

# 2011 New Mexico State University Combined Research and Extension Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

New Mexico (NM) agriculture must remain competitive in U.S. and world markets. This requires a continuous flow of appropriate technology addressing local needs within New Mexico. It is critical that the College maintains and strengthens programs that address these needs. The College recognizes that agricultural competitiveness and efficiency should take into account social and environmental costs. Determining these factors requires a coordinated, team approach within the College and among researchers and Extension faculty.

New Mexico Cooperative Extension has a tremendous role in helping to keep New Mexico's agricultural economy strong particularly in light of international border competition issues. Drought and water disputes, use of expansive range lands, invading diseases and pests, and national economic downturns, all play a role in maintaining, retaining and building New Mexico's agriculture infrastructure. Extension specialists and agents are working toward resolving conflicts through researched solutions, mediation through involvement of clientele in problem solving, incorporation of technology applications whenever feasible, and continuous reintroduction of tried and true practices.

New Mexico is continuing work to ensure an adequate and safe food and fiber system. Researchers continue to address promotion of regulatory compliance, product process development, food safety (contamination and protection) and sanitation, and marketing of specialty food products. Target audiences include clientele in nearly every county along with Native American meat processors and many farmers' market groups. A challenge in programming is to deliver the same basic message at several different levels of complexity to non-technical audiences, multicultural, and multilingual populations, as well as scientists and industry clientele. Research and education complement each other in the on-going efforts to control and reduce the introduction of pathogens into the food supply. While researchers are constantly seeking ways to reduce or eliminate contamination in the production and processing of food products, extension personnel are working with food handlers to ensure the safe delivery of food and food products from farm to consumer.

Even though New Mexico has a strong agricultural based economy, hunger issues persist for children and families. Extension efforts will continue to focus on improving the accessibility of food that is nutritious, safe, culturally acceptable, and affordable in both rural and urban areas. Food safety and security outreach will include strategies and programs aimed at both consumer and producer education. Extension specialists, agents and educators will continue to implement food safety programs targeted to food managers and handlers, as well as to home food and specialty farm producers and consumers.

A healthy, well-nourished population can be a consequence of access to, safe processing of, and delivery of nutritious foods particularly in households that are economically and nutritionally at risk. Even though agricultural and commercial advances have resulted in abundant food at ever-lower prices, many New Mexico households continue to face obstacles in securing a healthy, well-nourishing diet.

Barriers include a lack of resources and a limited understanding of nutrition. New Mexico State University (NMSU) works annually on strengthening food and nutrition programs and doing research

designed to alleviate barriers and improve the nutrition, well-being, and food security of NM citizenry. Agricultural Experiment Station researchers address the research needs of the agricultural products grown in NM. Cooperative Extension faculty deliver food preparation and nutrition education programs. In this tricultural state, not all households choose to consume food in accordance with dietary recommendations nor is regular exercise part of a daily or weekly routine (47.2% are inactive). In recent years, the focus of nutrition and health policy has shifted, because for many Americans, the problem is now one of overconsumption of certain foods or components. In fact, 4 of the top 10 causes of death in the United States are associated with diets that are too high in calories, total fat, saturated fat, or cholesterol or too low in dietary fiber. Improvements in diet and health can reduce illness and productivity losses, improve educational attainment, and prevent premature death. Solutions center on education to improve consumer understanding, behaviors, and food choices. New Mexico has a rich and diverse land and natural resource base that is arid and semiarid and, in many respects, extremely fragile. This natural resource base is a major contributor to the economic well-being of the state's residents. Its economic uses result in demands for various resources. In addition to direct demands for land and water, there is increasing pressure for recreation-related activities that represent a growing economic opportunity. Activities related to the state's natural beauty and its wildlife make a major contribution to the economy. The potential to develop, manage, and protect natural resources needs to be encouraged.

Both rural and urban human activities can pollute land, water, air, and food. Through teaching, research, and Extension programs, the New Mexico State University College of Agriculture and Home Economics is committed to furthering our understanding of human impact on the environment, and to supporting environmentally-sound agricultural and natural resource practices. The College will continue its efforts to understand the interaction between the environment and production agriculture. New Mexico's future is increasingly tied to regional environments and a global economy. Clearly defined regional and international perspectives are essential for the programs of the College. The University's traditional programs can be enriched by regional and international components and thereby better achieve their full potential.

International activities enhance global understanding incorporating international dimensions into the ongoing instruction, research, and Extension efforts of the College. Graduates of the College need an education that will allow them to achieve success in a global economy. They must have the skills necessary to keep New Mexico a supplier of food and fiber throughout the world and keep New Mexico a destination for tourists from around the world.

Economic opportunity and quality of life vary greatly for New Mexican. New Mexico still suffers from some of the highest statistics nationally relative to families with children poverty levels, per capita retirement incomes, numbers of high school graduates, illiteracy, crime, unemployment in rural communities, teen-pregnancy, and uninsured motorists among other unsatisfactory figures. Addressing the quality of life issues is a core piece in New Mexico Extension's educational effort.

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	38.5	0.0	61.0	0.0
Actual	23.4	0.0	56.4	0.0

## **II. Merit Review Process**

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

- Internal University Panel
- External University Panel
- External Non-University Panel

### **2. Brief Explanation**

Projects are reviewed by faculty of the College of Agricultural, Consumer and Environmental Sciences. When necessary or appropriate, we have faculty from outside our college review projects.

## **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 non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of the general public
- Survey specifically with non-traditional groups

#### **Brief explanation.**

See above checklist.

### **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.**

See above checklist.

**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
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

**Brief explanation.**

See above checklist.

**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.**

See above checklist.

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

National priorities often are not aligned with state needs and priorities.

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>
2037183	0	2052276	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>	2270622	0	4975446	0
<b>Actual Matching</b>	2270622	0	4975446	0
<b>Actual All Other</b>	0	0	0	0
<b>Total Actual Expended</b>	4541244	0	9950892	0

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

## V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Sustainable Management of Natural Resources
3	Agricultural Markets, Trade, and Economic/Business Development
4	Food Safety
5	Health and Wellbeing
6	4-H and Youth Development

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

**Program # 1**

**1. Name of the Planned Program**

Global Food Security and Hunger

**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	8%		8%	
202	Plant Genetic Resources	8%		8%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	6%		6%	
204	Plant Product Quality and Utility (Preharvest)	6%		6%	
205	Plant Management Systems	8%		8%	
211	Insects, Mites, and Other Arthropods Affecting Plants	7%		7%	
212	Pathogens and Nematodes Affecting Plants	7%		7%	
213	Weeds Affecting Plants	6%		6%	
215	Biological Control of Pests Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	6%		6%	
301	Reproductive Performance of Animals	7%		7%	
302	Nutrient Utilization in Animals	8%		8%	
303	Genetic Improvement of Animals	3%		3%	
304	Animal Genome	1%		1%	
305	Animal Physiological Processes	5%		5%	
306	Environmental Stress in Animals	1%		1%	
307	Animal Management Systems	7%		7%	
308	Improved Animal Products (Before Harvest)	1%		1%	
	<b>Total</b>	100%		100%	

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

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

<b>Year: 2011</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>

Plan	3.0	0.0	6.6	0.0
Actual Paid Professional	11.7	0.0	31.1	0.0
Actual Volunteer	20.2	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
887369	0	2574264	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
887369	0	2574264	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

This research demonstrated that responses to supplementing newly received feedlot calves with rumen-protected branched-chain amino acids are variable. An initial study demonstrated that rumen-protected branched-chain amino acids improved performance and the adaptive immune responses of newly-received feedlot steers. However, a second study at the Clayton Livestock Research Center showed that supplementation of rumen-protected branched-chain amino acids for 28 days after initial processing increased dry matter intake, but did not improve performance and health of newly received feedlot calves. Additionally, our research demonstrated that plasma amino acid concentrations decreased in bottle-fed Holstein calves exposed to an endotoxin. This suggests that metabolic demand for amino acids may increase during periods of immunological stress. However, fortifying a 20% crude protein milk replacer with additional essential amino acids did not improve nitrogen retention of bottle-fed calves, which implies that the milk replacer was not limiting in essential amino acids. This research provides insight towards providing nutrition to target improved animal immunity by identifying those amino acids that are limiting in newly weaned beef calves, thereby providing the opportunity to reduce calf morbidity. If this effort reduces calf morbidity by only 2% annually, savings to the United States beef industry is estimated to be \$12 million/year (based on 600 million/year morbidity loss).

A study was performed to determine if mRNA for CXCL12 and CXCR4 is differentially expressed using real-time PCR (qPCR) in blood from pregnant and cyclic ewes. In jugular blood samples, the greatest expression of CXCL12 mRNA was on day 35 of gestation and was significantly ( $P < 0.05$ ) elevated compared to all days tested. A similar expression pattern of CXCL12 was observed in uterine vein samples with the greatest expression on day 35 of pregnancy. Expression of CXCR4 was detected on all days but did not differ. Ruminant pregnancy is characterized by changes in immune cell populations in the periphery and these changes are likely important for conceptus protection. The increase in CXCL12 in peripheral blood is interesting as it correlates with placentation in sheep. The CXCL12/CXCR4 system may affect migration of immune cells into the uterus and aid in fetal-maternal tolerance. CXCL12 mRNA in white blood cells from both jugular and uterine vein samples exhibited a similar expression pattern, with peak CXCL12 observed on Day 35 of pregnancy. As gene expression of CXCL12 is increased in peripheral blood cells from sheep during early pregnancy, it is conceivable that detection of CXCL12 in



blood could serve as a pregnancy diagnostic tool. Data from the current study provides a solid foundation for future study of CXCL12 and CXCR4 functions during implantation and placentation in domestic ruminants.

The New Mexico Recombinant Inbred Lines (NMRILs) are having a significant impact on understanding the host/pathogen interaction of *C. annuum*/*P. capsici*. Currently, the NMRILs are the standard for race differentiation in the world. As demonstrated with the Brazilian collection of isolates, the ability to identify new physiological races, can aid breeding for a durable resistance. New physiological races identified in Brazil, gives the plant breeder in the U.S.A., a head start on breeding for future physiological races that may occur in U.S.A. Anticipatory breeding, which has been successful with breeding for wheat rust, can now be applied to phytophthora blight. This host/pathogen interaction is becoming a model for studying the functional aspects of disease resistance to two very different disease syndromes, root rot and foliar blight. The results from these studies will give insight into host resistance and lead to a better understanding of the mechanisms underlying durable resistance. For instance, the NMRILs as a host differential have been used to track the virulence variability in New Mexico and will continue to assist in breeding for cultivars that are resistant to the physiological races of the pathogen in a specific area. Pyramiding combinations of race-specific resistance genes against *P. capsici* isolates specifically for a given region instead of searching for a universal resistant cultivar will benefit pepper growers.

Research is identifying grape and hops cultivars for elevations up to 6,000 ft. This research is also examining the potential to grow some medicinal herb species. Two workshops on managing risks associated with growing southwestern medicinal herbs were attended by over 40 people. An online tutorial is making the workshop material accessible to the widest possible audience. Focus group results are guiding Gardens for Health intervention development phases. Cooperators include Navajo Technical College, Dine College, San Juan College, BIA, and Fred Hutchinson Cancer Research Center.

