

# 2009 University of Arizona Combined Research and Extension Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

It has been a challenging year for research and extension at the University of Arizona. State budget cuts have reduced the number of faculty and thus the number of impacts throughout the various programs. The State provides a 10 to 1 match to Federal dollars. In the following we describe the accomplishments particularly those related to federal dollars.

EFNEP, the federally funded Extension Food and Nutrition Education Program, addresses the needs of low-income, minority families and youth nationwide. The goal is to teach families with children how to stretch their limited food dollars, plan and prepare nutritious foods and make informed choices about food and other lifestyle issues that support family health and well-being. During the past year, ninety-eight percent of the 2,768 participants completed their classes, up from ninety-six percent of 3,069 adults in 2008. Post-participation dietary surveys from 2,768 individuals showed that overall fifty-eight percent improved their food resource management skills, sixty-three percent improved their nutrition practices and fifty-one percent now follow recommended food safety practices. Their food resource management skills increased from twenty-two percent to forty-three percent and food safety practices increased from forty-two to seventy-three percent after program participation; 2,109 individuals now participate in some type of physical activity daily.

The Supplemental Nutrition Assistance program was developed to provide another source of nutrition education (in addition to EFNEP) to food stamp eligible audiences by the University of Arizona Cooperative Extension. The program's mission is to shape food consumption in a positive way, to promote health, and reduce disease among all people living in Arizona. Nutrition messages have been integrated into: food safety, obesity and disease prevention, physical activity, and gardening activities. The Arizona Nutrition Network media thrust was "Champions for Change" balancing caloric intake with calories expended, increasing consumption of fruits and vegetables, whole grains, and using low-fat milk products. Daily physical activity was encouraged. During the past year, total direct education contacts for SNAP-Ed participants by age were: 48,318 under 5 Years, 265,682,513 for 5-17 Years (grade K-12) 2,050,518 for 18-59 Years and 268,431 ages 60 Years and older for a grand total of 268,050,077-all ages combined.

Foodborne diseases are a widespread and growing public health problem, both in developed and developing countries. In the United States, for example, around 76 million cases of foodborne diseases, resulting in 325,000 hospitalizations and 5,000 deaths, are estimated to occur each year. Detecting waterborne and foodborne contaminants usually involves collecting a water or food sample, sending it to a laboratory and waiting for the samples to be filtered, incubated, tested and identified under a microscope. If a critical infection is suspected, say for highly dangerous *E. coli* 0157:H7, the pathogen may already have multiplied and spread before the report arrives days later. Laboratory studies show that the our newly developed LOC test is faster than conventional testing methods, taking an average of less than five minutes to deliver results on location. The degree of accuracy is three orders of magnitude greater than for conventional real-time or rapid tests (close to a single cell level). The method can be used to monitor early spread of pathogens, rather than being used after the outbreaks, thus potentially saving lives and money. The annual cost for foodborne illness in the U.S. is estimated to be \$152 billion, according to a new report by Pew Charitable Trusts and Georgetown University.

Most people are familiar with *Salmonella* and its potential to make people ill. But few know about *Campylobacter jejuni*, even though it competes yearly with *Salmonella* in making people sick. *Campylobacter* is one of the main causes of bacterial foodborne disease in the United States and worldwide. Raw chicken is one of the most common carriers of the bacteria. In the U.S. alone, 2.4 million cases are reported annually, with costs exceeding \$1 billion. Americans consumed 86 pounds of chicken per person in 2006, the most recent numbers available. Ongoing research trials show the vaccine has significantly reduced the pathogen's ability to colonize young chickens' intestines. Preliminary studies utilizing a newly developed vaccine indicate that *Campylobacter* infection was reduced by 99.9 percent compared with a control group: 4.4 million *Campylobacter* organisms were present in non-vaccinated birds, compared to 5,220 organisms in the vaccinated birds. At least 500 organisms are needed to produce the disease in humans, but the chlorine in the packinghouse chillers usually reduces bacteria by 1,000 to 100,000 organisms.

Prolonged drought has reduced water resources in Arizona, making water sustainability a critical issue for all generations. Arizona Project WET (Water Education for Teachers) aims to deepen young students' understanding of water as an interconnected resource, thus helping them to become emissaries of wise water use in Arizona communities. Over the past

decade, 1,336 teachers have worked with their students to enhance the learning experience of the Water Festival by carrying the learning goals into the classroom. This creates a learning community where teachers and students alike are motivated to learn about water and to work together to protect Arizona's water future. Since 2000, the Arizona Water Festival program has served 33,337 young Arizonans in 20 Arizona communities—youth who are caring for watersheds, conserving water and sharing this knowledge with their friends and families.

Although trees offer more than aesthetics in a landscape, the true value of their contribution is usually unknown. A street tree inventory conducted on the University of Arizona campus assisted a larger effort undertaken by the City of Tucson's Department of Urban Planning and Design to assess the species distribution, annual costs/benefits and maintenance priorities for municipal trees. According to the 2007-2008 inventory, the 2,130 street trees in the study (about 26 percent of all trees on the UA campus) annually take up and use 246,620 pounds of carbon dioxide (CO<sub>2</sub>); reduce the energy costs for UA facilities by \$18,230; reduce emission, pollutants and particulates by 9,994 pounds; and intercept more than a million gallons of rainfall or storm water (reducing flooding).

Properly tailored weather information can assist with important management decisions related to variety selection, planting dates, crop assessment, pest control, irrigation and harvest, particularly during times of prolonged drought. The Arizona Meteorological Network (AZMET) was developed in 1987 to provide weather data and information in near real time to the state's producers of agricultural and horticultural crops. AZMET is widely accepted as an important (and often the only) source of meteorological information pertaining to the production of agricultural and horticultural crops in Arizona. Use of AZMET information continues at a high rate; users accessed AZMET web pages 1,850,000 times in 2009. The total number of user sessions for AZMET equaled 255,470 in 2009, or 700 per day; data transferred from AZMET's websites totaled 292 gigabytes.

