2015 University of Nevada Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted
Date Accepted: 07/25/2016

I. Report Overview

1. Executive Summary

The University of Nevada's College of Cooperative Extension used federal funds in calendar year 2015 to address the National Institute for Food and Agriculture's (NIFA) major themes of Global Food Security and Hunger, Climate Change and Natural Resources, Childhood Obesity Health and Nutrition, Food Safety, Human and Family Development and Community and Economic Development. Nevada Extension did not focus on the NIFA theme of Renewable Energy. Nevada Extension used funding to partially support 12.44 of 28.0 full time equivalent positions. Those supported included 10 county-based educators, 17 subject matter specialists and 1 area director. Nevada Extension and the College of Agriculture, Biotechnology and Natural Resources 2014 plan of work projected 33.5 FTE for the six program areas. Nevada Extension supported 12.44 positions with funds allocated under the Smith Lever Act, including 3.54 FTE for Global Food Security and Hunger, 2.54 FTE for Climate Change and Natural Resources, 1.07 FTE for Childhood Obesity Health and Nutrition, 0.62 FTE for Food Safety, 3.39 projected for Human and Family Development and 1.29 projected for Community and Economic Development. Lack of state and federal support led to under participation in 5 of the 6 NIFA program areas listed above. Food Safety was a minor effort in calendar year 2015.

Nevada's federal personnel commitments emphasized Global Food Security and Hunger as a first priority, with Childhood Obesity Health and Nutrition, Human and Family Development, Climate Change and Natural Resources, Community Development and Food Safety as priorities 2--5, respectively.

In 2015, federal funds supported 13% of Nevada Extension's activities, general funds from the state of Nevada supported 18%, grants, contracts, gifts and sales accounts supported 28% and funds provided by ad valorem shares of county taxes supported 41%.

Nevada Extension's faculty who were supported with federal funds produced 18 peer-reviewed journal articles, 35 abstracts contributed to societal meetings and conferences, 16 fact sheets and special publications and 55 presentations to community groups and trade organizations. These were distributed among the six themes in approximately the same proportion as our reported effort. with 33 journal articles, 27 abstracts from conference presentations, 2 fact sheets and 15 presentations as part of the category of Global Food Security and Hunger, 8, 66,12 and 15 respectively in the category of Climate Change and Natural Resources, 1 journal article in the category of Childhood Obesity Health and Nutrition, none in Food Safety, 4, 35, 11, and 5 in the category of Human and Family Development and 6, 21, 2 and 15 in the category of Community and Economic Development. A comprehensive training program on Good Agricultural Practices currently in review will become the foundation for an effort focused on food safety in 2015.

Nevada Extension exceeded matching requirements with state, county and grant funding, matching $346,028 in federal expenditures for activities in Global Food Security and Hunger with $692,055 in state, county and other funding, $312,282 in federal expenditures for activities in Climate Change and Natural Resources with $624,564, $141,411 in federal expenditures in Childhood Obesity Health and Nutrition with $282,821, $490,117 in Human and Family Development with $980,234, and $312,282 in Community and

Economic Development with $324,564.

Nevada Extension had 115,002 and 255,738 adult and youth contacts in 2015, again distributed approximately proportionately to expenditures of federal funds among the six themes. These included Global Food Security and Hunger (31,976 adult contacts, 2,906 youth contacts), Climate Change and Natural Resources (10,810 adult contacts, 5,831 youth contacts), Childhood Obesity adult contacts, Health and Nutrition (18,408 adult contacts, 110,348 youth contacts), Human and Family Development (33,155 adult contacts, 123,877 youth contacts), and Community and Economic Development (20,653 adult contacts, 12,776 youth contacts).

Evaluations of Nevada Extension's federally supported efforts indicate that audiences have increased knowledge following participation. Evaluations generally take the form of pre- and post-event questionnaires and are analyzed to determine statistically significant differences. In general, all Extension events produce statistically significant improvements in knowledge indicators, as seen in the reports provided under each theme.

Nevada Extension continues to face challenges with respect to having adequate personnel to address NIFA's themes. In part this is because state and federal budget reductions led to greater reliance on county and grant funds. This will continue to be an issue in calendar year 2016, especially because several Nevada counties are anticipating budget shortfalls, which will likely reduce funding for county Extension offices and because state and federal funds for Nevada Extension are likely to remain at levels provided in 2015.