Since 2005, sorghum grown for silage has increased 79% and statewide production has nearly doubled over the past 5 years from 210 to 400 thousand tons. This indicates that producers are learning of the benefits of forage sorghum, particularly the water-saving benefits that allow for money savings and disaster prevention. In addition, milk production in New Mexico has increased 17% over the same period, indicating that increased feeding of sorghum silage has not negatively impacted milk production as some feared. Producers have been educated on best management practices of forage sorghums and corn in limited irrigation situations and their knowledge has been increased significantly about such systems. It is evident that awareness of the urgency to produce more water-conserving crops has been increased as the landscape has changed, particularly in eastern New Mexico, to include more irrigated sorghum crops (both silage and hay). This has only been strengthened due to extreme droughts in 2011. The variety testing program is used to evaluate variety and hybrid adaptation to both irrigated and dryland growing scenarios in eastern New Mexico. Use of better-adapted varieties allows growers to utilize their resources more efficiently and leads to economic savings. Particularly, more efficient water and nitrogen utilization contributes to conservation efforts and sustainable agricultural production. Requests for variety information are on the rise, especially with respect to forage sorghums, which are gaining popularity in silage productions systems that are hindered by limited water quantities.

Urban residential vegetation characteristics and climate data were integrated into a web interface that allows homeowners to use historical, current, and predictive climate data to determine water budgets. The web interface could be used as a decision tool to reduce drought vulnerability of urban landscapes.

Mature pecan orchards maintained with resident vegetation showed accelerated soil dry-down compared to a weed-free control, but differences in physiological water stress could not be detected. This suggests that vegetated row middles (useful for preventing soil erosion, increasing soil organic matter and furnishing habitat for beneficial insects) does not present a likely problem for maintaining high irrigation

water use efficiency in mature pecan orchards.

New Mexico is a small cotton production state with many small cotton farms which are still growing saved Acala 1517 seed in 2011. However, information on the acreage of Acala 1517 was not officially collected. The newly released Acala 1517-08 increased lint yield by 20% and its replacement of older Acala 1517 cultivars will have significant economic impact. When this new cultivar is grown in 20% of the cotton acreage (50,000 acres) in New Mexico, its yield increase will be translated to 2 million pounds of more fibers, equivalent to 0.2 million dollars.

Several new advanced lines averaged 20-25% more yield than Acala 1517-08 based on multiple tests and their commercialization will further improve the net return (by 0.2 million dollars) for cotton producers in New Mexico. Furthermore, the transgenic cotton carrying the auxin gene will further increase cotton yield by 15% (0.15 million dollars). Therefore, cotton yield potential in New Mexico has increased by 65% over a 10-year period from 2002 to 2011 through genetics.

Six quantitative trait loci (genetic factors) and candidate gene markers for Verticillium wilt resistance were identified, which will facilitate the understanding of the resistance mechanism in cotton.

A new marker system (miRNA-AFLP) based on small RNA was developed, which provides a useful tool to study relationships between small RNA and fiber traits. A number of DNA markers including SSCP, STS and CAP were developed and reported from fiber candidate genes. This will provide candidate gene markers to study their relationships with fiber yield and quality and for marker-assisted selection. Many drought and salt responsive genes have been identified, which will provide a base for identifying genes responsible for abiotic stress tolerance and for developing candidate gene markers for stress tolerance breeding in cotton.

Once work on the ET internet site has been completed, farmers will be able to access this site and track irrigation water use. They will be able to follow the water use for their crop and determine when to irrigate next. This internet site will help the farmer to use the right amount of water at the right time. As the farmer properly manages the irrigation time and amount, energy and other input costs will be minimized.

Developing a simple spreadsheet tool that will evaluate irrigation pump performance, will help irrigation farmers track energy use and efficiency and help identify any problems that are developing. This tool will identify a problem before thousands of dollars are lost to inefficient pumping.

Developing a low cost, easy to construct water control gate will help irrigation districts and farmers manage water more efficiently. This device will be safer than stop-log structures and individual irrigation districts or farmers will be able to construct this gate with common fabrication tools that they have available.

Canal control algorithms will help irrigation districts determine how much water to divert down canals to meet the water demands of individual farms without sending too much of too little. Water use will be matched to the needs of the water users with little or no waste.

The results of this project will inform plant breeders on the linkage between physical phenotype, nutritional composition and genetic variability for three key traits in Capsicum. This will increase the speed at which improved Capsicum varieties can be generated. The results of this project also demonstrate the association of particular nutraceutical composition (pro-vitamin A) with specific Capsicum genes and varieties.

Recommendations for rotational/cover crop species with specific roles, characteristics, and modes of use are in development. In this way, growers will have access to information regarding weed and pathogen

suppression, and crop growth enhancement characteristics of each rotational, bioactive (biofumigant) crop. This can help to minimize the costs and reduce the environmental harm of traditional chemical fumigants.

Onion germplasm was identified with foliage characteristics associated with onion thrips feeding nonpreference. In addition, germplasm was identified that possessed a reduced number of thrips per plant than most entries. Both of these characteristics suggest that there is the genetic potential for reduced thrips feeding and possibly reduced Iris yellow spot virus spread. Entries were identified that exhibited less severe IYS disease symptoms than most entries. Selection for reduced thrips number and IYS disease severity appears to be effective. Additional cycles of selection may be beneficial for increasing tolerance to thrips and/or IYSV. The onion industry in New Mexico and the United States is valued at farm gate annually at 50-60 million dollars and 900-1,000 million dollars, respectively. The potential impacts of this study are the offsets of yield reduction caused by IYSV and onion thrips and the cost of chemical control of thrips. The potential economic impacts of this research could be 10-15% of the current farm-gate value that is estimated to be lost due to injury from IYSV and onion thrips. In addition, the cost of chemical control of thrips, that is estimated at 7.5-12 million dollars, could be saved with the availability of a thrips-tolerant onion cultivar.

If 5% of New Mexico's alfalfa growers select the highest yielding alfalfa variety over the lowest yielding variety within a region, the return would be at least \$2.5M annually. Alfalfa varieties are being developed by the private sector for resistance to cowpea aphid. Dona Ana, a variety released by New Mexico State University in 1982, may also have resistance. Cowpea continues to be a more suitable candidate for forage than pigeonpea in the high plains of eastern New Mexico. While cowpea has higher nutritive value than lablab, the latter is higher yielding by about 0.6 tons/acre. Consequently, producers growing monoculture legumes could increase gross returns per acre by approximately \$175 at current hay prices of \$300/ton by growing lablab. For those continuing to grow cowpea for forage, because soil type-induced micronutrient deficiencies affect the nutritive value of cowpea forage and these deficiencies are visually noticeable, producers growing monoculture cowpea forage might improve returns per acre by harvesting the forage by soil type and using nutritive value analysis as a marketing tool. Sorghum forage growers using single-cut rainfed systems for hay can increase returns/acre by about \$140 by using photoperiod-sensitive hybrids compared to conventional sorghum-sudangrass hybrids. Adding lablab to corn or sorghum grown for silage can increase crude protein concentration without increasing fiber content. This increase in nutritive value also can increase the market value of the silage product.

Commercialization of the drought tolerant alfalfa cultivar, NuMex Bill Melton, will ensure that farmers in the southwestern U.S. can benefit from its yield stability in both well-watered and water-limited environments. Evidence indicates that alfalfa populations which are most productive under limited flood irrigation allotments likely develop extensive root systems. Such populations appear to be able to more thoroughly explore the soil profile for available moisture to support shoot growth over longer periods of time. Evaluation of several hundred NPGS accessions over time specifically indicated that populations from Uzbekistan and Peru are particularly useful for improving alfalfa drought tolerance in irrigated western U.S. environments. The integration of DNA marker linkage data with field performance of genetically defined alfalfa research population families under varying soil moisture conditions has identified regions of alfalfa chromosomes that influence shoot and root biomass production and water-use efficiency under drought stress. DNA marker assisted selection programs are in progress to transfer such markers into elite cultivars to evaluate their impact on cultivar productivity in water-limited environments. Our results suggest that the ERECTA gene plays an important role in affecting alfalfa forage productivity and water-use efficiency in drought-prone environments.

Other factors besides examination grade may affect the prices that the public is willing to pay for a flower arrangement. Higher-priced arrangements may be more popular to our bidding audience than are lower-priced arrangements. The impacts on the students included the following: increased confidence in flower arranging, increased readiness for the real world of a retail flower setting, improved plant

identification skills, increased employability in the floriculture profession, and increased desire to continue making flower arrangements.

Pest management is best taught from the stand point of integration and education. This approach is used with both youth and adult audiences. Information access points include youth contests (presentations, judging, posters, curriculum, and displays). General public, small farm, and master gardener workshops, field days, posters, publications, demonstrations, certification trainings, and news releases are useful tools for adult education. Organic producers increased their knowledge of key pests and beneficial found in their vegetable and fruit crops resulting in a better understanding of how to plan and practice organic and integrated pest management (IPM) programs on their farms. Conventional producers and extension agents receive training for pesticide applicator licensing exams (~900/year pass exams), receive training in identification of common pest and beneficial arthropods plus basic concepts of IPM. Gardeners also have available to them numerous entomology and arthropod trainings related to their gardens. Program participants (86%) are found to share information learned with their spouse and/or friends. Comments from participants include, "I never before realized the role weeds play in the lifecycle of other pests. I gained knowledge from your class to understand what weeds I have and the importance of controlling them. I will develop a weed management plan, keep notes on what I do, evaluate and make changes if a control doesn't work. Thank you, excellent presentation and invaluable information."

Specialists continue to provide assistance to extension agents covering alfalfa and forage crop production variety selection, soil preparation, fertilization and harvesting practices. Native American producers have been and are in need of more educational assistance since recent USDA equip laser leveling projects have resulted in near sterilization of some fields. Producers that have instituted some of the presented information have increased crop yields by as much as 50%. Educational programs on various subjects related to irrigated and dry land field crops and weed management were presented at one producer conference and two field day.

Surveys and follow up conversations indicated that over 95% of attendees had significantly increased in knowledge and that the programs were useful and relevant to their operations. Less than 10% indicated that they had only 'some' increase in knowledge. Almost all attendees indicated that they had an improved level of understanding with respect to water and resource conservation and crop management as related to alfalfa, corn and sorghum silage and grain, wheat, sorghum weed management. Research results have clearly shown that farmer inputs (other than water) in corn and forage sorghum silage systems can be reduced significantly without detriment to yields and end-product quality. For example, seed and fertilizer inputs may be reduced as much as 25% in limited irrigation systems without negative effects. This is very significant, especially with respect to fertilizer as this is one of the most expensive inputs on a farm. This information will continue to be presented to farmers and agricultural professionals in an effort to broaden resource conservation and profitability in the region.

Greater than 90% of farmers/agencies recognize the need for more water conserving practices in order to maintain regional agriculture and economic stability. Easily, more than 10% of regional farmers have begun implementing water-conserving practices in their operations. Results from field day and workshop surveys indicate that greater than 70% of producers have changed to more water use efficient crops and methods in the past 5 years. Agriculture and regional economics have been maintained and, in some cases, improved through conservation efforts highlighted by this and other similar programs.

Weed management in sorghum continues to be the number one requested area among growers of sorghum for research improvements and updates. This program strives to highlight the benefits of new weed control technologies through research plots containing herbicide-tolerant sorghums and demonstrations to show the benefits of these technologies. More than 95% of sorghum growers have

indicated that they will utilize this technology when it becomes available. The most requested aspect of this technology is cost and availability of products, and varieties containing it.