During the mid-90s, insecticide applications in cotton typically accounted for about half of all insecticide use in the United States. In 1995, nearly 100 percent of Arizona's cotton acreage was sprayed multiple times for pink bollworm and silverleaf whitefly. New technologies have enabled cotton growers to reduce their spray applications significantly while maintaining competitive yields. These technologies also help growers implement more ecologically-based, sustainable IPM programs and become less dependent on broadly toxic insecticides. Over the past 8 years, the fully implemented cotton IPM program has resulted in a 69 percent reduction in pesticide sprays for all insects combined, including whiteflies, pink bollworm, Lygus bug and others. Insecticide usage decreased by more than 1.6 million pounds. In 1995, cotton growers sprayed on average 12.5 times with broadly toxic insecticides totaling nearly 1.71 million pounds. Today, (2006-2009), cotton growers have sprayed just 1.5 times with safer compounds totaling less than 70,000 pounds, a 24-fold reduction in insecticide use.

Scientists from the University of Arizona, Washington University-St. Louis, Cold Harbor Laboratory and Iowa State University deciphered the complete genetic code of the maize plant for the first time in 2009. After four years of collaboration on the National Science Foundation-funded Maize Genome Sequencing Project, the researchers were able to provide the complete sequence and structures of maize genes and their locations, in linear order, on both the genetic and physical maps of maize. Their findings provide a "gold standard" reference for scientists working to understand the biology and evolution of maize.

The powdered roots and/or extracts derived from roots of the winter cherry plant—*Withania somnifera* (L.) Dunal—have been used for more than 3,000 years in India as a general tonic to build stamina, improve mental concentration, relieve stress and enhance health. Commonly known as "ashwagandha" in Ayurvedic medicine, scientific tests on the preparation have shown that it has anti-inflammatory, cardio-protective, antioxidant and antitumor properties, among others. *Withania* is widely cultivated for commercial use in its native India, and also in the Middle East and in North America. Ashwagandha is sold as a dietary supplement in the United States and Europe. The compound withaferin A, scientifically studied since the 1960s, seems to play the largest role in the plant's anticancer effects by reducing tumor mass and preventing the growth of blood vessels that make a tumor malignant. It also shows promise in treating Alzheimer's and Parkinson's diseases.

University of Arizona scientists at the Southwest Center for Natural Products Research and Commercialization (or Natural Products Center), in collaboration with the Whitehead Institute at the Massachusetts Institute of Technology, have discovered a second form of withaferin that has identical functions in a less potent, slower-acting form that might be used as a "prodrug," or drug precursor in the pharmaceutical industry.

Finally, the College has filed 7 patent applications and had 3 patent applications issued during the past year.

**Total Actual Amount of professional FTEs/SYs for this State**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	50.0	0.0	105.0	0.0
Actual	47.0	0.0	57.0	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 Director oversees this process and ensures that any suggested changes are made to the satisfaction of the reviewers and the Associate Director. External review of programs and projects is obtained from County Extension Advisory Boards 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.**

The major effort for the past year involved a major rewrite of the College's Strategic Plan that covers the research, extension and academic programs of the College. This effort was made available for review and comment by all faculty and staff, all advisory boards, major commodity organizations and selected stakeholders across the state. The revised plan is available on the College web site ([www.ag.arizona.edu](http://www.ag.arizona.edu)).

**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

**Brief explanation.**

Over 100 county advisory board members provide input and priorities to county programs on an annual basis. More than 350 stakeholders are annually involved in both Extension and Research programs.

**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 meeting with the stakeholder groups or providing them with written materials for their review and input.

**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 Action Plans
- To Set Priorities

**Brief explanation.**

Input received from a variety of sources is considered when developing annual plans and their input was particularly relative this year during the rewrite of the College Strategic Plan.

**Brief Explanation of what you learned from your Stakeholders**

Stakeholders are very concerned about the federal debt, the national and world economy, lack of federal and state support for agricultural research and extension programs and propensity for the government to screw up international trade.

IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
1852576	0	2153058	0

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
	<b>Extension</b>		<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	395968	0	263189	0
<b>Actual Matching</b>	3176373	0	3709737	0
<b>Actual All Other</b>	0	0	0	0
<b>Total Actual Expended</b>	3572341	0	3972926	0

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from</b>				
<b>Carryover</b>	0	0	0	0

**V. Planned Program Table of Content**

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

**V(A). Planned Program (Summary)****Program # 1****1. Name of the Planned Program**

PLANT SCIENCES

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
201	Plant Genome, Genetics, and Genetic Mechanisms	22%		22%	
205	Plant Management Systems	16%		17%	
206	Basic Plant Biology	14%		13%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		19%	
212	Pathogens and Nematodes Affecting Plants	18%		19%	
215	Biological Control of Pests Affecting Plants	10%		10%	
	<b>Total</b>	<b>100%</b>		<b>100%</b>	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	8.0	0.0	36.0	0.0
Actual	7.0	0.0	15.0	0.0

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
127696	0	77668	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
656700	0	730114	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

Issue

During the mid-90s, insecticide applications in cotton typically accounted for about half of all insecticide use in the United States. In 1995, nearly 100 percent of Arizona's cotton acreage was sprayed multiple times for pink bollworm and silverleaf whitefly. New technologies have enabled cotton growers to reduce their spray applications significantly while maintaining

competitive yields. These technologies also help growers implement more ecologically-based, sustainable IPM programs and become less dependent on broadly toxic insecticides.

#### 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.) Safe for humans, these tools kill only their target pests, allowing natural processes to play a larger role in the control of all other insects. The UA College of Agriculture and Life Sciences initiated the program in collaboration with growers, USDA, Arizona Department of Agriculture, Arizona Cotton Growers' Association, Cotton Incorporated, Arizona Cotton Research & Protection Council, industry and others.

#### Impact

Over the past 8 years, the fully implemented cotton IPM program has resulted in a 69 percent reduction in pesticide sprays for all insects combined, including whiteflies, pink bollworm, Lygus bug and others. Insecticide usage decreased by more than 1.6 million pounds. In 1995, cotton growers sprayed on average 12.5 times with broadly toxic insecticides totaling nearly 1.71 million pounds. Today, (2006-2009), cotton growers have sprayed just 1.5 times with safer compounds totaling less than 70,000 pounds, a 24-fold reduction in insecticide use.

On a per-acre basis, growers applied 4.15 pounds of active insecticide ingredient per acre of cotton in 1995. By 2009 they had reduced this amount to 0.48 pounds of active ingredient, a reduction of 3.66 pounds or 88.3 percent. 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).

