obesity in the border population, the effects of a sedentary lifestyle and poor eating habits are critical in educating and preventing youth from a lifetime of these conditions. Obesity is related to serious health conditions such as hypertension, type-2 diabetes, hypercholesterolemia, coronary heart disease (CHD), stroke, asthma, and arthritis.
What has been done
The Teens Advocating for Sustainable Change Program was developed and became known as the Douglas High School 4-H Mentors. The group successfully worked to obtain funding and other donations to support awareness campaigns of living a healthy lifestyle. They facilitated the use of pedometers to help other students track their activity outputs in the Walk Across Arizona Program, they acquired 65 abandoned bicycles from the University of Arizona Parking and Transportation Department and repaired/repurposed them for use in the Paul Huber Middle School 4-H Club in Douglas, Arizona, and they led physical activity lessons to various groups including 40 families from the Family Leadership Institute.
Campylobacter Vaccine for Poultry Targets Human Foodborne Illness
Issue
Food safety remains a high level concern to the general public. Campylobacter is the second most common cause of human foodborne diarrheal illness in the United States, causing an estimated 1.3 million cases annually and resulting in health care costs of somewhere between $800 million to $5.6 billion per year. The handling and consumption of poultry is considered to be the most significant risk factor in transmission of the bacteria to humans, with up to 80 percent of human campylobacteriosis cases attributable to the poultry reservoir. Complications of infection with Campylobacter include Guillain-Barre syndrome, reactive arthritis, and irritable bowel syndrome. The U.S. has the largest broiler chicken industry in the world, producing approximately 8.52 billion broiler chickens in 2013. Chicken consumption surpasses both beef and pork consumption. In 2011, the USDA implemented new performance standards for Campylobacter on chicken carcasses at processing establishments. These standards allow no more than eight positive Campylobacter samples in a 51-sample set. Furthermore, USDA is proposing new measures in 2015 to reduce Campylobacter in ground chicken and turkey products as well as raw chicken breasts, legs, and wings. To date, there is no vaccine available to industry to reduce the numbers of Campylobacter in poultry and intervention strategies remain insufficient.
What has been done?
Funded by the USDA, faculty and graduate students in the UA School of Animal and Comparative Biomedical Sciences, along with Dr. Roy Curtiss' team at ASU, have developed a new poultry vaccine using an attenuated strain of Salmonella to express Campylobacter genes in chick intestines. The vaccine reduces the number of Campylobacter organisms within the intestine, so ultimately less Campylobacter is transferred to humans and therefore significantly fewer foodborne illnesses will occur. The vaccination process is simple; it is easy to produce and safe. The Salmonella is engineered to live long enough to stimulate antibody production, is attenuated so it cannot produce disease in chicks or humans, and dies before the chicks are harvested. The goal is to halt the contamination before it spreads and survives on raw chicken sold in stores. The researchers are working with the UA's Tech Launch Arizona to partner with industry to further develop the vaccine to meet the needs of industry. Poultry vaccine studies are continuing to align with these goals.

Impacts reported in Report Overview

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	210322	400000	131857	250000

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	56	103	159

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
2014	157

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

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
2014	342179

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All citizens need to be aware of importance of nutrition, health and food safety.

What has been done
Workshops, health fairs, including EFNEP and SNAP-Ed programs.

Results
342,179 participants, not including indirect contacts were made aware and gained knowledge of these issues.

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 #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
2014	342179

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

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

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: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	21.0	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