Integrated field crop production and management programs have continued to deliver educational programs to growers and stakeholders. Feedback shows that the over 80% of the surveyed clients are learning new information on soil health management and are ready to implement practices that will promote sustainable soil management. Feedback from cotton growers also show that information provided through educational tools (annual cotton conference and tri-annual Cotton Newsletter) have helped them in learning and implementing better management practices on their farms. 100% of farmers surveyed indicated their continued interest in subscribing to the New Mexico Cotton Newsletter.

Soil degradation due to poor soil and crop management has affected yields on New Mexico farms. Dissemination of information on sustainable production practices is helping farmers in the State understand how to better manage their crops and soils, reduce environmental degradation and improve their economic bottom line. Integrated field crop production and management extension program has enabled farmers in New Mexico to learn how to improve their soil and adopt sound agronomic management practices to help optimize yields on their farms. A survey conducted during a recent workshop on Corn Production in southern NM showed that 90% of the attendees found the information presented on soil and crop management useful, and are willing to attend similar workshops in the future.

The 2011 grape growing season suffered severe damage. Trunks of vines froze and split killing the vines to ground level or in some cases killing the vines completely. The range of damage included frozen primary, secondary, tertiary buds and frozen canes, spurs and cordons. The different severity of damage from vineyard to vineyard made it necessary to take different approaches to recover the plants. As a result, fruiting potential for 2012 was restored. Information about USDA assistance for vine loss and crop loss was distributed, many grower have qualified for such assistance. The Viticulture Program has investigated for several years methods to mitigate late frost. Double pruning is promoted as a cultural practice; it is used now by several vineyard managers including the largest grower in the state. Variety selection is another tool available to the growers. The fruitfulness among varieties is different on their primary, secondary and tertiary buds. Varieties which are late budding and/or fruitful on their secondary bud are selected. One such variety (Pinot Meunier) was identified by the viticulture program several years ago and is planted in small plots since 2010. The results are so encouraging that the NM Winegrowers Association has authorized up to \$10000.00 for two cold hardy strains of this variety to be imported. Other Varieties could be sourced from USDA-ARS those are; Pinot Noir-Marianfeld, Early Red Malvasia, Red Veltliner, Red-White Veltliner, Yellow Ortlieber, Wittberger, Rothgipfler, Sauvignon Vert, Clevner-Mariafeld. These varieties will be propagated and planted for testing. Growers are now selecting increasingly varieties recommended by the viticulture program based on the site specific conditions. The Northern New Mexico Micro Grape Growers Association (NNMMGGA) sought help after the group lost 95% of 2600 vines. The problem was identified, the responsibility for the loss rested chiefly with the growers but the nursery agreed to replace the vines. Two more grower workshops were held during the year. During these workshops some of the group's early confidence was restored. None of the associations 17 active members dropped out. After a pruning work shop in Las Cruces one participant remarked, "no one ever explained it this easy ... I can do this". The 30th Annual Vine & Wine Conference in Albuquerque helped the dissemination of information throughout the state. Follow up calls with regards to freeze damage lead to better management of the injured plants. This Conference also informs participants of current issues in wine marketing and enology.

New Mexico has a long and historic tradition in agriculture and specifically in crop production. This agricultural industry is a vital part of New Mexico's economy as well as an important part of its cultural heritage. Crops are continually at risk for attack by established and exotic plant diseases. These plant diseases threaten productivity and profitability for New Mexico's agriculture. In addition to a rich history of rural farming, New Mexico is becoming more and more of an urban state. Approximately 75% of New

Mexico's population lives in urban centers. This urban community also has a need for research based information on landscape and home garden pest and disease problems. The plant pathology program supports agricultural producers and urban clientele by providing educational programs and diagnostic services for identification and management of plant disorders. Educational programs provided regularly to grower groups, master gardeners, pesticide applicators, and horticulture groups. Educational programs on various subjects related to plant health management were presented at two grower conferences in 2011. A total of 140 contacts were made. In surveys of those in attendance, an average of 85 percent of the people in attendance at these conferences felt that they had increased their knowledge of the subject matter either "to a great extent" or "to a good extent." The audiences also indicated that the subject matter was presented in a clear and understandable manner. A majority (over 90%) of the people in attendance indicated that they would attend other workshops on related subject matter as available.

**Pesticide Applicator Training:** One Pesticide Applicator Training workshop was presented in 2011. Approximately 70 people, mostly commercial pesticide applicators, crop producers and landscape/nursery workers, were in attendance. The presentation focused on learning the meaning of plant symptoms and developing better observational skills. 92% of attendees indicated that they learned something new about identifying plant diseases. Overall feedback on the presentation was excellent. The following are examples of comments received following the presentation: "I really enjoyed that this presentation was interactive. I learned a lot about how to look and plants and try to figure out the problem." Very interactive! I learned a lot!" The problem identification slides were very helpful. It was fun trying to figure out the problem."

Participants in the First Detector Training programs reported a change in attitude regarding issues related to crop biosecurity as a result of attending the training. A First Detector Training Workshop was taught in Albuquerque and broadcast statewide via Centra. This workshop included certification training and continuing education for already certified first detectors. A course evaluation of the training was conducted: 91 % of the participants indicated that the training gave them a considerable amount of new information on the mission of the National Plant Diagnostic Network, and 9% indicated that the training gave them some new information. 94% of the participants indicated that the training gave them a considerable amount of new information on how to determine if a pest is 'high risk' and 6% indicated that they got some new information. 92% of the participants indicated that the training gave them a considerable amount of new information and 8% indicated that the training gave them some new information on the diagnostic process and how to correctly collect and submit samples for diagnosis. 100% of the participants said the training provided enough information to help them understand crop biosecurity issues. 100% of the participants indicated that as a result of the training they know who to contact if they think they have found an exotic or "high risk" pest. Teach and certify individuals in issues related to crop biosecurity. The National Plant Diagnostic Network (NPDN) First Detector program promotes the early detection of invasive, exotic plant pathogens, arthropods, nematodes, and weeds. Implementation of the NPDN program occurs primarily through partnering Land Grant University (LGU) members. The NPDN's lab network is prepared to assist in the rapid screening of plant pathogens and pests of concern in the Trained and certified 40 people. Provided continuing education for 10 already certified First Detectors. These newly certified First Detectors join over 450 others in the state of New Mexico who are aware of potential risks to plants and understand the importance of early detection and rapid response to pest outbreaks. In other states, Certified First Detectors have been responsible for being the first to find significant pests of regulatory significance.

Diagnostic services were provided on an as needed basis. In 2011, 1,582 plant samples were submitted to the lab for diagnosis. Samples were submitted to the lab from 5 U.S. States and 23 NM Counties. Samples were submitted by County Extension Agents, regulatory officials, growers, industry representatives and the general public. All samples were processed in a timely manner and a diagnostic report for each sample was created. The record discusses the diagnosis and treatment recommendations for the specimen. Data on disease occurrence in the state is uploaded to the National Plant Diagnostic Network as part of our role as a state support lab for the Network. Although field visits were not specifically

tracked, both the specialist and the Plant Diagnostic Clinician made numerous field visits helping growers and county agents with plant disease problems. Although not formally surveyed, many users of the diagnostic clinic have let us know how valuable the service is and that they appreciate our expertise and assistance. This year we discovered 5 new diseases in New Mexico and published 3 First Reports on new diseases discovered in 2010.

Extension specialist participated in the National Legume IPM PIPE Survey. This project surveyed sentinel bean plots for viruses, foliar and soil-borne diseases. In New Mexico, we planted and maintained 5 sentinel plots (2 at the Clovis Ag Science Center and 3 at Leyendecker Plant Science Center). This project involved weekly plant status reports on growth and development as well as disease status. Twice during the growing season, 150 plant samples were collected and processed for 2 specific rust diseases (soybean rust and common rust) and 3 specific virus diseases (alfalfa mosaic virus, bean common mosaic virus and beet curly top virus). Data was uploaded on a weekly basis to the National IPM PIPE database which provided real time disease assessment for researchers and growers.

Assistance to farmers to help with the monitoring of pink bollworm and control of alfalfa weevil have been ongoing. Traps set in the last two years in farmers' fields showed no pink bollworms captured. NM loses over \$1.2M/year due to losses/control of alfalfa weevil much of which could be eliminated with more effective biological control. Four releases in the Pecos Valley, two in the Portales area and two in Socorro County have detected *omyzus incertus* and established populations of *Bathyleptes* spp and *Oomyzus incertus* throughout New Mexico. These efforts will continue and farmers will be notified each month of findings and potential eradication options.

Extension research is being done to understand the prevalence and outbreak dynamics of certain serotypes of Salmonella in dairy cattle. Three efforts in this project are 1) to determine if waste milk pasteurization reduces Salmonella prevalence in calves and subsequently all cattle on the farm; 2) to develop best management practices for Salmonella in cull cows, demonstrate that a small portion of cull dairy cows ("downers") and not all cull animals are likely a source of Salmonella transmission to the slaughterhouse and to identify management factors that may influence (positively or negatively) Salmonella prevalence; 3) to determine if Salmonella Newport bacterial extract SRP vaccine reduces Salmonella shedding in dairy cows.

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

The target audience includes: ranchers, feedlot operators, dairy producers. small/medium/large-scale agricultural operations, business, associations, cooperatives, consulting firms and collectives that might or might not be defined as a farm under the USDA economic return criteria, but are land owners, managers, consultants, or students who wish to improve agricultural production and efficiency. Other audience participants include Extension agents, other agricultural specialists, pesticide applicators, Master Gardeners and garden clubs, youth (4H, Future Farmers of America and other groups) and the general public.

## **3. How was eXtension used?**

eXtension was not used in this program

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

### **1. Standard output measures**

2011	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: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	5	131	136

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

**Output Target**

**Output #1**

**Output Measure**

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and Extension media are important outputs for the various projects falling under this planned program.

Year	Actual
2011	0



**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of trained professionals
2	# of improved animal varieties
3	# of research publications
4	# of methods, technology, and animal varieties adopted by public and private sectors

**Outcome #1**

**1. Outcome Measures**

# of trained professionals

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	16

**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>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome

- 305 Animal Physiological Processes
- 306 Environmental Stress in Animals
- 307 Animal Management Systems

**Outcome #2**

**1. Outcome Measures**

# of improved animal varieties

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

# of research publications

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	131

**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>
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)

205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
305	Animal Physiological Processes
306	Environmental Stress in Animals
307	Animal Management Systems

#### **Outcome #4**

##### **1. Outcome Measures**

# of methods, technology, and animal varieties adopted by public and private sectors

Not Reporting on this Outcome Measure

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

##### **External factors which affected outcomes**

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

##### **Brief Explanation**

New Mexico continues in severe drought, which affects animal and range science research, as well as agronomic plant research.

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

Evaluations were not formally set up for this year.