Since 1996, growers have cumulatively saved over \$212 million in pesticide costs and in reduced insect damage—which has decreased by more than 60 percent over the past four years. Over a quarter of the state's 150,000 acres of cotton was never sprayed for insect pests, and since 2008 growers have reported zero sprays for pink bollworm for the first time since the mid-1960s. The IPM plans have been exported for use in California, Texas, northern Mexico, Australia and Latin America.

#### Issue

Maize, which was domesticated over the past 10,000 years from a grass called "teosinte" native to Central America, is one of the world's most important food crops. Last year in the United States alone, 12 billion bushels of maize grown on 86 million acres of land was valued at \$47 billion. Improved crops are needed because agriculturists are challenged to grow more crops on less land, with less water, and on poorer soil. Such efforts are urgent: The United Nations predicts that world food output must grow by 70 percent over the next four decades to feed a projected extra 2.3 billion people by 2050.

#### What has been done

Scientists from the University of Arizona, Washington University-St. Louis, Cold Harbor Laboratory and Iowa State University deciphered the complete genetic code of the maize plant for the first time in 2009. After four years of collaboration on the National Science Foundation-funded Maize Genome Sequencing Project, the researchers were able to provide the complete sequence and structures of maize genes and their locations, in linear order, on both the genetic and physical maps of maize. Their findings provide a "gold standard" reference for scientists working to understand the biology and evolution of maize. Scientists at the Arizona Genomics Institute and the Arizona Genomics Computational Laboratory independently led the UA's effort to generate a set of full-length cDNAs [complementary DNA], sequences that represent about 27,000 of the maize genome complement. UA scientists also led the construction of an integrated genetic and physical map of maize in a previous NSF-funded project that began in 1998. Genetic maps show the location of genes along a single DNA molecule; physical maps also show the order and spacing of the genes. The maps served as the blueprint, or roadmap, to sequence the genome.

#### Impact

The decoded maize genome is available for scientists to study. See the websites below.

The Arizona team's work provides a comprehensive foundation to systematically study maize biology with the goal of breeding higher yielding, disease-resistant and drought-tolerant cultivars. Among the more than 27,000 maize sequences independently sequenced at the UA, the team discovered about 1,600 unique maize genes - genes not found in other plant databases. These unique maize genes are priority targets for studies that will provide information to better understand the biology and production of maize and cereal crops.



**2. Brief description of the target audience**

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

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	17000	30000	5000	1000
<b>Actual</b>	16000	25000	5200	1250

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

Year: 2009

Plan: 2

Actual: 3

**Patents listed**

UA09 006A Water Soluble Pro-drug for the Heat Shock Inducing Compound Withaferin A

UA09 049 Efficient cDNA Synthesis from Very Small Quantities of Starting RNA

UA10 048 Identification of a Novel Pollen Tube Stimulant from Arabidopsis Pistils

**3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	12	22	34

**V(F). State Defined Outputs****Output Target****Output #1****Output Measure**

- Number of individuals participating in educational programs

Year	Target	Actual
2009	17000	15000

**Output #2**

**Output Measure**

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

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	55	60

**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 and insect damage

**Outcome #1**

**1. Outcome Measures**

Adoption of better management practices for crop production

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Adoption of alternative crop technologies

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	150	100

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

**Issue (Who cares and Why)**

Cotton Producers--it effects their bottom line

**What has been done**

Up to date IPM program has been presented at commodity meetings

**Results**

There has been a uniform adoption of the new technology

**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 and insect damage

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1000	500

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

**Issue (Who cares and Why)**

Cucurbit Yellow Stunting Disorder Virus (CYSDV) has been discovered in the Yuma Valley. This virus affects cantaloupes and honeydew mellons. This causes severe loss of the crops

**What has been done**

Growers have been made aware of the disease and efforts are being made to select less resistant varieties.

**Results**

The virus is spread by whiteflies. Plants and crops that serve as hosts for the whiteflies have been identified and management plans to limit whitefly infestations have been developed

**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

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

1. Evaluation Studies Planned

- After Only (post program)

**Evaluation Results**

No formal evaluations performed

**Key Items of Evaluation**

**V(A). Planned Program (Summary)**

**Program # 2**

**1. Name of the Planned Program**

ENVIRONMENT, WATER, LAND AND NATURAL RESOURCES

**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	32%		35%	
111	Conservation and Efficient Use of Water	20%		16%	
112	Watershed Protection and Management	18%		18%	
121	Management of Range Resources	30%		31%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	21.0	0.0
Actual	9.0	0.0	19.0	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
213208	0	44027	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1314084	0	1507162	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

Issue

Water quality and availability in the arid West are issues that affect all Arizonans, including youth. By training teachers to present water awareness education in K-16 classrooms, Arizona Project WET (APW; "WET" stands for "Water Education for Teachers"),

administered through the University of Arizona's Water Resources Research Center, assists in building water-related decision making skills in both students and adults. APW is recognized as the only comprehensive water education program for K-16 audiences with a statewide partnership and delivery system.

#### What has been done?

Water education curricula were developed by water resource specialists working together with teachers. In 2009, statewide water education programs involved 485 teachers reaching 29,227 students. As part of the third grade water unit for Tucson, Sunnyside and Flowing Wells districts, UA students presented 209 in-classroom ground water flow model presentations to 4,734 students in 2009. The Sweetwater Wetland Water Festival culminating event was attended by 157 third grade classes reaching 4,729 students. In 2009 the Energy & Environmental Science 6th Grade Unit, incorporating 16 APW lessons, was finalized and adopted in the same districts. The peer-reviewed School Water Audit Program and Arizona Water Map Curriculum Guide offer new teaching resources to educators and students. *The Wild Ride through the Water Festival Online Module* is available on the APW web site for digital learners and teachers.

#### Impact

Survey data shows that 93 percent of the teachers participating in the statewide workshops "intend to become a better water steward as a result of an APW workshop," 97 percent said "the resource materials provided will be helpful for teaching about water & environment," and 95 percent said the workshop activities were relevant and improved my knowledge." The third grade water unit has been adopted as one third of the science curriculum for 5,673 students in Tucson, Sunnyside, and Flowing Wells district schools. For those same districts, the Energy and Environmental Science Curriculum is one third of the curriculum for 4,862 sixth grade students,

#### Issue

The Southwest's continuing drought makes water conservation critical. Research shows that students can be conduits to educate parents and guardians and even local decision makers about water stewardship. With both youth and adult audiences in mind, the School Water Audit Program (SWAP) was developed with the motto "SWAPping Water Waste for Water Efficiency."