The Nevada Agricultural Experiment Station (NAES) contribution to the NIFA 2015 Annual Report will focus on select programs that reflect the unique benefits to a diversity of clientele and stakeholders in Nevada.

NAES and the College of Agriculture, Biotechnology, and Natural Resources are focused on improving the quality of life for all Nevadans through education, research and outreach that support the agricultural enterprise; foster community health and well-being; promote natural resource sustainability; and stimulate statewide economic development.

This past year, NAES formula-funds grant program included Hatch, Multi-State, and McIntyre-Stennis funding opportunities, was driven by peer and stakeholder review, and embraces the Federal-State partnership directed by the Hatch Act and subsequent Farm Bill provisions.

One of NAES's state performance metrics is external funds leveraged per dollar of formula funds funding. In 2014-2015, $2.6M in federal-state appropriations were leveraged by faculty to generate $6.54M in external funds. Our faculty published 86 peer-review journal articles, trained 86 graduate and 204 undergraduate students, gave over 190 presentations, and conducted 85 workshops.

Some of this year's research highlights include:

<u>Global Food Security and Hunger</u>

- An elite line of drought tolerant teff has been identified
- A new protocol was designed to determine grape-root epidermis characteristics
- 674 examples of drought-tolerant grapes were collected from southern Nevada
- New evidence suggest that beef cattle digestion can be improved through the use of chia seed or glycerin supplements
- To improve pollen tube development under stressful conditions, two cell membrane lipid pumps have been identified that play critical roles in heat-stress tolerance and vegetative development. A third

membrane gene was found, which controls hypersensitivity to heat stress.
- New discoveries in potato epidermis and cactus cuticle
- Bovine foothill abortion vaccine trials have included inoculating over 7,500 cows and a small vaccine manufacturer is now interested in manufacturing the vaccine when FDA has given approval.

Climate Change, Natural Resource Management and Environmental Science

- Development of a new method for measuring atmospheric mercury and lead isotopes along with particulate matter, simultaneously
- Creation of a native Nevadan grass seed collection for use in future research projects
- A Database for Inventory, Monitoring and Assessment (DIMA) of Nevada's rangelands at the watershed scale was developed
- Barrick Gold Corporation is incorporating State-and-Transition Model thresholds to determine how best to spend restoration dollars
- RNA-Sequence database of de novo assembled Jeffrey Pine Beetle mRNA was built - the first for this species
- A novel, high-throughput method to measure P450 enzyme activity based on O_2 monitoring in real time was constructed.
- The Pinyon-Juniper Model developed here has shown substantial improvement in predictive power over existing products (Landfire, National Land Cover Dataset, and Greenwood & Weisberg)
- First documentation of widespread canopy decline associated with drought in pinyon pines in central Nevada.
- Our scientists have created innovative laboratory protocols for soil organic matter density fractionation.
- Patent - Tittiger, C., Figueroa-Teran, R., Blomquist, G., US 8404825 B2 "Method for producing monoterpene and monoterpinoid compounds and use thereof", Regular, United States

Sustainable Energy

- Mutant line of camelina showing resistance to herbicides across generations
- Oil production genes were successfully transferred to model plants, which in turn started producing oil droplets
- Two transformation strategies were designed for the catalytic conversion of gumweed bio-crude in the aqueous phase into hydrocarbon fuel.
- The Prickly-Pear Cactus (Opuntia ficus-indica) transcriptome database is now completed
- Patent - Cushman, J. C., Lim, S. D., "Engineered Tissue Succulence in Plants", Provisional, United States. Date of Patent Application: November 13, 2015

Childhood Obesity, Nutrition, and Health

- Elucidation of the underlying molecular mechanisms that grape seed supplements have upon serum triglyceride levels.
- The optimization of an in-house extraction technique is finalized, using whole grape seeds for the isolation of low molecular weight procyanidins a class of flavonoids.

Community and Economic Development

- The Economic model used to assess northern Nevada ranches is now being calibrated to investigate the ramifications of range fragmentation to ranchers in southern Nevada
- An economic model was devised that evaluates ranchers' financial impact of adopting or not trichomoniasis vaccine for range cattle.
- Development of a web-based program called Regional Economic Analysis Project to analyze U.S.