##### **Key Items of Evaluation**



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

**Program # 2**

**1. Name of the Planned Program**

Sustainable Management of Natural Resources

**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>
102	Soil, Plant, Water, Nutrient Relationships	15%		15%	
103	Management of Saline and Sodic Soils and Salinity	5%		5%	
121	Management of Range Resources	30%		30%	
123	Management and Sustainability of Forest Resources	10%		10%	
135	Aquatic and Terrestrial Wildlife	10%		10%	
136	Conservation of Biological Diversity	5%		5%	
405	Drainage and Irrigation Systems and Facilities	10%		10%	
605	Natural Resource and Environmental Economics	15%		15%	
	<b>Total</b>	100%		100%	

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

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

<b>Year: 2011</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	7.3	0.0	14.3	0.0
Actual Paid Professional	5.0	0.0	16.8	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
441161	0	1520332	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
441161	0	1520332	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**

We maintained a working relationship with area producers to complete dormant and growing season grazing trials in two adjacent riparian study areas. Our continued partnership insures grazing protocols remain consistent between years and seasons. Undergraduate and graduate students helped local personnel maintain study area infrastructure. Herbaceous production and utilization as well as woody browse production and utilization were estimated following each grazing trial. Analysis of data continues with specific attention focusing on comparisons between treatments and control, as well as long term trend analysis (9 years). Monitoring of cottonwood regeneration in riparian areas was continued following harvest of multiple overstory trees in 2008. Additional stream channel recovery work was completed by undergraduate students and local area producers following the recommendations of an environmental engineer. Similar to the prior year, several thousand pounds of rock were strategically placed in and adjacent to the stream bank to promote stability. Riparian grazing issues on federal grazing allotments were of keen interest to producers, agency managers, and researchers during the past year which was characterized as being one of the driest years on record in New Mexico. Working with the Range Improvement Task Force we utilized the results from this on-going study to educate producers and agency managers on riparian grazing trends during drought. Results were also used to help resolve conflicts on the ground as well as to suggest appropriate grazing regimes for dormant and growing seasons. Multiple educational field trips were conducted to visit federal grazing allotments across NM. The Range Department at New Mexico State University continues to utilize the study area as a laboratory for field trips designed to expose students to riparian ecology, sustainable grazing strategies, cottonwood regeneration, and stream restoration in southwestern riparian areas. Information from this research project continues to be disseminated to stakeholders and local groups/organizations at several Cooperative Extension programs throughout the year.

Grazing patterns of cattle herds can be accurately observed and characterized by riders on horseback. If observers well trained, visual observations can be a way to identify grazing distribution traits for individual cattle, however there must be a large number of observations. Ten or less observations may not be sufficient to characterize the grazing patterns of cattle in some areas. GPS tracking data indicates that there are large phenotypic differences in grazing patterns among cattle. If grazing distribution can be inherited, producers will be able to identify cattle that have superior grazing patterns and use them for developing replacement cows, which should improve the distribution of their cattle. However, this approach requires grazing distribution to be a heritable trait, which our research team is currently investigating.

Targeted grazing studies will refine and further evaluate the use of low-stress herding and strategic

supplement placement as tools to improve big game habitat with cattle without fencing. To our knowledge, our team members are the only researchers that have attempted to focus beef cattle distribution without fencing in order to accomplish specific land management objectives. This research is examining the potential to use cattle for developing fire breaks in forested rangeland. We are not aware of any other studies that have examined this potential ecosystem service with beef cattle. In addition, the economic viability of target cattle grazing is being evaluated. Preliminary results suggest that some cattle ranchers could develop fire breaks in rugged terrain to assist firefighters at a cost similar to other alternatives, such as mowing, that only be applied in gentle terrain. Such a practice could potentially reduce the risk of damage to private property, reduce costs of wildland firefighting efforts, and provide additional income to cattle ranchers. This research will also contribute much-needed understanding of the factors that determine whether and when ranchers and other land managers are likely to implement this type of innovative management practice.

Results of studies will contribute to developing better prescriptions for vegetation management on Piñon Juniper dominated rangelands. Data analyzed so far suggest that a mix of vegetation structure types within a grazing pasture offers better habitat conditions than pastures with a single vegetation type. Results of spatial patterns study will test current understanding about the importance of dams in early life learning of foraging behaviors of their offspring. Preliminary data suggest that groups rather than individuals may transmit foraging cultures to the young. Analysis of this two-year data set will allow us to test this hypothesis.

An important goal of understanding the effects that plant nutrients and toxins exert on diet selection patterns of sheep and goats is to use this knowledge to manipulate diet preferences of small ruminants used in targeted grazing programs (TG). A study provides practical information on the limitations of targeted grazing (TG) with sheep as a tool to reduce white locoweed on rangelands. It suggests that to optimize TG results, grazing should be excluded from treated areas to allow non-target plants a better chance to outcompete white locoweed.

Vegetation surveys in the 4 study pastures for herbage production and plant cover were completed in October of 2011. All 4 pastures were stocked with cattle in March 2006. Cattle weights and calf crop information were collected periodically in 2006, 2007, 2008, 2009, 2010, and 2011. Results show higher cow and calf weights in lightly stocked pastures than conservatively stocked pastures. Forage production has been higher in lightly than conservatively stocked pastures. Grazing use has averaged 29% in lightly stocked pastures and 39% in conservatively stocked pastures. A model has been developed and published relating long term forage production to precipitation on the steady pastures. This research has the potential to reduce the adverse impacts of livestock grazing on rangeland soils, vegetation and wildlife. Light stocking leaves more residual vegetation for protection of soils, watershed, and wildlife habitat. Light grazing appears to allow forage plants to maximize their productivity and it may be more beneficial than grazing exclusion. Light grazing lowers rancher risks and may increase monetary returns over conservative grazing based on preliminary results. This research has the potential to reduce rancher/environmentalist conflicts by providing better technology to maintain and improve vegetation and wildlife habitat. Increased rancher income could reduce rangeland losses to subdivisions and other development. In previous research from this project, we found conservative grazing was advantageous over moderate grazing in terms of maintaining forage production, drought, reducing rancher risk and providing higher net profits.

Policymakers in North America's Upper Rio Grande Basin face the challenge of designing programs and plans for allocating the basin's water supplies efficiently and fairly to support current uses and environments. Water users, managers, and legislators also seek resilient institutions that can ensure adequate supplies for future generations. This work addresses those challenges by designing and applying an integrated basin-scale framework that accounts for the basin's most important hydrologic, economic, and institutional constraints. Its unique contribution is a quantitative analysis of three plans for



addressing long term goals for the basin's reservoirs and aquifers: (1) no sustainability requirement at all, (2) sustaining water stocks, and (3) renewing water stocks. It identifies water use and allocation trajectories over time that result from each of these three plans. Findings show that it is hydrologically and institutionally feasible to manage the basin's water supplies sustainably. The economic cost of protecting the sustainability of the basin's water stocks can be achieved at 6 - 10 percent of the basin's average annual total economic value of water. We plan to use the knowledge gained in developing these river basin policy frameworks to secure insights into cost-effective water and agricultural conservation policies in New Mexico and other water-stressed regions of the world such as Iraq, Israel, and Afghanistan. We are also looking for lessons from this work that enables New Mexico water leaders to be better informed for the design of more resilient water institutions for the Rio Grande Basin in the face of potential drought and climate change.

Numerous ephemeral ponds were visited and ponds containing water were sampled using nets to collect the various crustaceans inhabiting them. At dry ponds, soil samples were obtained and returned to the laboratory. Pilot experiments were initiated to develop microcosm and mesocosm approaches for laboratory experimentation with ephemeral pond crustaceans. These experimental chambers will allow us to evaluate basic water chemistry effects on ephemeral pond crustaceans such as pH, temperature, and nutrient enrichment. Results from fish and crustacean projects will benefit water management in arid landscapes and help managers foresee possible effects of human interventions on the ecology of aquatic systems.

As a result of this project we will be better able to sustainably manage our native vertebrate fauna and desert and plains grasslands. These projects will result in recommendations for grazing management that will incorporate measures of native biological diversity and ecological factors that influence diversity. Results from our research on burrowing owl ecology will directly affect the management of the USDA Forest Service Great Plains National Grasslands. Data collected for this project can also help alleviate future entanglements related to the management needs and status of specific species, and will contribute to enhanced wildlife viewing.

Our large carnivore research will provide valuable information that state game agencies can use to manage their populations. Our work on examining the effects of climate change with respect to carnivore populations across North America will provide federal and state resource agencies with information necessary to plan future conservation efforts and identify lands important for purchase. Finally, our work examining how climate change is expected to influence the demography and distribution of species is valuable for building a wealth of evidence to convince the public and policy makers that we are having a major impact on our Earth.

This study identified some of the primary seasonal habitats within home ranges of elk, identified calving habitats, and annual habitat use of adult elk. This data will be used to develop improved management and wildlife conservation strategies. We refined a new method to assess the percentage of woody vegetation cover as a tool to evaluate elk habitats using 2005 color Digital Orthophoto Quarter Quads (DOQQs). The imagery was segmented and classified at two scales based on spatial, spectral, and textural information with an object-oriented analysis approach in order to extract percentage of woody cover. The resulting spatial cover model yielded five habitat classes: 1) grassland with low quantities of woody vegetative cover (0-20%), 2) grassland with high cover (21-100%), 3) woodland with low cover (0-40%), 4) woodland with moderate cover (41-66%), and 5) woodland with high cover (67-100%). Accuracy of the descriptive spatial model was assessed by evaluating a 100 m radius around 1,063 random locations. The overall accuracy was 71%, suggesting that the classification procedures were moderately successful in extracting woody vegetation cover from the surrounding landscape.

Open-canopies in mature pecan orchards have potential to modify tree microclimate and surrounding soil surface conditions, yet little is known about the root zone soil water dynamics in irrigated pecans within

and outside tree canopies. Simulations were carried out using HYDRUS-1D model to quantify isothermal and thermal water fluxes in the unsaturated zone of a mature pecan orchard in Las Cruces, New Mexico, with and without root water uptake. Isothermal water flux dominated the soil water movement in bare soils immediately after irrigation, while the contribution of thermal vapor flux increased with increasing soil drying because of upward isothermal and much smaller thermal water, and vapor fluxes within 20 cm depth. In contrast, isothermal water flux was predominant throughout the under-canopy soil profile. Immediately after irrigation, trends of under-canopy actual and potential evaporation rates were similar. With the depletion of surface soil water, evaporation losses were lower and actual transpiration due to root water extraction substantially contributed to actual evapotranspiration. Relative evapotranspiration (ratio of actual to potential) correlated ( $P < 0.05$ ) with the pecan stem water potential. Root water uptake pattern followed the root density distribution immediately after irrigation but compensated uptake remained higher during water-stressed conditions in the top 20 cm. The project results demonstrate that about 11% of water is lost due to vapor flow. The contour maps of soil properties along with their spatial structures can be used in making better future sampling designs and management decisions.

Results from the water research at the Alcalde Sustainable Agriculture Science Center continue to build our understanding of how a significant amount of irrigation water diverted into a valley seeps from ditches and percolates below fields and then resides in shallow groundwater for 1 to 3 months before returning to the river. This storage and release function provides water to the river in times of low flow and may save water on a regional basis by reducing evapotranspiration losses. Local acequia groups have recognized the importance of acequia hydrology through the project and are requesting presentations on this research.

This study is the first that we are aware of to report environmental impact of applying treated industrial wastewater to native lands of the Chihuahuan Desert. Adoption of similar industrial wastewater land application practices by other New Mexico towns could mitigate salinization of the Rio Grande by 5% to 10% while providing financial benefits through cost-effective wastewater processing. Increased shrub fecundity and thus invasiveness, along with declines in intershrub space species richness, may be consequences of saline-sodic effluent irrigation on Chihuahuan Desert lands. However, ecological benefits of the increased biomass must also be considered in the overall management of land application in the region.