##### What has been done?

Arizona Cooperative Extension professionals led teachers, volunteers and students in implementing two SWAP pilot projects conducted with middle school students during the 2008-09 school year. At Wilson K-8, 10 volunteers spent more than 100 hours performing water audits with 100 sixth graders. Tucson Water donated 200 aerators, 100 low-flow shower heads, 100 shower timers, 100 toilet flappers and hundreds of dye tabs. At Cottonwood Middle School, 18 volunteers including the mayor and the director of the Arizona Department of Water Resources Active Management Area donated over 100 hours working with 120 seventh graders. The City of Cottonwood provided 270 aerators, 72 catch cans, and 250 dye tabs. The four teachers involved with SWAP at those schools participated in training and used the 12-unit (150 page) School Water Audit Program (SWAP) peer-reviewed curriculum. They presented their experiences with SWAP at the National Science Teacher Association conference in Phoenix, and continue to teach with and promote the program. A business has provided funds to implement student recommendation in the next pilot of this program.

##### Impact

Wilson K-8 School: Student data analysis resulted in a projected water savings at Wilson K-8 of 225,000 gallons/year (a 44 percent savings on bathroom and classroom faucets) through the installation of faucet aerators. The annual financial savings through Wilson K-8 retrofits is about \$1,200 using a rate of \$3.58/Ccf or \$.00479/gal. At students' homes, through installation of 112 aerators, 99 shower timers, 85 shower heads and 79 dye tablets and toilet flappers, an estimated 2,486,480 gallons of water and \$1,379 will be saved annually (using a water rate of \$2.28/12,000 gallons).

Cottonwood Middle School: Student data analysis showed a projected water savings of 250,000 gallons/year (a 53 percent savings on bathroom and classroom faucets) at their school through the installation of faucet aerators. The annual financial savings through Cottonwood Middle School retrofits is about \$1,400 using an assumed rate of \$3.58/Ccf or \$.00479/gal. Through the installation of aerators and use of dye tablets to detect leaks in 16 percent of the toilets at the students' homes, an estimated 3,340,480 gallons of water and \$10,355.49 will be saved annually (using a water rate \$3.10/1,000 gallons and toilet savings calculations based on loss of 200 gallons/day for leaky toilets). APW nominated Cottonwood Middle School SWAP for the 2009 Excellence in Economic Development Award for Future Leaders, presented to them by the governor of Arizona at the



Governor's Regional and Rural Development Conference in August 2009.

Volunteer hours for both schools were valued at close to \$4,000, at the Independent Sector volunteer rate of \$19.51 per hour.

## **Issue**

Prolonged drought has reduced water resources in Arizona, making water sustainability a critical issue for all generations. Arizona Project WET (Water Education for Teachers) aims to deepen young students' understanding of water as an interconnected resource, thus helping them to become emissaries of wise water use in Arizona communities.

### **What has been done?**

Arizona Water Festivals use structured Arizona Project WET lessons that meet 4th grade water education standards, covering the water cycle, value of water and conservation, watersheds, and the ground water system. Nine water festivals were held in 2009 in Nogales, Maricopa, San Simon, Sierra Vista, Verde Valley, Payson, Tucson, Yuma and Chandler, serving 4,877 students, 220 teachers and 248 parents. Sixteen community leaders also participated. In addition 104 high school students who served at Arizona Water Festivals also learned these important water concepts. Specialized volunteer training around the state reached 491 volunteers in 2009—the number of students served grows each year.

### **Impact**

Over the past decade, 1,336 teachers have worked with their students to enhance the learning experience of the Water Festival by carrying the learning goals into the classroom. This creates a learning community where teachers and students alike are motivated to learn about water and to work together to protect Arizona's water future. Since 2000, the Arizona Water Festival program has served 33,337 young Arizonans in 20 Arizona communities—youth who are caring for watersheds, conserving water and sharing this knowledge with their friends and families. The hundreds of volunteers trained to deliver effective water education have increased their own water literacy and are now more able to talk about water issues with friends and colleagues throughout the community. One hundred percent of participating teachers agreed that the water festival expand student knowledge on water-related topics, feel that it helps them to teach things they are required to teach in a more effective manner, rate their students' reaction to the festival as "excellent" and feel that the water festival should be repeated in their community; 98 percent agreed that their students are more likely to conserve water after they attend a festival. Volunteers provided 2,554 service hours delivering the festivals, a contribution valued at \$51,719 (using Independent Sector value of \$20.25). One hundred percent of all volunteers surveyed in 2009 said their time was well spent; 98 percent reported they would volunteer again.

## **Issue**

Before 2000, range monitoring workshops had been offered for several years by the University of Arizona, yet range monitoring as a standard operating procedure on Arizona ranches had been sporadically adopted. In 2000, a USDA grant "Reading the Range" was obtained and demonstration ranches for range monitoring were established with technical assistance provided. It was hoped that this practice would encourage neighboring ranches to consider implementing similar practices on their ranches. With continued funding and agency collaboration on workshops, equipment and other needs, the practice of range monitoring has steadily gained more active participants within the ranching community.

### **What has been done**

In an effort organized through the Gila County Extension director, Reading the Range monitoring data was collected collaboratively by the NRCS, US Forest Service, ranchers and their employees and family members, USFS-Rocky Mountain Research Station, private consultants, and other interested parties from August to December of 2009 on 35 ranches. Ten Extension reports (1,725 pages total) were completed in 2009 for monitoring conducted in 2007, and extensive time was spent setting up databases for all ranches to accommodate electronic data entry in the field with touchpad computers purchased in 2008 and 2009. A series of talks on various critical aspects of range management were presented at conferences and workshops for ranchers across the state in 2009.