Water Investigations Program
Issue
With growing populations and their impacts on natural resources within the state of Arizona, critical programming has been initiated to address the future needs of the citizens and water conservation. Awareness at a young age will help to shape behaviors in understanding impacts of water usage, and mis-usage. There are many opinions as to what the future of Arizona is, but we can still anticipate record growth and the demand for natural resources. In addition, we can expect that there are going to be jobs designed to address the needs of the growing population and the skills needed to fill those jobs is something we can begin to look at currently.
What has been done
There are many tactics to address the concerns, but the Water Investigations Program (WIP) uses Science, Technology, Engineering and Math (STEM) to get students engaged with practical reasoning and problem solving. This solves two distinct purposes: 1.) It creates vast awareness on water in Arizona and helps to open that dialogue at a young age, and 2.) It provides students an avenue to get connected in the fields of STEM to solve real-world problems. The WIP used various funding to introduce ways to teach including hands-on working with water audit kits, stream water quality testing kits, macro invertebrate sampling kits, stream-flow meter, groundwater flow models and riparian area presentations. Training of volunteers and coordinators over the summer and school year help to prepare for the growing interest in the program. Over 6500 Arizona students attended three water technology presentations including one of 4 STEM Symposia, one of 118 one-hour Groundwater Flow Model Presentations, and a Water Efficiency Technology Presentation.
Sustainable Economic Development: Solar Energy
Issue
Residential construction and development is not driving Arizona's economy in the way it did in 2008. There is a glut of vacant housing, due to foreclosures, because of over entitlements granted in the mid-2000s. The future of economic development and community resiliency in Arizona will depend on a diverse economy that isn't reliant on just one sector such as housing or resource extraction--both vulnerable to boom-bust cycles. Enhancing local food systems and renewable energy are two areas that this program is assisting with to build more resilient communities that will be better prepared to weather future economic downturns.
What has been done?
Started in 2011, Renewable Energy Opportunity Analysis (REOA) was completed in 2013 to include all counties, cities and lands throughout the state. This analysis was conducted to provide decision-makers, solar developers and communities with maps and GIS shapefiles that identify the areas within their communities that are best suited for the siting of utility-scale solar facilities. The analysis used fundamental land use criteria such as the location of roads, transmission lines, substations, slope and aspect as weighted determinants of suitability. An agent with the UA College of Agriculture and Life Sciences Cooperative Extension and a professor from the UA College of Social and Behavioral Sciences) supervised the GIS modeling process as well as the creation of the maps for each region of the state. The maps are accessible online. While the aim of this effort has been to publicize the availability of these maps and data as widely as possible, the maps have also been provided to cities, counties and individuals upon request, tailored to their specific area. Most notably, in November 2014 the results of the analysis were made available to anyone with an internet connection through an interactive online mapping application: http://cals.arizona.edu/reoa/.

Impacts reported in Report Overview

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	45316	69000	12870	25000

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

Patent Applications Submitted

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	148	190	338

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Effectiveness of the research program will be used to reach direct and indirect contacts

Year	Actual
2014	386

Output #2

Output Measure

- Number of individuals participating in educational programs

Year	Actual

2014	58186

Output #3

Output Measure

- Number of individuals adopting new technology

Year	Actual
2014	1500

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
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All participants in the research and extension programs and the respective clientele for these programs care.

What has been done
Arizona has a fully integrated research and extension program and all faculty strongly pursue competitive grants.

Results
More than $1.5 million dollars in non-USDA grants were obtained to support this program.

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
2014	12808

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
2014	183

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
1,338 volunteers donated their time teaching others.

Results
Master Gardener volunteers donated over 93,900 hours in 2014.

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
2014	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
1,338 Master Gardener volunteers shared information directly with 22,909 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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

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	Diseases 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: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	35.0	0.0
Actual Paid	3.3	0.0	6.8	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