Interest in aquaculture has increased in New Mexico, with a number of new operations in various stages of start-up and operation. There is a growing interest in developing sustainable greenhouse aquaponics, as evidenced by the responses received to a statewide survey on industry priorities. This survey reported 100% of respondents found that the specialist was greatly helpful in their quest to establish a successful aquaculture operation and was quick to respond to their questions and queries. 100% of respondents indicated that their knowledge had improved "to a great extent" thanks to information provided. 75% of respondents indicated that the likelihood of their modifying a current aquacultural practice based on information obtained from the specialist was "fair" to "great". The aquatic resources and watershed management program is only 2 years old and therefore medium-term impacts are not yet available.

Surveys were conducted before and after watershed stewardship presentations. Attendees learned new concepts and were more knowledgeable about the importance of watershed stewardship and the role of human and land use practices on non-point source pollutions. Prior to hearing watershed stewardship talks, only 60% of attendees surveyed thought learning about watershed management was important, compared to 100% after the talk. When surveyed, 100% of attendees knew that most pollutants entering our waters came from non-point source pollution after the talk, compared to 10% before that talk. Comments given anonymously by surveyed participants in the 2010 watershed stewardship talks included, "great presentation", "very insightful", "got a broad understanding on how small things you do can alter the life of a stream and/or river", "awesome", "cool:", "awesome class", "very interesting", "very informative and

useful", "I very much enjoyed the pictures, showed watersheds that were close to my community". When surveyed, 95% of attendees rated the class as providing worthwhile to very worthwhile information.

The Southwest Turfgrass Conference was attended by over 150 people, and the presentation on "Water quality issues in ponds" received an average rating of 1.3 (from 1=best to 4=poor) for presentation style and 1.4 (1= very relevant to 4=no relevance) for topic relevance. In addition, this topic was listed by participants as one in which their knowledge of the subject was most improved after the presentation. Conference attendees rated their knowledge on water quality issues in ponds with an average of 1.7 before and 3.0 after the presentation (1 = poor to 4 = excellent).

Extension circular on Golden Algae was very well received at both the state and national level. In addition to being posted on the NMSU CES website, the article has also been posted on the New Mexico Department of Environment website, copies were requested by the New Mexico Game and Fish, and the article was requested and has been sent out to a national distribution list of over 250 HAB (hazardous algae blooms) scientists throughout the country.

Pest management is best taught from the stand point of integration and education. This approach is used with both youth and adult audiences. Information access points include youth contests (presentations, judging, posters, curriculum, and displays). General public, small farm, and master gardener workshops, field days, posters, publications, demonstrations, certification trainings, and news releases are useful tools for adult education. Organic producers increased their knowledge of key pests and beneficial found in their vegetable and fruit crops resulting in a better understanding of how to plan and practice organic and integrated pest management (IPM) programs on their farms. Conventional producers and extension agents receive training for pesticide applicator licensing exams (~900/year pass exams), receive training in identification of common pest and beneficial arthropods plus basic concepts of IPM. Gardeners also have available to them numerous entomology and arthropod trainings related to their gardens. Program participants (86%) are found to share information learned with their spouse and/or friends. Comments from participants include, "I never before realized the role weeds play in the lifecycle of other pests. I gained knowledge from your class to understand what weeds I have and the importance of controlling them. I will develop a weed management plan, keep notes on what I do, evaluate and make changes if a control doesn't work. Thank you, excellent presentation and invaluable information."

Accumulation of excessive salt and/or sodium in irrigated soils can reduce crop yields, reduce the effectiveness of irrigation, ruin soil structure, and affect other soil properties that ultimately reduce crop productivity and sustainability. Specialist identified 175 saline soils and 184 sodic soils in 16 counties out of 959 samples that were interpreted from NMSU's Soil Testing laboratory. The identified soils necessitated testing irrigation water as the source of salinity. Once the reclamation process was complete fields were expected to return to productivity. The identified sodic soils required the addition of calcium, usually applied as gypsum, in addition to extra water in order to leach the soils of the sodium and return the field to a productive sattu.

Farmers attended several workshops focusing on maintaining proper crop rotation in conjunction with rates and timing of nutrients from organic and synthetic sources under irrigated conditions; meeting crop needs and improving soil quality while minimizing or eliminating risks to the environment; increasing soil quality and crop productivity by applying research based management of organic and synthetic fertilizers; and employing cropping systems while minimizing or eliminating environmental contamination risks.

Nutrients, particularly nitrate-N, have been implicated in decreasing ground water quality in New Mexico while surface water sources remain precariously near natural state. A total of 959 soil samples were evaluated for nutrient content so that guidance could be given to 468 clientele as to what fertilizers or

organic amendments could be added or incorporated into their rotations to soil to meet crop needs. Twenty clients requested organic amendment recommendations which resulted in either, manures, seed meals, or legume rotation recommendations to meet their cropping system goals. Water management practices were suggested in cases of high soil nitrate levels in order to reduce the chance for leaching nitrate to below the root zone. Clientele that were from dairies received recommendations to grow alfalfa as a means of removing excess nitrate-N from the soil profile and reduce risk of leaching to below the root zone and into groundwater. Fields with excessive levels of nitrogen in the top three feet of soil were reduced by switching from corn/wheat rotation to perennial alfalfa. The use of improved, salt tolerant varieties of alfalfa also had an impact on crop yield which further improved nitrogen removal from fields and prevented movement of nitrate into groundwater resources. Nutrient recommendations lead to either improved use of purchased fertilizers through improved rates or timing with plant growth. Organic recommendations also help reduce the use of synthetic fertilizers as the nutrients in the organic amendments are accounted for and credited toward the nutrients needed for good plant growth. By teaching producers about soil properties, better yields can be achieved and source material contamination can be reduced.

In collaboration with the New Mexico Organic Program, Western School IPM Working Group, Western Small Farm IPM Working Group, New Mexico CES county agents, Hubbell House Alliance/Albuquerque Open Space, New Mexico Department of Agriculture, and New Mexico Public Schools Facility Authority, 'bug nights' have been held to educate on beneficial insects, insect ID, bio-controls, pest management, pollination, insectary plants, and various vertebrate enhancement features (bird, bat, and bee boxes). The total 2011 participants' scores increased from an average of 15.3% (range: 0 to 42.9%) before the events to an average of 74.6% knowledge gained after the events.

Approximately 4.8 million acres of the Small Farm Task Force area in northern New Mexico are federally managed by the US Forest Service or the Bureau of Land Management. The remainder lands are either held in tribal trust or are privately held lands. Traditional uses of the land have been a primary sustaining resource for the native people since Spanish colonization. The focus of the Specialists work has been to ensure that all traditionally underserved farmers and ranchers are provided with the opportunity to participate in USDA programs, including those from Farm Service Agency, Natural Resources Conservation Service, Rural Development, and Forest Service through our education and technical assistance. Specialists provide natural resource educational programming and research benefitting individuals and communities within the Small Farm Task Force Area, with the ultimate goal of sustaining the natural resources of which the citizens of New Mexico rely. Programs and publications produced include:

"Our Natural Resources" Natural Resources of New Mexico series: description of each and various uses, wildlife, forests, rivers/lakes, history of fire, desert ecosystems, agricultural benefit to our natural resources

- Attracting Wildlife to Your Property
- Attracting Beneficial (IPM collaboration)
- Natural Resource Directory
- Living in the Wildland Urban Interface
- Sustainable Living
- Hantavirus Prevention (as part of a Wildlife series)
- Wildlife Conflict, Deterrents and How to Reduce Exposure
- Range Management Principles
- Determining Stocking Rates
- Defensible Space and Firewise Communities
- Guide to Developing a Management Plan

## 2. Brief description of the target audience

Target audiences include:ranchers, farmers, urban landscapers, park departments, state and federal agencies, private homeowners, and recreational users of parks, forests, and waters.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2011

Actual: {No Data}

**Patents listed**

{No Data Entered}

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
<b>Actual</b>	3	5	0

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

**Output Target**

**Output #1**

**Output Measure**

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and Extension media are important outputs for the various projects falling under this planned program.

Year	Actual
2011	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of trained professionals
2	# of research publications
3	# of Extension publications
4	% of people adopting NMSU recommendations

**Outcome #1**

**1. Outcome Measures**

# of trained professionals

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	14

**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>
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

**Outcome #2**

**1. Outcome Measures**

# of research publications

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	57

**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>
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics



**Outcome #3**

**1. Outcome Measures**

# of Extension publications

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2011	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
103	Management of Saline and Sodic Soils and Salinity
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

**Outcome #4**

**1. Outcome Measures**

% of people adopting NMSU recommendations

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	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**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

**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**

Continuing severe drought in New Mexico hampered research efforts.

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

Formal evaluations were not conducted for this reporting period.

**Key Items of Evaluation**

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

**Program # 3**

**1. Name of the Planned Program**

Agricultural Markets, Trade, and Economic/Business Development

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

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
511	New and Improved Non-Food Products and Processes	5%		5%	
601	Economics of Agricultural Production and Farm Management	25%		25%	
602	Business Management, Finance, and Taxation	20%		20%	
603	Market Economics	10%		10%	
604	Marketing and Distribution Practices	10%		10%	
606	International Trade and Development	5%		5%	
608	Community Resource Planning and Development	15%		15%	
610	Domestic Policy Analysis	5%		5%	
611	Foreign Policy and Programs	5%		5%	
	<b>Total</b>	100%		100%	

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

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	4.9	0.0	7.0	0.0
Actual Paid Professional	3.0	0.0	5.2	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
220501	0	454857	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
220501	0	454857	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

We have developed water use estimates for pecans, cotton, and alfalfa in New Mexico's Lower Rio Grande Valley. Relationships between crop water use and crop yield have been developed for pecans in the region. The economic cost of deficit irrigation in pecans has been quantified. In Albuquerque's South Valley community we have identified and quantified socio-economic and technical parameters which affect agricultural productivity and agricultural water use in peri-urban, small, scale, multicultural, traditional agriculture. These technical engineering and hydrologic results are being used develop technologies and guidelines which will enhance the profitability and sustainability of small-scale farms. We have documented the Albuquerque-area consumer preferences with respect to local and organic produce. We are estimating the value of food and agricultural commodities produced in the region (but not necessarily sold commercially), estimating the economic impact of agricultural production, and identifying and documenting BMPs for irrigated agriculture in New Mexico's South Valley. We have developed a database of public land ranches in southwestern New Mexico that includes information about various socio-economic characteristics of the ranches, including rates of ownership turnover, and impermanence threats to ranch management.

The proposed studies are expected to provide better understanding on how rising trade volume, recent technological innovations, and changing market structure impact U.S. food industry. For instance, Acharya, Kinnucan, and Caudill (2010) developed a new test that can be used to examine whether firms enjoy market power and if they do whether they change their pricing behavior as market conditions change. The model is tested using data from U.S. fresh strawberry market and the results show that buyers/retailers are more apt to exercise market power during peak harvesting season when farm supplies are abundant than when they are scarce. As a result, strawberry growers are losing about 6% of their gross revenue.