### Impacts

From the original six participants enrolled in Reading the Range in 2001 on 100,000 acres, the program has expanded exponentially to now include 37 ranches encompassing 1,041,384 acres. On the Tonto National Forest, 30 percent of grazing allotments are now enrolled in Reading the Range and USFS officials recommend involvement in the program for new ranch owners. Data are being collected from 197 key areas and the results are being incorporated into NEPA (National Environmental Policy Act) documents on the Tonto National Forest. The touchpad computers have been successfully integrated into range monitoring by clientele from 9 to 69 years old; among them are some who had never used a computer. Written testimonials:

"You and your program are a treasured asset to us and others who value responsible use of the land we're entrusted with." -  
-from a new participant

"Without this program I think we would be out of luck again. Each year I learn from the monitoring and appreciate the knowledge you share." --from a continuing participant

"From my perspective I can't thank you enough for all the work you provide here for the Tonto, not to even mention the benefits to our people for training and orientation...Your efforts are truly making a difference on the Tonto." --from a USFS regional director of rangeland management

### Issue

All communities in the White Mountains Zone of Arizona's Navajo, Apache and Greenlee counties are listed as "at risk communities" in the Federal Register with respect to catastrophic wildfire. At the national level, forest health sustainability, along with wildland fire risk mitigation, prevention and education are part of a priority program under the direction of USDA-NIFA. The Healthy Forest Restoration Act (JFRA) prioritized Community Wildfire Protection Plans (CWPPs) and their implementation. NIFA and the University of Arizona have adopted Firewise USA as an applicable community and property owner education and implementation tool for comprehensively addressing wildland fire community risk issues. Local governments throughout the area determined that effectively addressing the risk to local communities was a priority and requested Cooperative Extension to provide leadership, on the ground development and programming facilitation.

### What has been done

As part of an ongoing effort that continued in 2009, Arizona Cooperative Extension in Navajo County increased fire mitigation awareness by developing a comprehensive program that includes education guides, training, assessments and a highly visible demonstration area in cooperation with local communities. The Navajo County Extension director was a co-author on the NRCD's national publication, NACD Community Wildfire Desk Guide, published in June 2009. The handbook addresses how to prepare for, respond to and recover from a catastrophic wildfire in and around rural communities. The 2009 Sitgreaves Community Wildfire Protection Plan Report was developed and published through the Navajo County Cooperative Extension office.

### Impact

In 2007, vegetation reduction to cut wildfire risk was carried out on 2,700 acres in local communities through grants and through the Community Wildfire protection Plan, followed in 2008 by an additional 480 acres thinned in the communities and more than 5,000 acres thinned by the US Forest Service. In 2009, 1,400 acres of private and 8,600 acres of public land were thinned for health and fire risk reduction. Totals to date are 7,580 acres of private and 64,600 acres of forest treated to reduce wildland fire intensities.

Local communities have developed and implemented CWPP statutes and ordinances that make them safer for residents. Included in the mapping and reporting process are 6,373 properties; of these, 2,677 property owners have completed necessary fuels reduction hazard mitigation or forest health treatments on their properties. This has created a mosaic of fuel breaks across local communities that will limit fire behavior and increase the potential for defending populated areas if a major wildfire starts. Forest contracts developed through associated with the restoration efforts on public land through this project have generated \$53 million in revenue. Of this, a UA economist determined that with multipliers and improvements to local communities the total economic impact in the regional area has been \$97 million over the past six years, with the impact in the past year coming in at approximately \$26 million. There has been a social and cultural shift locally, evidenced by recent votes, work being done on private property and a general acceptance of the basic concepts of wildland fire and forest health, including the expenditure of over \$6,350,000 on property treatments for forest health and fire mitigation/prevention.

**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

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	15000	20000	6000	500
<b>Actual</b>	13500	19500	6800	1100

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 1  
 Actual: 1

**Patents listed**

UA09 119Algae Raceway Integrated Design

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	10	48	58

**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	Target	Actual
2009	2	2

**Output #2**

**Output Measure**

- Number of individuals participating in educational programs

Year	Target	Actual
2009	15000	13000

**Output #3**

**Output Measure**

- Number of individuals adopting new technology

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	1000	900

**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 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	35	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
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	Quantitative Target	Actual
2009	10000	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
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

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
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2009                      350                      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
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

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	8000	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
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

Continuing reductions in state budgets place a significant strain on all programs.

#### V(I). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- After Only (post program)

##### Evaluation Results

No formal evaluations conducted

##### Key Items of Evaluation

**V(A). Planned Program (Summary)**

**Program # 3**

**1. Name of the Planned Program**

ANIMAL SCIENCES

**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	6%		4%	
302	Nutrient Utilization in Animals	19%		17%	
305	Animal Physiological Processes	19%		20%	
306	Environmental Stress in Animals	8%		10%	
311	Animal Diseases	48%		49%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	22.0	0.0
Actual	2.0	0.0	8.0	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
35034	0	93937	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
432090	0	765729	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

Issue

Most people are familiar with Salmonella and its potential to make people ill. But few know about Campylobacter jejuni, even though it competes yearly with Salmonella in making people sick. Campylobacter is one of the main causes of bacterial foodborne disease in the United States and worldwide. Raw chicken is one of the most common carriers of the bacteria. In the U.S. alone, 2.4 million cases are reported annually, with costs exceeding \$1 billion. Americans consumed 86 pounds of chicken per person in 2006, the most recent numbers available.

**What has been done**

Funded by the USDA, faculty and graduate students in the UA Department of Veterinary Science and Microbiology have developed a new poultry vaccine using an attenuated strain of Salmonella to express Campylobacter proteins in chick intestines. The vaccine induces the chicks to make antibodies against Campylobacter, resulting in lower Campylobacter carriage in poultry, ultimately less Campylobacter transferred to humans and therefore significantly fewer foodborne illnesses. The vaccination process is simple, easy to produce and protective to the chick. The Salmonella is engineered to live long enough to stimulate antibody production, but dies before the chicks are harvested. Chickens need to be vaccinated early because they become infected at just two to three weeks of age. The goal is to halt the contamination before it spreads and survives on raw chicken sold in stores. The vaccine may be available in two to three years.