Incorporating Key Pest IPM into Horizontal Contexts of Multiple-Pest IPM
Issue
Pesticides are powerful tools for controlling pests within agriculture - both food and fiber. However, some pesticides pose a greater risk than others to human health and the environment. Today's farmers are under constant pressure to develop new ways to combat pests while keeping the yields safe and healthy. Recently, various insect and pest outbreaks have prompted further understanding and research of additional, more integrative, IPMs and their impact to field crops. The Brown Stink Bug posed special problems from 2012-2014, especially in identifying practices compatible with key pest IPM. Aflatoxin levels were at decade's high levels in 2013 and widely present again in 2014. And Arizonans are always on the lookout for other outbreaks and ways to combat them.
What has been done
Through this program, faculty have put together material through research to make those within the agriculture community aware of Multiple-Pest IPM methods. Many people have been reached through publications, presentation, and workshops. Researchers have consulted on various publications and articles on the role of GM technology in our food system and delivered training on this topic to Master Gardener groups to help provide them with evidence-based information to share with others. In addition, a 20-year database has been made available for reference and a major effort was made to supply growers with key natural enemy information from 2011-2014.
Improving Desert Agricultural Production and Produce Safety
Issue
Commercial agricultural production within western Arizona (Yuma County) is represented with approximately 120,000 multi-cropped acres (of 270,000 acres total) exceeding $2.8 billion in 2014 (Frisvold, 2014). Since 2005, the specific needs of agricultural producers in the region have been assessed on an annual basis at the conclusion of field day events, meetings, workshops and interactions with grower groups. In 2012, this countywide appraisal, in collaboration with the Arizona Department of Agriculture, resulted in a statewide Extension and outreach, research-based effort whose focus covers all field production and handling aspects of fresh produce safety.
What has been done?
The "Enhancing Desert Crop Production and Produce Safety" program identifies current problems and issues facing agricultural producers in the region, and develops new and appropriate technologies, tools and cropping schemes for greater crop uniformity, quality and production. It coordinates Extension efforts with departmental collaboration in the UA College of Agriculture and Life Sciences, state regulatory agencies and industry representatives to deliver information through various avenues to benefit Arizona producers. In 2014 the program disseminated university-, extension- and agent-developed curricula, publications and other information to more than 1,200 clients within the state via meetings/workshops and one-on-one contacts. By adopting innovative agricultural schemes and technologies into current management practices, growers will be better prepared for a future of changing agricultural landscapes with improved farm profitability and minimized adverse effects to the environment.

Impacts reported in Report Overview

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

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6154	18000	3679	12000

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	46	125	171

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2014	9833

Output #2

Output Measure

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

Output #3

Output Measure

- Number of research projects conducted on all aspects of Plant Sciences, Entomology

Year	Actual
2014	254

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 crop and animal technologies
3	Adoption of more cost effective means for controlling plant and animal diseases along with insect issues
4	Adoption of more cost effective means for controlling plant diseases, including insect issues
5	Adoption of alternative crop technologies.

Outcome #1

1. **Outcome Measures**

Adoption of better management practices for crop and animal production

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Adoption of alternative crop and animal technologies

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Adoption of more cost effective means for controlling plant diseases, including insect issues

2. **Associated Institution Types**

- 1862 Extension
- 1862 Research

3a. **Outcome Type:**

Change in Action Outcome Measure

3b. **Quantitative Outcome**

Year	Actual
2014	0

3c. **Qualitative Outcome or Impact Statement**

Issue (Who cares and Why)
New pests and diseases are appearing each year as they become more resistant to pesticides. Major insect damage to crops costing significant dollars and utilizing major amounts of pesticides.

What has been done
An integrated pest management program (IPM) established in Arizona in 1996, refined in 2006 and continued through today uses insect growth regulators (IGRs) effective against whiteflies, transgenic cotton (with Bt (Bacillus thuringiensis) effective against pink bollworms, and a reduced-risk feeding inhibitor (effective against Lygus bugs.)

Results
Statewide averages for cotton insecticide use patterns in Arizona from 1979 through 2010 show that insecticide use on cotton for all insects combined?including whiteflies, pink bollworm, Lygus bug and others reached a 32-year low over the last 5 years, while also reducing costs to all-time lows. The estimated cumulative savings in control costs and yield (from reduced losses to insects) from 1996 through 2010 was more than $223 million.
Growers applied 4.15 pounds of active insecticide ingredient per acre of cotton in 1995. In 2009 and also in 2010 the amount of active ingredient applied per acre was reduced by 3.66 pounds, or 88.3 percent, to just 0.48 pounds per acre. This is the equivalent of applying less than a can of soda on an area the size of a football field just once over the cotton season (March to October).