The core objects of this project are to explore and identify possible value-added products made from New Mexico agricultural commodities, to examine current production and marketing tools available for value-added agriculture operations, and to identify and evaluate existing marketing channels that can be used to market New Mexico agricultural products. Industry participants are changing their behavior and are exploring new opportunities. Some industry participants are taking information provided by this project's research and examining opportunities to use similar strategies in their own industries. Prompted by exposure to publications and presentations regarding new marketing opportunities, participants in a number of industries are examining opportunities of developing and expanding new markets. Specifically, participants are interested in value-added production possibilities as well as opportunities to regionally brand products grown, raised, and/or processed in New Mexico.

The broccoli brigade project is investigating organic fertility options. The community projects are introducing a new vegetable to new growers, and helping them successfully bring a new crop to market.

The important finding of a soil moisture study was that there is potential to improve prediction and estimation of the annual variation in forage yields on rangeland by using soil moisture probes and soil moisture models instead of the traditionally considered summaries of annual precipitation amounts. This is important for evaluating alternative management strategies for adjusting to drought and potential changes in climate. It is anticipated that in the future soil moisture measurements will be incorporated into research about the effect of climate on livestock production strategies and management alternatives.

A burning study agreed with others that have shown an increase in grass yield following removal of snakeweed with herbicide spraying. However, a similar beneficial increase in grass yield after burning was not observed. Use of prescribed fire on blue grama range in central New Mexico should be viewed as a control alternative for removing broom snakeweed, but not as management practice for increasing forage production.

When fee and non-fee grazing costs are considered when comparing private and public grazing costs, the total cost of grazing on public lands exceeds the cost of grazing private leased lands.

A total of 60 participants from New Mexico, Arizona, and Colorado attended the hands-on schools. Attendees were instructed on the use of both mechanical and hand shears since availability of electricity or culture dictates which equipment might be used. In conjunction with the shearing schools a wool marketing initiative has been conducted for 7 shearing seasons. This year approximately 80,000 pounds of wool was marketed through a producer owned warehouse in Kansas. Producers from Northern, Northwestern, and Northeast New Mexico, including Navajo producers from Arizona sold wool through this project. Other Native American participants were Acoma Pueblo, Laguna Pueblo, Santo Domingo Pueblo, and Cañoncito Navajo. Some producers sold wool for .85 cents per pound for coarser wool up to \$2.00 for fine wool as compared to 10-20 cents per pound at local trading posts. Hopefully the higher market will provide incentive to continue sheep production.

Collaboration with a local inventor has resulted in a demand for approximately 4,000 locally produced lamb carcasses per year. Extension has provided educational information to lamb buyers on carcass grading, feed availability, and live lamb selection. Also a dialogue between the livestock specialist, sheep producers, and the lamb buyer has been established to maintain a working relationship between all the participants. Lamb prices are at an all-time high this year with several producers receiving as much as \$280 per lamb in late fall early winter sales. This makes it especially challenging for processors to set wholesale prices at food distributors. Prices are predicted to stay high due to live sheep shortages nationwide.

This past year approximately 10,000 attendees were given presentations on sheep production/shearing demonstrations at the New Mexico State Fair, Southern New Mexico State Fair, and Kids, Kows, and More Programs at Santa Fe, NM, Moriarty, NM, Las Vegas, NM, and Albuquerque, NM. Attendees are given presentations on sheep management practices, New Mexico Sheep History, and sheep shearing demonstrations.

Surveys and follow up conversations indicated that over 95% of attendees had significantly increased in knowledge and that the programs were useful and relevant to their operations. Less than 10% indicated that they had only 'some' increase in knowledge. Almost all attendees indicated that they had an improved level of understanding with respect to water and resource conservation and crop management as related to alfalfa, corn and sorghum silage and grain, wheat, sorghum weed management. Research results have clearly shown that farmer inputs (other than water) in corn and forage sorghum silage systems can be

reduced significantly without detriment to yields and end-product quality. For example, seed and fertilizer inputs may be reduced as much as 25% in limited irrigation systems without negative effects. This is very significant, especially with respect to fertilizer as this is one of the most expensive inputs on a farm. This information will continue to be presented to farmers and agricultural professionals in an effort to broaden resource conservation and profitability in the region.

Efforts to improve profitability of local vegetable markets include teaching the construction of low cost greenhouses (hoop houses) and working with producers, planners, and public officials to develop and demonstrate mechanisms and strategies for enhancing the variability and competitiveness of agriculture as a viable economic alternative. Largely because of the work of numerous agents and specialists farmers' markets have grown 92% over the past twenty years. There is so much interest in farmers' markets that tourism brochures and specific farmers' market statewide 'trails' have been published and created. A key element for selling produce at markets is understanding regulations and completing required paperwork. Extension offers workshops in several counties to assist local growers and market managers in this effort.

A Value-Added Publication was completed. A series of educational programs were developed and delivered New Mexico Crop Cost and Return Estimates to provide financial planning tools to producers, agents, and others. These estimates are the most widely used NMSU Extension documents annually. Each county in New Mexico is impacted by these data. The 2011 Cost and Return Estimates were published. These CARE's are utilized by greater than 3,000 individuals throughout the state. Lenders, producers, appraisers, county faculty and other agency personnel employ this economic information.

Greater than 6,500 livestock production units in New Mexico may benefit from this data. The ability to perform financially and economically is often a function of a greater understanding of the commodity that is being marketed. The value chain beef analysis program facilitates that understanding. The value chain for New Mexico beef cattle has not been understood fully until recently. A program directed at providing New Mexico consumers with New Mexico beef as they indicated was their preference has been established. Greater than 4,000 beef cattle have been processed through this program since its inception a year ago. This is a cooperative program with New Mexico Department of Agriculture, NMSU, New Mexico Beef Council and NM-BII.

New Mexico's dairy industry is the number one agricultural industry in terms of cash receipts. Important developments included collaboration with many programs and universities, funding for teaching, the development of a Large Herd Dairy Management Class, and consideration and participation of NMSU Dairy Extension in USDA CAP Grants. Efforts currently underway are: 1) identification of consensus priorities based on dairy industry inputs; 2) establishing multi-disciplinary faculty teams to address the industry's identified problems and issues through collaborative research, education, extension, and service programs; 3) providing coordinated and enhanced undergraduate and graduate training programs; 4) development of grant opportunities; 5) developing long-term technological partnerships with producers and allied industries; 6) generating research knowledge and technology necessary to solve production and related industry environmental/natural resource issues; 7) disseminating knowledge and technologies and tailored training programs; and 8) expanding extension education to producers, allied industries and agency personnel.

Community Resource and Economic Development (CRED) is designed to link county agents and community leaders to CRED resource professionals, programs, and organizations/agencies, public and private, at the local/state/federal level. New Mexico is a large, sparsely populated, and relatively poor state, with 17.9 percent of its population living below the poverty line (20.5 percent in rural areas). Many rural residents experience basic food, consumer products, and medical services gaps, having to drive hours to the nearest providers. Major CRED Program Activity has included developing 14 community development partnerships throughout the state. Examples include the Laguna Pueblo Entrepreneurship and Economic Revitalization Project initiated at the request of the Governor of the Laguna Pueblo. The project seeks to encourage and prepare young Laguna Pueblo adults, through educational activities and

technical assistance, to start-up and manage businesses that will provide goods and services locally to Laguna Pueblo residents. Stronger Economies Together (SET) Program has involved 11 counties in workshops on regional economic development topics. Over 60 leaders and residents are participating in the SET workshops on strategic planning, securing funding for the plans, and implementation steps. The Farmers Markets Project reduces producer financial risk (and low returns) at farmers' markets through a series of workshops focused on crop diversification, season extension, high value crop production techniques and resource requirements, financial management, market assessments, marketing strategies and business planning. The Revitalizing Traditional Zuni Agriculture Project is a collaborative effort between NMSU-CES, the Zuni Public School District, and the Rural Education Division of the New Mexico Public Education Department. Students at Zuni high school are being introduced to agriculture through horticulture and bee-keeping. Commenting on the value of the student's efforts, community Elders have acknowledged "This program is extremely valuable because like many Native American communities in transition, without this kind of educational approach, the Zuni tradition and history could get lost." According to Elder Herrin Othole, who has taught at Zuni High School since 1979 - "There weren't any Wal-Marts when we were growing up here, and you could still find waffle gardens all over the Zuni River valley. But now it's a different story. We've lost our agricultural activity and we've also lost a lot of our need for physical activity. Our community has seen a serious rise in health problems like diabetes. This project gets kids moving and motivates them to make changes in their lifestyles."

Planning is the key to wise resource allocation and investment decisions by producers, businessmen and women, organizations, and local government. During the past year 19 planning and management training sessions focusing on small business cheese production for (over 400) producers, businessmen and women, community organizations, county agents, and local officials have been conducted. Pre and post workshop tests and follow-up interviews indicate that workshop participants increased their knowledge and adopted practices for making improved resource allocation and investment decisions.

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

The target audiences include agricultural producers, business owners, and policy makers.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	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: 2011

Actual: {No Data}



**Patents listed**

{No Data Entered}

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	2	2	0

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

**Output Target**

**Output #1**

**Output Measure**

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and Extension media are important outputs for the various projects falling under this planned program.

Year	Actual
2011	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of research publications
2	# of Extension publications
3	# trained professionals

**Outcome #1**

**1. Outcome Measures**

# of research publications

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	18

**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>
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
606	International Trade and Development
608	Community Resource Planning and Development
610	Domestic Policy Analysis
611	Foreign Policy and Programs

**Outcome #2**

**1. Outcome Measures**

# of Extension publications

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2011	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
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
604	Marketing and Distribution Practices
608	Community Resource Planning and Development

**Outcome #3**

**1. Outcome Measures**

# trained professionals

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	5

**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>
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
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
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**Brief Explanation**

{No Data Entered}

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

Formal evaluations were not conducted during this reporting period.

**Key Items of Evaluation**

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

**Program # 4**

**1. Name of the Planned Program**

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
501	New and Improved Food Processing Technologies	50%		50%	
502	New and Improved Food Products	5%		5%	
503	Quality Maintenance in Storing and Marketing Food Products	25%		25%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	20%		20%	
	<b>Total</b>	100%		100%	

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.5	0.0	0.5	0.0
Actual Paid Professional	1.0	0.0	1.4	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
68000	0	104074	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
68000	0	104074	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**

Chile pepper mash (*Capsicum annuum* cv. Mesilla Cayenne) is a major industrial food product in New Mexico. The fermentation of chile pepper mash depends on temperature, acidity, salt concentration, dissolved air, available carbohydrates and enzymes. The microbial flora involved in pepper mash fermentation has not been fully characterized and was the focus of this work. The objective of this study was to evaluate the microbial characteristics of fermented chile pepper mash by enumeration, isolation and characterization of lactic acid bacteria involved in the process. The levels of each of the microorganisms examined declined over time. Lactic acid bacteria isolated from the mash included *Lactobacillus plantarum*, *Leuconostoc mesenteroides*, *Leuconostoc citreum*, *Lactococcus lactis*, *Streptococcus oralis*, *Streptococcus mitis*, *Streptococcus salivarius*, *Streptococcus sanguinis*, and *Enterococcus faecium*. Further studies to determine their suitability as starter organisms could improve the fermentation process. The fermentation of chile pepper mash depends on many factors such as temperature, air, available carbohydrate and microflora is a natural process that has not been fully characterized for industrial processing. Identifying the micro biota of the fermented chile mash can improve the production capacity and processing steps used by local facilities. Characterization can further identify any potential pathogenic microorganisms or explore the use of a starter culture that may be used to ferment the chile mash.