**Impact**

Ongoing research trials show the vaccine has significantly reduced the pathogen's ability to colonize young chickens' intestines. Preliminary studies indicate that Campylobacter infection was reduced by 99.9 percent compared with a control group: 4.4 million Campylobacter organisms were present in non-vaccinated birds, compared to 5,220 organisms in the vaccinated birds. At least 500 organisms are needed to produce the disease in humans, but the chlorine in the packinghouse chillers usually reduces bacteria by 1,000 to 100,000 organisms. Vaccinated chickens should be free of Campylobacter after processing, according to the researchers who are refining the vaccine. The vaccine's effect could be significant, as the U.S. poultry industry is the world's largest producer of poultry meat: about 8.9 billion broilers go to market annually in the U.S. , with a value of \$21.5 billion. Europe has similar broiler production figures. The vaccine would serve as an intervention method for Campylobacter when the USDA mandates reduced numbers of food-borne pathogens in chicken, most likely in the next few years.

**2. Brief description of the target audience**

Commodity groups, state agencies, producers, youth.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	300	100	1500	200
<b>Actual</b>	275	95	1400	180

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 1  
 Actual: 1

**Patents listed**

UA10 022Control of Milk Production and Mammary Involution

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	10	20	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  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Create awareness and increase knowledge  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Expand participation in our Annual Cow College program

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	100	200

**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 beef cattle for arid land conditions

**Outcome #1**

**1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	50	30

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

**Issue (Who cares and Why)**

Adoption of breeds that are the most profitable in the desert southwest is important to livestock producers

**What has been done**

Various crosses and breeds have been tested at the V-V Ranch for production efficiency

**Results**

Results of these tests have been summarized and presented to livestock producers

**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

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

1. Evaluation Studies Planned

- After Only (post program)

**Evaluation Results**

No formal evaluations performed.

**Key Items of Evaluation**

**V(A). Planned Program (Summary)**

**Program # 4**

**1. Name of the Planned Program**

MARKETING TRADE AND ECONOMICS

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
605	Natural Resource and Environmental Economics	80%		80%	
610	Domestic Policy Analysis	20%		20%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of professional FTE/SYs expended this Program**

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	4.0	0.0
Actual	2.0	0.0	4.0	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
5081	0	21663	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
325543	0	341994	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**

Issue

The financial crisis that hit the United States in 2009 affected numerous sectors of the American economy, including agricultural enterprises. To present critical information to agricultural producers quickly, without requiring speakers or the audience to travel, a webinar was designed and presented through the Western Extension Committee, an organization of extension economists from the 13 western states, Guam and other Pacific Islands .

What has been done

In 2009, the five-part webinar "Ag in Uncertain Times" featured 17 live, interactive 90-minute seminars on the following areas: operating in the face of uncertain credit; operating in the face of uncertain markets; families facing uncertainty in agriculture; operating in risky environments; and managing agricultural enterprises in uncertain times. More than 40 professionals and



leading industry experts were accompanied by live audio, Powerpoints, videos and slides, with questions taken using a chat feature during each presentation. Software and hardware were provided through Montana State University, with numerous individuals nationwide participating in presenting and/or moderating discussions in June, September, October, November and December. Institutions providing personnel and resources included the University of Arizona; University of California Davis; Colorado State University; Montana State University; Western Center for Risk Management Education and Washington State University; University of Wyoming; and University of Minnesota Center for Farm Financial Management. The entire series of webinars remains available online as a resource for the agricultural industry and for extension educators to download and use as needed.

**Impact**  
A pioneering effort, the "Ag in Uncertain Times" webinar drew widespread interest for each session offered during 2009. Between June and December, the time frame of the webinar series, the number of "unique" visitors to the site was 6,519, with 304,060 hits.

Participants ranged across the United States, with 55 percent from the western region; 26 from the central region; 9 percent from the northeast, 7 percent from the southeast, and 3 percent from areas outside the U.S. The audience included agricultural producers; agribusiness members; agricultural lenders; consultants; educators; and others. Praised as a unique, timely way to reach a wide audience simultaneously with a wealth of practical, expert information, the webinar was nominated for and received the 2010 Western Agricultural Economics Association Outstanding Extension Program Award, for Project.

#### Issue

The primary objective of Risk Management Education (RME) is to serve as a key resource for information and applied research analyses related to marketing and management issues surrounding Arizona's agricultural production inputs and commodities—particularly critical during the current economic downturn.

#### What has been done

During 2009, Risk Management Education (RME) was delivered to an estimated 953 producers and government agency personnel through oral conference presentations and hands-on computer workshop trainings primarily in Arizona, but also in Colorado, Nevada and Utah. Sample titles of presentations include "Determining Economic Value of Cutouts and Livestock Market Situation" (to Navajo, Hopi and Tohono O'odham tribal ranchers); "The Changing Beef Industry: Input costs, Consolidation, and MCOOL," (to ranchers); at Southwest Marketing Network (SWMN) Conference: "Keeping the Younger Generation in the Community and on the Farm" and "Developing a Sound Business Plan," among many others.

#### Impact

When workshop participants were solicited on the odds that they would incorporate any of the information covered into future decisions that would favorably impact the financial position of their operation, 34 percent indicated there was an excellent chance this would occur and 58 percent gave a good chance of this occurring. Over 99 percent of the participants reported that the RME trainings were worth their time to attend. When asked how participants rate the relevance of topics presented at the RME trainings for their operation, 44 percent said the topics were excellent and 49 percent said they were good. Finally, 87 percent noted that the odds are good or excellent that they will incorporate something they learned from an educational event that will favorably impact the profitability of their operation. Written testimonials:

"The financial management system will help me understand my operation, determine trend of business and be more accountable."

"If my son can work it, why not me."

"This simple ranch form looks like I could use it and get some good feedback."

"Your workshop helped me better realize the factors limiting profitability of my operation."

"Workshop will alter how I track changes on livestock records, financial assets and liabilities."

"More effective way to evaluate alternative management decisions and see what is influencing the profitability of our ranch."

**2. Brief description of the target audience**

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

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	200	300	0	0
<b>Actual</b>	250	300	0	0

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

Year: 2009

Plan: 1

Actual: 0

**Patents listed****3. Publications (Standard General Output Measure)****Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	12	28	40

**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

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased financial stability of Arizona's producers
2	Number of individuals gaining knowledge by participating in educational programs
3	Adoption of management practices that assure a safe food supply

## **Outcome #1**

### **1. Outcome Measures**

Increased financial stability of Arizona's producers

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	500	475

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

## **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 Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	200	6000

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

**Issue (Who cares and Why)**

The 2009 financial crisis has hit the nation's agricultural enterprises.