Bureau of Economic Analysis data, State of Nevada Department of Employment, Training, and Rehabilitation data, and State of Nevada Taxation data.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	33.0	{No Data Entered}	18.5	{No Data Entered}
Actual	12.4	0.0	8.2	0.0

II. Merit Review Process

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

- Internal University Panel
- External Non-University Panel
- Expert Peer Review
- Other (Stakeholder Review)

2. Brief Explanation

UNCE's merit review process

UNCE's merit review process comprises multiple steps. Annually UNCE tenure-track faculty prepare a Role Statement detailing their teaching, research, and service activities for the coming calendar year. Extension faculty review their individual Role Statements with their Area Director and/or Department Chair who ensures the quality and relevance of planned programming efforts effectively address formally identified program goals. Both the Area Director and the UNCE Dean/Director for UNCE review and approve the plan.

Annually, UNCE faculty evaluate their peers' teaching, research and service activities to assess overall performance and program quality. Peers consider the results of formal needs assessments, programs developed in response, and the substance of documented outcomes and impacts in rating peer performance and providing narrative feedback. Area Directors also conduct an annual review of faculty performance and provide narrative feedback. Area Directors then meet individually with faculty to discuss the documented results of the peer review and Area Director's review. The UNCE Dean/Director also reviews and signs off on the evaluation documents.

Programs outcomes and impacts are reviewed by a Non-University External Panel (UNCE Advisory Committee) which includes key representative community and industry stakeholders. Also, to improve and ensure the quality of UNCE publications, a blind peer review process is utilized involving internal and external experts. Additionally, several UNCE faculty contribute specialized program content to eXtension Communities of Practice (CoP). Subsequently their program content is reviewed in the eXtension CoP selection process.

Finally, some Cooperative Extension efforts are a part of the Multi-state Review Committee (MRC) process and are documented, reviewed and approved by the sponsoring regional association. These committees are responsible for the review, evaluation, and recommendation of western multistate programs which may

involve research, academic programs, extension, and/or international programs.

NAES's merit review process

Scientific peer review drives the initial selection of research projects that comprise the NAES research portfolio. NAES administration solicits applications from NAES/CABNR scientists in a general call for proposals that identifies annual priority areas. Faculty submit proposals through an in-house, web-based content management system.

Based upon research priority area, expert peer reviewers are assigned by NAES administration to rate proposals based upon merit in the field of research, PI's qualifications, projected outcomes, degree of multi-disciplinary activity, and budget feasibility. The NAES administration concurrently sends proposals to its external advisory board panel representing stakeholder interests for evaluation and ranking based upon their constituents' inputs.

Tabulated results, comments, recommendations and proposals are then sent to the PI's home department administration for internal review. Departmental recommendations are then send forward to NAES administration. All findings are then compiled by NAES administration and final decisions are made based on the rankings, comments and stakeholder input.

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
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Other (Use of social media; conduct field days at our University field stations)

Brief explanation.

Use of local newspapers and radio, through public-service announcements, encourage stakeholders to participate in public meetings and listening sessions. In 2015, Nevada Extension also used paid advertisements in Edible Tahoe-Reno quarterly to specifically target the increasing number of small and urban farm operators, CSAs, and their clientele. Extension and Experiment Station had booths and representatives at the annual meetings of the Nevada Cattlemens' Association, the Nevada Association of Counties, the Nevada Small Farm Conference and the Governor's Conference on Agriculture. Extension organized an information/outreach tour of Northern Nevada in the Cattlemens' Update. Extension engaged the Latino Coalition in Clark County as members of a search committee to better understand and meet needs specific to the Las Vegas metropolitan area. Extension and Experiment Station participated on the Nevada Governor's Council on Food Security, the Northern Nevada Food Bank and the Nevada Governor's Drought Forum. Extension and Experiment Station also participated as a member of the planning committee for the Nevada Water Resources Association annual conference, the Nevada Governor's Conference on Agriculture and the annual Small Farm Conference hosted by Western Nevada Community College.

Faculty target traditional and non-traditional stakeholders through email and postal mail invitations to participate in public meetings, focus groups, and individual interviews. Poster announcements are placed in public places frequented by traditional and non-traditional audiences.

Formal needs assessments serve as another means for contacting stakeholders. Faculty continually assess stakeholders' perceived program priorities in order to efficiently allocate resources and to identify and develop partnerships for program implementation and delivery.

Primary data-collection methods include postal mail and internet surveys, focus groups, and individual interviews. Results of Cooperative Extension community needs assessments are published and made available to other university faculty and the broader public via the Nevada Extension website (www.unce.unr.edu/publications/assessments).