A total of 626 participants responded to Kitchen Creations survey questions. 53 % of Kitchen Creations participants have diabetes and 52% have a family member with diabetes. Most of the participants (58%) choose and prepare most of the foods eaten at home. The majority of participants (52%) were between the ages of 45 and 65. Participants were predominately female (80%). Many of the men who participated attended with their wives. Fewer participants with diabetes describe their health as being excellent (8.6% vs 11.8%). 50.6% of participants with diabetes and 54% of all participants described their health as good. More participants with diabetes describe their health as being fair (34% vs 24.7%) or poor (6.3% vs 4%). Ethnicity of participants was similar to ethnic distribution in communities where the classes were taught.

Better Process Control Schools ensure food safety market viability of commercially processed foods by providing certification courses reviewing processing steps, ingredients and thermal processes of acidified and low acid foods. The US FDA will not allow these products to be sold without this certification course. In 2011, schools were taught for acidified products for Spanish speakers in the U.S. and Guatemala.

New and improved food products were developed using cottonseed oil and meal. Extension specialist assisted Cotton Inc. team with research and development of marketable products. Research at the Texas Agricultural Experiment Station identified the enzyme that creates gossypol, which may allow it to be repressed from the cottonseed. This development meant there could be 48.5 million tons of edible cottonseed created each year. Edible glandless cotton seeds serve as a suitable replacement for peanuts due to its allergy-free characteristics. These value added products of cotton could potentially generate higher income for farmers and increase the competitiveness of cotton crop in New Mexico. Edible cottonseed oil has the potential to replace soybean oil in US markets. Edible cottonseed oil also has a healthier fatty acid profile compared to other edible oil. Edible cottonseed meal is a by-product of oil production that is high in protein low in carbohydrates and fats and is a good ingredient in gluten free products. Potential food products using cottonseed oil as a base and potential food products using cottonseed meal as a base for gluten-free snack spread, snacks and bread products were researched.

Organically grown broccoli and peanut are being studied to help local small farmers explore new



crops and markets. Current research has shown that broccoli grows well in spring and fall seasons in Southern NM. Local and state markets show promise in selling broccoli as a locally grown crop. NMSU researchers and extension specialists are leading the industry in the exploration to grow organic peanuts to meet a niche market, improve crop productivity and increase profit levels. Discussions held with industry, scientists, and university faculty are providing direction for future work to be completed.

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

Target audience is food processors in Arizona, Colorado New Mexico, Texas, and Utah.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	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: 2011  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	3	1	0

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

**Output Target**

**Output #1**

**Output Measure**

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and

Extension media are important outputs for the various projects falling under this planned program.

<b>Year</b>	<b>Actual</b>
2011	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of trained professionals
2	# of research publications
3	# of Extension publications
4	% of food processors using NMSU for their food product development

**Outcome #1**

**1. Outcome Measures**

# of trained professionals

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

# of research publications

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	1

**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>
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #3**

**1. Outcome Measures**

# of Extension publications

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	3

**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>
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

**Outcome #4**

**1. Outcome Measures**

% of food processors using NMSU for their food product development

Not Reporting on this Outcome Measure

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

**External factors which affected outcomes**

- Economy
- Public Policy changes
- Government Regulations

**Brief Explanation**

{No Data Entered}

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

Formal evaluations were not conducted during this reporting period.

**Key Items of Evaluation**

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

**Program # 5**

**1. Name of the Planned Program**

Health and Wellbeing

**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	5%		5%	
703	Nutrition Education and Behavior	20%		20%	
704	Nutrition and Hunger in the Population	20%		20%	
724	Healthy Lifestyle	20%		20%	
801	Individual and Family Resource Management	20%		20%	
802	Human Development and Family Well-Being	10%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		5%	
	<b>Total</b>	100%		100%	

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	7.0	0.0	1.1	0.0
Actual Paid Professional	2.8	0.0	1.9	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
190807	0	172687	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
190807	0	172687	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**

The educational media segment has published several publications focusing on the use of video technology to teach children. They are also in the process of writing a book targeted at educators, program leaders and parents summarizing the research on the benefits of exercise (active games) and the implications of gaming in a variety of learning settings.

For nearly 20 years, the use of parenting newsletters to educate families about childhood development has been a pinnacle program. Delivering educational resources that are cost effective to parents at a teachable moment decreases frustration and increases parents' knowledge. Topics presented include children's emotional, physical, intellectual, and social development at each early age stage. Each year an average of 27,000 families subscribe to the free three year newsletter series. Annual evaluations report that 90-plus percent of readers learn how to; talk to their baby, be less energy, feed safe and healthful foods, protect their baby from accidental injuries, play with their baby, how to feel more confident as a parent, and take care of themselves so they can be better parents. Families representing every county in NM are enrolled in the program.

Efforts have been underway for several years to expand the Just Be It! Healthy and Fit (JBI) curriculum to families in all counties. The program is in the final stages of being produced and disseminated to all counties. The JBI program educates youth about ways to reduce risk factors for childhood obesity for fifth grade students by providing nutrition education, increasing exercise time and affecting change in the home and school environments. The program is offered throughout the school year. 57% of students involved reported increasing their nutrition knowledge from pre to post surveys. However more work needs to be done to help students improve their fruit and vegetable intake and physical activity levels. Increases were not significant in these areas. Parents did report a 38% knowledge gain in nutrition knowledge from newsletters received at home. Students wrote many comments at the end of the post surveys including: "A great program!" "I liked to taste new foods, health snacks and try new exercises." Parents wrote that they appreciated their kids learning about leading a balanced life, reading food labels and receiving health tips.

In an effort to combat childhood obesity and teach children about healthy lifestyles, County Extension Agents from Santa Fe, Rio Arriba, and Los Alamos Counties revised and implemented a pilot program, Just Be It! Healthy and Fit, for fifth grade students in their counties in 2004-2005. Evaluation results from a pre/ post test of the 817 students showed that the workshops on My Pyramid, Power Up with Exercise, Making Healthy Snack Choices, and Goal Setting increased student knowledge scores 11%. Teachers were also surveyed and 93% felt the program was a good use of student time. The current need for



childhood obesity prevention education, the success of the pilot program, and the literature review's evidence that this program addresses the risk factors for obesity, all combined to make this project a program of excellence for Extension. It was chosen as a program to submit for USDA/CSREES funding as a Children, Youth, and Families at Risk-Sustainable Community Project for 2006-2011

Research shows that Americans who take care of themselves and manage their lifestyles are healthier, more productive, have fewer absences from work, and make fewer demands for medical services. Current health care disparities across New Mexico indicate the need for Cooperative Extension to address, within its own capacity and service, the health of New Mexicans. Some of the programs currently impacting New Mexicans are the Colorectal Cancer Awareness program, the Food Protection Alliance and the Tufts University StrongWomen Programs. The Health Specialist collaborated with Dr. Mary Anne O'Connell (ACES) in expanding the Colorectal Cancer Awareness Program in New Mexico. The Partnership for the Advancement of Cancer Research: New Mexico State University-Fred Hutchinson Cancer Research Center was developed to increase cancer research at NMSU, as well as increase minority participation in cancer research. Under the partnership, a grant from the National Cancer Institute funds efforts to increase colorectal cancer awareness among minority communities in New Mexico, as well as increase awareness among the Native American community. Through email, phone calls and face-to-face meetings, the Health Specialist promoted the program and how the educational display could be made available at county health fairs and other venues. One county (Los Alamos) took advantage of the display and another county (Torrance) is planning a 2012 display. Through a partnership with NMSU ACES college and New Mexico Department of Agriculture (NMDA), the Extension county agents are encouraged to organize Food Protection Alliances at the county level. All states will be organizing at the state level by request of the FDA; NM is the first state to organize. The goal is to have a committee that can respond to food recalls and conduct training in a coordinated manner. The Health Specialist is involved with the Food Protection & Safety Alliance at the state level and is a member of the Dona Ana County Alliance.

The StrongWomen Programs are evidence based. Certification for program leaders is offered through Tufts University. There are two different StrongWomen Programs offered in New Mexico; StrongWomen Healthy Hearts and StrongWomen Strong Bones. Both StrongWomen programs encourage women (and men) of all ages to live stronger, healthier lives by providing knowledge, inspiration, access to programs, and ongoing support. There are additional strength-building programs offered in some counties that are based on the Tufts model. The objective of this study is to provide the necessary educational materials and training to fitness and nutrition professionals to help them successfully implement and maintain the program.

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

The target audience includes: teenage mothers, low-income families, families suffering social stress, mal- or undernourished families, diabetics.

## **3. How was eXtension used?**

eXtension was not used in this program

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

### **1. Standard output measures**

2011	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: 2011

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	3	2	5

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

**Output Target**

**Output #1**

**Output Measure**

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and Extension media are important outputs for the various projects falling under this planned program.

Year	Actual
2011	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of research papers
2	# of Extension publications
3	# of trained professionals
4	% diabetics adopting NMSU recommendations regarding nutrition

**Outcome #1**

**1. Outcome Measures**

# of research papers

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	2

**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
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

**Outcome #2**

**1. Outcome Measures**

# of Extension publications

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	3

**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>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being

**Outcome #3**

**1. Outcome Measures**

# of trained professionals

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	21

**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
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

**Outcome #4**

**1. Outcome Measures**

% diabetics adopting NMSU recommendations regarding nutrition

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
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**Brief Explanation**

{No Data Entered}

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

Formal evaluations were not conducted during this reporting period.

**Key Items of Evaluation**

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

**Program # 6**

**1. Name of the Planned Program**

4-H and Youth Development

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
806	Youth Development	100%		100%	
	<b>Total</b>	100%		100%	

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

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

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	5.5	0.0	0.3	0.0
Actual Paid Professional	6.5	0.0	1.2	0.0
Actual Volunteer	37.2	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
462784	0	149232	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
462784	0	149232	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**

In New Mexico 4-H life skills development programs are carefully planned; directly impacting 71,638 youth (2011) between the ages of 5-19 and involving 7354 volunteers (2011) and trained faculty. NM youth participate in opportunities that explore responsibility, team building, self-confidence, positive thinking,



problems solving, communication, self-esteem, career planning, leadership, hobbies, respect, customs and cultural awareness, parliamentary procedures, civics, public service, shadowing, mentoring, community interactions, competition, goal setting, travel, event planning, and record keeping. Well-rounded club and individual projects include fitness, nutrition, yoga, fashion design, raising and showing animals, food safety, photography, robotics, entomology, child care, shooting sports, conservation, forestry, gardening, rodeo, and many more.

NM 4-H agents, specialists, and volunteers focus their programs on developing high quality experiences. Each activity is carefully planned to encourage life skill development while delivering subject matter to achieve specific results. New and repeated programs provide youth a dependable annual event calendar encouraging planned goal setting and eventual achievements. This past year 4-H activities included competitive events in agriculture, home economics, public speaking, entomology and parliamentary procedure contests as well as Home Economics Letterman program and Home Economic Schools, Youth Get-Away weekend, State Conference, Leadership and Ambassador Teams, Ag Fairs, Operation Military Kids, Ag Awareness Days, individual workshops (Confidence on Your World Tour, Stairway to Awesomeness, Ebony and Ivory, Rocking the Positive, Get a Rhythm, Spontaneous Combustion, Explosions in 4-H, and Tick, Tick...Boom), regional and international youth and club exchanges, Horse Shows, Shooting Sports, Rodeo trainings and contests, and after school, year round and seasonal 4-H club program activities.