**What has been done**

To present critical information to agricultural producers quickly, without requiring speakers or the audience to travel, a webinar was designed and presented through the Western Extension Committee

**Results**

Between June and December, the time frame of the webinar series, the number of "unique" visitors to the site was 6,519, with 304,060 hits.

Participants ranged across the United States, with 55 percent from the western region

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

**Outcome #3**

**1. Outcome Measures**

Adoption of management practices that assure a safe food supply

Not Reporting on this Outcome Measure

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- After Only (post program)

### **Evaluation Results**

No formal evaluations conducted.

### **Key Items of Evaluation**

**V(A). Planned Program (Summary)**

**Program # 5**

**1. Name of the Planned Program**

FAMILY, YOUTH, AND COMMUNITY

**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	40%		40%	
806	Youth Development	60%		60%	
<b>Total</b>		100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	23.0	0.0	5.0	0.0
Actual	20.0	0.0	5.0	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
14949	0	10094	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
136157	0	119427	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

Issue

Physical inactivity and poor dietary habits have been associated with increased risk of weight gain, diabetes, heart disease and metabolic syndrome. The Arizona Department of Health reports that obesity and overweight affect 60 percent of Arizona 's population. Nationwide, 18 million people have full-blown diabetes and another 41 million already have pre-diabetes. Almost 65 percent of adults are either overweight or obese and 20 to 30 percent of children are overweight or at risk for becoming overweight. In light of the links to adverse health outcomes and the continued increase in the prevalence of overweight and obesity in the United States , promoting daily physical activity has emerged as an important strategy for obesity and disease prevention efforts. Walking is a local, inexpensive and convenient way to develop fitness and healthy habits.

What has been done

The "Walk Across Arizona" grassroots initiative started in 2001 as a pilot project in an Arizona retirement community. It has since expanded statewide with 14 of the 15 Arizona Counties participating at some point. In 2009, the walking program was reorganized and changed to an 8-week walking program designed for teams of 10 people each, administered through Arizona Cooperative Extension and the UA's Community Health Advancement Partnership. Teams of friends, neighbors, co-workers and families include people of all ages, from children to senior citizens. Each county has a link on the Walk Across Arizona site, where team captains can access forms and record weekly miles, and county coordinators can manage the program and update local activities. Nutrition, energy levels, social interaction and other factors are also tracked. Weekly newsletters provide encouragement to increase physical activity, vegetable and fruit consumption with tips and nutritious recipes.

#### Impact

During 2001, the first year of the campaign, 34 teams with 329 registered participants walked 48,872 miles. Statewide since its inception, 1,088 teams with 9,529 participants (some repeated) from 14 of Arizona's 15 counties have reported walking over 2 million miles. Data analyzed from exit surveys of 2009 participants identified the top three benefits of participation: 1) Increased exercise they were already doing (49%), 2) Increased their energy levels (32%), and 3) Helped them to feel less stressed (31%). Participants reported walking more miles during the second half of the campaign and increased their vegetable and fruit consumption according to a comparison of pre and post reported behavior.

#### Issue

Recent figures released by the Centers for Disease Control and Prevention showed that Arizona's teen birth rate remains well above the national average. Arizona's rate of 62 births per 1,000 female teenagers age 15-19 was the fifth-highest in the nation. Santa Cruz County is one of the counties in Arizona with the highest teen birth rates. Nearly 40 percent of the births in Cochise County, Arizona are from unwed mothers, according to 2007 figures from the Arizona Department of Health Services. In 2008, Child Protective Services noted that 59 percent of reported child abuse cases were related to neglect; 34 percent of the reports were related to physical abuse. According to the Arizona Department of Economic Security (2008), "Working with families before inappropriate parenting practices begin is essential. Studies show that nationwide, 80 percent of all severe abuse incidents occur among children under age five, and most child deaths from abuse or neglect occur at an average age of 2.6 years. The first few years of life are a critical developmental period and abuse or neglect during this time severely impacts normal development." Imaging techniques developed in the 1990s called PET scans allow researchers to understand how the brain works and the importance of early development. Disseminating this research to parents and early care and education professionals is critical. It is now recognized that early child development has a lasting impact on a person's development, their ability to learn and their capacity to regulate their emotions over the life span (National Research Council, 2005).

#### What has been done

Four Arizona Cooperative Extension agents developed a peer reviewed "Brain Builders for Life" curriculum to use in statewide 16-hour training institutes offered to childcare providers. Extensive recruitment was conducted by mailing information about the institute to each registered childcare provider in the state. As a result, 102 participated in Graham, Greenlee, Cochise, Santa Cruz and Pima counties; 60 in Apache, Navajo, Coconino and Yavapai counties; 130 in Maricopa County; 35 in Pinal and Gila counties; and 32 in Yuma County. Participants took pre-post tests and recorded in their journals their comparisons of the teaching material to their childcare experiences. The goal was to increase caregivers' childcare skills, and their knowledge of brain development at different life stages. Despite limited state funding due to budget cuts, the Department of Health and Human Services provided a grant to help administer Brain Builders information statewide. The program received a competitive grant from Department of Economic Security Child Care Administration provided a grand to help administer Brain Builders For Life information statewide.

#### Impact

According to pre- and post tests, participants in the Brain Builders program improved their knowledge of brain development by more than 40 percent; prenatal development, nearly 70 percent; physical development, about 14 percent; emotional and social development, nearly 60 percent; and cognitive development, almost 70 percent. Journal examples of the techniques participants learned and how they used them with children in their care included: "...I have been working with a very difficult child...experts have observed him...it's funny how one thing you guys said gave me a clearer idea of how to deal with his behavior" (Pima County participant). Example of how they would improve

their childcare with the information acquired in the classes: "Talk to your kids instead of spanking them because they learn so much more through talking than spanking" (Nogales participant); 98 percent of the participating childcare providers rated the training as excellent.