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	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #5

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
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Control of Pink Bollworm in cotton plants

What has been done
Adoption of BT Cotton

Results
More than 95% of cotton farmers in AZ have adopted BT cotton. This resulted from the availability of the genetic material and demonstration by the UA that this technology is effective and economical.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods 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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

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: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	0.6	0.0	3.5	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

Animal Foraging Behavior and Distribution
Issue
Animal foraging and distribution problems are a major source of controversy on public and private rangelands throughout the western United States. Arizona is no exception as some individuals and groups call for the removal of livestock from public rangelands. As wild and domestic grazing animals forage across landscapes, they influence biotic and abiotic components of rangelands through the plant species they utilize and the habitats they occupy. Improper grazing distribution can degrade economic and ecological values of watersheds across various hierarchical scales. Control of animal foraging and distribution patterns, whether from wild or domesticated ungulates, is pivotal to successful rangeland management.
What has been done
Extension workshops, professional papers and abstracts, and peer-reviewed extension and journal articles have been designed and developed to meet the evolving needs of Arizona's citizenry and their awareness of these issues. Research results related to using visual, auditory and olfactory cues to manage foraging behavior and spatial distribution of rangeland livestock have been integrated into teaching, extension and service activities whenever possible. Programming is offered in both oral and written forms and attempts to reach both traditional (rural) and non-traditional (urban) audiences. Audiences of programming efforts are often very diverse and include ranchers, environmentalists, range and wildlife managers, scientists, students, and the general public.
Smartphone Biosensors for Food Safety, Animal Diseases and Human Health
Issue
Infectious pathogens from food, animals and humans are widespread and growing public health problems, both in developed and developing countries. Detecting such pathogens usually involves collecting a food/water sample or a blood/urine specimen, sending it to a laboratory and waiting for the samples to be filtered, incubated/amplified, tested and identified under a microscope or gel-doc device. If a critical infection is suspected, say for highly dangerous Ebola, E. coli O157:H7, avian flu or malaria, the pathogen may already have multiplied and spread before the report arrives days later.
What has been done?
1. Previously, a series of "lab- on-a-chip" (LOC) devices was developed at the Biosensors Laboratory in the College of Agriculture and Life Sciences at the University of Arizona. The silicon-based LOC has been replaced with paper platform, called paper microfluidics, and subsequent optical detection has been made with the use of a smartphone, utilizing its white LED flash as a light source, its digital camera as a light detector, and a software application for data processing. In 2014, this smartphone-based paper microfluidics technology was applied to detect the bacterial pathogens from myriads of field water samples as well as human urine specimens, with the lower limit of detection of 10 cells per mL sample.
2. A new method of conducting polymerase chain reaction (PCR) in much faster assay time has been invented by the Biosensors Laboratory, utilizing automated manipulations of microliter droplets in a portable platform. Further modifications were made in 2014 using the interfacial tension effect to monitor the progress of PCR amplification, called DOTS qPCR (droplet on thermocouple silhouette real-time PCR). While almost all real-time PCR uses fluorescence, DOTS qPCR is the first-ever demonstration of utilizing interfacial tension. With this innovative technology, positive signals were obtained in less than 5 cycles, compared to 15-25 cycles in conventional real-time PCR, significantly reducing the sample-to-answer assay time to less than 5 minutes, as well as simplifying the device layout and design.

Impacts reported in Report Overview

2. Brief description of the target audience

Commodity groups, state agencies, pest management advisors, pesticide applicators, youth, ag ventures program. Plans are underway to attempt to include non-traditional audiences.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	3000	94	1500

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

Patent Applications Submitted

Year:	2014
Actual:	1

Patents listed
Targeted Biocides

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	3	62	65

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
2014	24

Output #2

Output Measure

- Number of individuals gaining knowledge by participating in educational programs, such as range livestock nutrition workshops.

Year	Actual
2014	594

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers adopting more sustainable and profitable large scale dairy production practices.
2	Adoption of more profitable breeds of cattle for arid land conditions.

Outcome #1

1. Outcome Measures

Number of farmers adopting more sustainable and profitable large scale dairy production practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	180

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 #2

1. Outcome Measures

Adoption of more profitable breeds of cattle for arid land conditions.

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

Reason for not reporting

We do not have the resources to sustain this as a separate program. The information is included in the Human Nutrition, Health & Food Safety program.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	2.0	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct workshops, research, meetings, school enrichment, and information delivery.

2. Brief description of the target audience

Special focus on youth/adult interaction.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2014

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	6	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Actual
2014	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Reduce childhood obesity

Outcome #1

1. Outcome Measures

Reduce childhood obesity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

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 whit 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.