The goal of youth programming is to provide developmentally appropriate opportunities for young people to experience life skills. Through the experiential learning process, youth internalize the knowledge and gain the ability to apply the skills appropriately. In evaluations, parents and participants stated, "While doing demonstrations, presentations and community service I have learned self-confidence, speaking and socialization skills. I have learned to lead younger members and am trying to be the best role model I can be for them, because of older members that were such a positive influence for me. I now have goals in life with the help of 4-H. Knowing that I have had the support from my club has helped and guided me to the trail that is right for me" (7 year 4-H Member in Military 4-H Club). "My children have been a part of 4-H for 5 years. In this time I have seen them mature and grow because of the 4-H program. It has opened them up to experience things that they may have never been able to experience otherwise. It has given them skills that will be needed throughout life such as public speaking, teaching others how to do something, leadership skills and many more things that are valuable to them" (4-H Parent of Member in Military 4-H Club).

There was a 25% increase in junior instructors last year. Following attendance at the Home Economics Schools, various junior 4-H instructors stated, "Because of participating in the Home Economics School, I have more confidence in leading." "I have learned new techniques for completing projects and facilitating workshops." "I have become a much better leader, team member and communicator." Comments from Home Economics program participants include: "I have changed in many good and fun ways. I could see what and how I changed. I'm glad about it!" "I get better every time I come here." "I have learned how to be more respectful of the things and people that are around me." "I have changed after participating in Home Economics school because I am more creative and confident. I appreciate the hard work everyone puts in."

Adult volunteer leaders participating in the Home Economics Schools stated that, "The whole 4-H event seems to bring the best out of all the kids." "It is a great place to learn more about all aspects of Home Economics in a fun, loving, exciting environment."

To facilitate the on-going development of 4-H curriculum and assist graduate students in completing course requirements, curriculum development has been coordinated as a creative component for graduate student master's degree projects in the Agricultural and Extension Department. Coordination between the State 4-H Office and the Agricultural and Extension Education Department is a win-win arrangement

producing cost efficient and dynamic project materials and assisting graduate students meet requirements for completing a Master's Degree. This year graduate students revised and/or developed 4-H curriculum on Genealogy, Babysitting, Food Preservation, Horse Judging, Braiding, Rodeo Safety, and Cloverbud Food Fun.

### STEM Education

The Memorial Middle School Agricultural Extension and Education Center (MMSAEEC) is a model youth science center delivering inquiry-based learning and experiential education programs. The mission of the MMSAEEC is to deliver educational programs in agriculture and natural resources to youth in Las Vegas, NM. A basic premise of the mission is to develop a model of excellence for agriculture and natural resource science teaching and learning that complements in-class instruction by providing context to content through hands-on learning opportunities; to enhance youth learning opportunities, particularly targeted at underrepresented Hispanic students in STEM. A peer-reviewed journal article about MMSAEEC activities with national reach has been accepted for publication, a juried article was published in a professional periodical, and two peer-reviewed poster abstracts were published in a national journal.

Short term objectives:

Obj. 1 - Design, develop, and deliver STEM-based agricultural and natural resource science education programming that complements in-class teaching and/or experiential learning opportunities that meet New Mexico public education content standards, benchmarks and performance standards. Programs were delivered at each grade level (grades 6-8) in scientific method, agri-science, and emerging issues in agriculture and natural resource science.

Sixth grade programs focused on exploring the scientific method through a fertilizer experiment in the greenhouse. Over 16 weeks, 282 students were involved in hands-on experiments studying bean physiology and root structures using a variety of teaching methods. Seventh grade programs focus on agri-science. Modules for the agri-science program include: plant/light relationships, plant/ water relationships, plant breeding, and plant physiology. Course content includes learning objectives, materials, methods, key terms, data collection activities, tables, and final report.

Eighth grade programs focused on emerging issues in natural resource science. Exploration of natural resource science is achieved primarily through lectures, labs, and greenhouse experiments. This program was a yearlong study. Topics and activities included global and local water issues, the water cycle, measuring water footprint, water properties, pollution, and quality monitoring, and building a water purification system. This program reached 247 students.

One cross curricular program focused on nutrition. This program was delivered through the Health class to 91 students to complement nutrition education. Students harvested fresh produce from the campus agricultural system, designed healthy snacks using the fresh produce, consumed the fresh produce in class and discussed the importance of good nutrition. A six week ecology field-based summer program was offered to fifteen students.

Obj. 2 - Conduct research on MMSAEEC model. The Las Vegas City Schools and the West Las Vegas school district are cooperating on a four-year quasi-experimental study to compare science achievement, agriculture and natural resource science achievement, leadership life skills development, and career interests between students participating in MMSASC learning activities for three years and students who receive their instruction without the agricultural science Center enhancements. Standards-based Assessment (SBA) test scores have been obtained from study school districts and year one data collection is complete. Data has been collected from 395 students participating in the program (treatment group) and 248 students in the control group over two years. Data analysis for year one is complete and a manuscript for submission to a peer-reviewed journal is in preparation. Data analysis for year two is underway.

Obj. 3 - Build collaborative relationships with other agencies and organizations by identifying and meeting with key agency and organization representatives to multiply effectiveness of program efforts, and enhance program reach and visibility. MMSAEEC partnered with six non-profit organizations, foundations, government agencies, and other educational institutions. These collaborations further the missions of the partner groups, as well as enhance programmatic impacts achieved through these various partnerships.

Obj. 4 - Gain local, state and national recognition for MMSAEEC through programming efforts, educational innovativeness and model value. Center recognition was increased through numerous venues such as websites, center tours and workshops, poster presentations and a presentation to New Mexico County Agents on 4-H Science opportunities.

Obj. 5 - Procure grants or other funding to support program activities. Two grants were applied for and awarded \$5,000 from the Office of the Vice President for Research at NMSU. Total sponsored research was \$19,000.

Obj. 6 - Provide support to and collaboration with State 4-H program to initiate 4-H Science programs at state and national levels. A statewide science plan of action was submitted to national 4-H; serving on two regional/national committees related to 4-H Science (Western Region 4-H Science Liaison and Western Region 4-H Science Academy); help establish 4-H National Youth Science Day to bring together youth, volunteers and educators from the nation's 111 land-grant colleges and universities to simultaneously complete the National Science Experiment; Increase county agent awareness about 4-H Science through presentations, newsletters; and serve as a resource for 4-H Science related programs.

7th grade teachers reported that students exhibited increased knowledge about agri-science, which is supported by research findings both from State Standards Based Assessment data science scores ( $p=0.0086$ ; 34.9 vs. 29.3) and the agriculture and natural resource science achievement tool data ( $p=0.0482$ ; 12.89 vs. 10.71); preference by students for the hands-on, applied nature; and enhanced motivation and attitude of students. 61% of students have a preference for learning by doing, 75% rated the program as good or excellent, 59% said they learned a lot, and 71% of students indicated they have developed at least some new science skills as a result of participating in the program.

8th grade teachers reported that students exhibited increased knowledge about agri-science, which is supported by research findings both from State Standards Based Assessment data, physical science scores ( $p=0.0008$ ; 8.6 vs. 6.7) and science and people scores ( $p=0.0724$ ; 3.5 vs. 3.0), and the agriculture and natural resource science achievement tool data ( $p=0.0482$ ; 12.89 vs. 10.71).

A learning evaluation for the Agri-science field day determined that students achieved 62%, 73%, 60%, and 76% correct responses on paired questions for each of the four modules, respectively. Seventy-six percent indicated a preference for experiential learning and 95% rated the experience as good or excellent. University students responded that field-based teaching opportunities were invaluable for applying what was learned through the course. Science teachers found great value in the experience for both groups of students. Results are being used to improve the field day, and replicate it in other parts of the state.

#### Medium-term objectives

Obj. 1 - Develop and enhance the MMSAEEC youth science center facilities and landscape teaching facilities. Develop 2,000 linear feet of trails connecting the greenhouse with the rest of the physical campus landscape for teaching purposes; 640 sq. feet of raised beds are in vegetable and fruit production; one-third acre is in row-crop vegetable and raspberry production; and a campus orchard with 55 fruit trees has been established. 100% of students have been involved in producing fresh food from campus systems. Fresh produce was used in a farm-to-school program in the Health class to teach nutrition. About 50% of

electrical energy needs for greenhouse is supplied by solar and wind power. The Center captures, stores, and reuses water annually through a catchment system. All of these systems are used for public demonstration.

Efforts on the transformation of Memorial Middle School campus into a youth agricultural science Center are on-going. Improvements this year include maintenance of on-site agricultural planting during severe drought and on-site composting; continued use of hoop houses provided cut leaf lettuce for teaching and student consumption.

The Center continues to be a demonstration site for renewable energy and small scale agricultural production. Grafting workshops have increased community interest in fruit tree grafting and orchard restoration, while the wind turbine and solar panels attract interest in renewable energy. Parental and community interest in the program has also increased. We are establishing ourselves as an integral part of the community, in both formal educational efforts and non-formal outreach, and are achieving a high level of community support. I continue to provide Center tours to community members and parents of students as requested.

Obj. 2 - Measure program impacts through a 4 year research project to assess improvements to average yearly progress on science test scores, learning and development in agricultural and natural resource science, and leadership and youth development life skills, and increase interest in agriculture and natural resource careers. We have found significant differences in the State Standards Based Assessment (SBA) scores between treatment school (MMS) and the control school. The treatment school has higher scores on all five subscales, with significant differences on 4 of the five. The mean scores on the State Standards Based Assessment (SBA) for treatment school (MMS) was higher than the mean for control school for Science Total ( $p=0.0086$ ; 34.9 vs. 29.3).

Long-term Objective

Obj. 1 - Contribute to the advancement and knowledge of public education-based youth development efforts statewide and nationally. Ongoing efforts.

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

Youth ages 5 to 19 are targeted to learn life, leadership and citizenship skills through: Project Work, Special Interest Groups, School Enrichment, Competitive Events, Fairs, Clinics, Workshops, Record Books, Camps, Community Service, Public Speaking, Elected/Appointed Offices, etc.

**3. How was eXtension used?**

eXtension was not used in this program

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

**1. Standard output measures**

2011	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: 2011

Actual: {No Data}

**Patents listed**

{No Data Entered}

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

**Number of Peer Reviewed Publications**

2011	Extension	Research	Total
Actual	2	1	0

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

**Output Target**

**Output #1**

**Output Measure**

- The specific output measures will vary according to the specific project being monitored. The development of research procedures and technology, training of students, publishing research papers, and disseminating research results via educational workshops, conferences, and Extension media are important outputs for the various projects falling under this planned program. Numbers of students involved in 4-H programs also will be outputs.

Year	Actual
2011	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	# of Research publications
2	# of Extension publications
3	% volunteers trained

**Outcome #1**

**1. Outcome Measures**

# of Research publications

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2011	17

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

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
806	Youth Development

**Outcome #2**

**1. Outcome Measures**

# of Extension publications

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2011	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**

<b>KA Code</b>	<b>Knowledge Area</b>
806	Youth Development

**Outcome #3**

**1. Outcome Measures**

% volunteers trained

Not Reporting on this Outcome Measure

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

**External factors which affected outcomes**

- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**Brief Explanation**

{No Data Entered}

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**



Formal evaluations were not conducted during this reporting period.

**Key Items of Evaluation**