**2. Brief description of the target audience**

Parents, educators, youth, community groups

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	6500	100000	70000	45000
<b>Actual</b>	7200	101000	76000	50000

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

**Patent Applications Submitted**

Year: 2009

Plan: 0

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	18	17	35

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of individuals participating in educational programs

Year	Target	Actual
2009	70000	55000

**Output #2**

**Output Measure**

- Number of educational events, training workshops and clinics

Year	Target	Actual
2009	215	200

**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	Quantitative Target	Actual
2009	7000	7100

**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

Not Reporting on this Outcome Measure

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

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

**Brief Explanation**

The poor state and national economy has had a detrimental effect on all of our programs.

**V(I). Planned Program (Evaluation Studies and Data Collection)**

1. Evaluation Studies Planned

- After Only (post program)

**Evaluation Results**

No formal evaluations conducted

**Key Items of Evaluation**

**V(A). Planned Program (Summary)****Program # 6****1. Name of the Planned Program**

HUMAN NUTRITION, HEALTH AND FOOD SAFETY

**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	25%		33%	
703	Nutrition Education and Behavior	42%		36%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	33%		31%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

## 1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	9.0	0.0
Actual	7.0	0.0	6.0	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
0	0	15800	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
311799	0	245311	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

Issue

EFNEP, the federally funded Extension Food and Nutrition Education Program, addresses the needs of low-income, minority families and youth nationwide. The goal is to teach families with children how to stretch their limited food dollars, plan and prepare nutritious foods and make informed choices about food and other lifestyle issues that support family health and well-being. Funded nationally by the USDA, EFNEP is staffed locally in each state and the U.S. territories by Extension-trained nutrition educators.

What has been done?

Arizona's EFNEP program is offered in 5 of the state's 15 counties—Cochise, Maricopa, Pima, Pinal and Santa Cruz. The national standardized EFNEP curriculum includes classes on family nutrition and diet for good health, meal planning and food preparation, comparison shopping and food safety. Food or vouchers for food are not provided to participants. The goal is to help adults and youth change their behavior by learning how to select nutritionally sound diets, thus promoting family health and nutritional well-being. In 2009, EFNEP served 2,768 program families (representing approximately 8,500 to 10,000 family members) who attended classes across Arizona. Youth numbered 6,521 (an increase from 4,702 youth last year); 94 percent of youth participants were 5<sup>th</sup> grade or younger. The Arizona EFNEP program included 61 percent minorities (Hispanic, African-American and American Indian); 49 percent of EFNEP adults participated in one or more food assistance programs such as food stamps or WIC. About 370 volunteers assisted with family nutrition education.

#### Impact

Ninety-eight percent of the 2,768 participants completed their classes, up from 96 percent of 3,069 adults in 2008. Post-participation dietary surveys from 2,768 persons showed that overall 58 percent improved their food resource management skills, 63 percent improved their nutrition practices and 51 percent now follow recommended food safety practices. Their food resource management skills increased from 22 to 43 percent and food safety practices increased from 42 to 73 percent after program participation; 2,109 now participate in some type of physical activity daily

#### Issue

The powdered roots and/or extracts derived from roots of the winter cherry plant—*Withania somnifera* (L.) Dunal—have been used for more than 3,000 years in India as a general tonic to build stamina, improve mental concentration, relieve stress and enhance health. Commonly known as "ashwagandha" in Ayurvedic medicine, scientific tests on the preparation have shown that it has anti-inflammatory, cardio-protective, antioxidant and antitumor properties, among others. *Withania* is widely cultivated for commercial use in its native India, and also in the Middle East and in North America. Ashwagandha is sold as a dietary supplement in the United States and Europe. The compound withaferin A, scientifically studied since the 1960s, seems to play the largest role in the plant's anticancer effects by reducing tumor mass and preventing the growth of blood vessels that make a tumor malignant. It also shows promise in treating Alzheimer's and Parkinson's diseases.

#### What has been done

University of Arizona scientists at the Southwest Center for Natural Products Research and Commercialization (or Natural Products Center), in collaboration with the Whitehead Institute at the Massachusetts Institute of Technology, have discovered a second form of withaferin that has identical functions in a less potent, slower-acting form that might be used as a "prodrug," or drug precursor in the pharmaceutical industry. The UA team used an entirely nontraditional method—*aeroponics*—to produce bulk amounts of withaferin A needed for biological evaluation. In aeroponics, plants are set over enclosed chambers where their suspended roots are misted with water and nutrients, instead of growing in soil. The UA College of Agriculture and Life Sciences provided funding for the project, along with the USDA.

#### Impact

Using the aeroponic system for cultivation yielded *Withania* plants with five times the biomass produced in soil-grown plants. The nontraditional method produced more than 20 grams of the active ingredient withaferin A in a single greenhouse operation in Tucson. Withaferin A normally costs about \$195 for just 10 milligrams, thus the potential value of the test crop was about \$390,000. And although *Withania* usually takes two to three years to mature to sizeable roots to be commercially viable, it took just six to nine months in this study.

Not only did the aeroponic method yield bigger plants faster, with more withaferin A than usual, it also unexpectedly stimulated the plants to produce large amounts of a new natural product—a water soluble sulfate form of withaferin A. Upon testing, this new form demonstrated the same bioactivity as withaferin A. The researchers found it was able to inhibit the proliferation and survival of tumor cells, disrupt tumor formation and induce the healthy cells' heat-shock response to reduce stress and increase survival. The difference is that the sulfate form of withaferin A is slower acting and water soluble, and can be converted to withaferin A in cell culture media. The researchers, expecting that this withaferin A analog will convert to its active form when metabolized in the body, are pursuing further testing in animal models. The patent will be held by the UA and MIT.

Withaferin A is just one of hundreds of such compounds the Natural Products Center has isolated, characterized and evaluated since its inception in 1996. The center searches for compounds in desert plants and their associated microorganisms

## 2. Brief description of the target audience

General public, educators, health professionals, extension educators

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	25000	25000	600	20000
<b>Actual</b>	20000	20000	700	18000

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

**Patent Applications Submitted**

Year: 2009

Plan: 1

Actual: 1

**Patents listed**

UA09 032Novel Active Inhibitors for Akt

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	5	0	5

**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  
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	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

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2009	2000	1950

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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	Quantitative Target	Actual
2009	5000	4750

### 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

### 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 and Data Collection)

#### 1. Evaluation Studies Planned

- After Only (post program)

#### Evaluation Results

No formal evaluations performed

#### Key Items of Evaluation