Frequently, faculty develop partnerships with a variety of stakeholder groups as part of program planning, development, and implementation. These community and organizational partnerships provide an ongoing venue for receiving stakeholder input and feedback for the life of a program.

An advisory board has been established to counsel Experiment Station in matters of research, resident instruction and outreach. The board's qualifications cover a wide spectrum of interest, from local ranchers to federal agencies. Board members are asked to conduct focus groups based upon their home district to ascertain viewpoints and ideas on the needs and deficiencies of their local region.

Nevada Cooperative Extension will reform an Advisory Committee in 2016. The committee has been inactive since 2014 due to several factors. Committee members will represent a diverse cross-section of stakeholders with programmatic interests from the two Extension areas (north and south) and rural and urban communities, including minorities. Two Advisory Committee members are representatives on the Council of Agricultural Research, Extension, and Teaching (CARET) and regularly communicate with Nevada's Congressional delegation as well as USDA/NIFA administrators.

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
- Other (Informal discussions with key stakeholders)

Brief explanation.

Nevada Agricultural Experiment Station currently has a broadly based advisory board committee that meet and provides input multiple times per year. In addition, we have faculty members that schedule and coordinate meetings throughout the state with the purpose of obtaining direct input to the NAES research portfolio.

Our partnership with University of Nevada Cooperative Extension (UNCE) provides assistance and access to stakeholders through joint efforts like the annual Cattlemen's Update - a program designed to bring the researcher to the rancher - and Beginning Famers and Rancher events held throughout the state. With NAES administration abiding by an "open door policy", informal discussions with key stakeholders provides important input into our research programs and resident instruction. Comments are also received through our website.

Stakeholder input is routinely used to identify emerging issues, to direct and redirect Extension programs and also in the hiring process. Stakeholders include local elected and appointed officials, community leaders, citizens, underserved groups and individuals, university leadership, university academic departments, and UNCE faculty and staff. Therefore, the areas to be emphasized reflect the views of a broad set of stakeholders. Stakeholder input is used to determine the necessary qualifications of those hired and/or to create new positions, as new funding becomes available. Stakeholders also participate in UNCE faculty searches. Additionally, stakeholder input is used to help establish program priorities and to acquire necessary funding.

Use of local newspapers and radio, through public-service announcements, encourage stakeholders to participate in public meetings and listening sessions. In 2015, Nevada Extension also used radio announcements and paid advertisements in trade and limited distribution newsletters to reach small scale producers. Extension also sponsored booths and representatives at the annual meetings of the Nevada Cattlemens' Association, the Nevada Association of Counties, the Nevada Small Farm Conference and the Governor's Conference on Agriculture. Extension organized an information/outreach tour of Northern Nevada in the Cattlemens' Update. Extension participated on the Nevada Governor's Council on Food Security, the Northern Nevada Food Bank and the Nevada Governor's Drought Forum. Extension also participated as a member of the planning committee for the Nevada Governor's Conference on Agriculture and the annual Small Farm Conference hosted by Western Nevada Community College.

Faculty target traditional and non-traditional stakeholders through email and postal mail invitations to participate in public meetings, focus groups, and individual interviews. Poster announcements are placed in public places frequented by traditional and non-traditional audiences. Formal needs assessments serve as another means for contacting stakeholders. Faculty continually assess stakeholders' perceived program priorities in order to efficiently allocate resources and to identify and develop partnerships for program implementation and delivery.

Primary data-collection methods include postal mail and internet surveys, focus groups, and individual interviews. Results of Cooperative Extension community needs assessments are published and made available to other university faculty and the broader public via the Nevada Extension website (www.unce.unr.edu/publications/assessments).

Frequently, faculty develop partnerships with stakeholder groups as part of program planning, development, and implementation. These community and organizational partnerships provide an ongoing venue for receiving stakeholder input and feedback for the life of a program. Nevada Cooperative Extension is reforming an Advisory Committee to replace the current membership, which has been inactive since 2014. Committee members will bring programmatic oversight and support to each of Nevada Cooperative Extension's programmatic themes. Two Advisory Committee members also serve as representatives on the Council of Agricultural Research, Extension, and Teaching (CARET) and regularly communicate with Nevada's Congressional delegation as well as USDA/NIFA administrators.

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

1. Methods for collecting Stakeholder Input

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

Brief explanation.

In development and strategic planning of Experiment Station research programs and priorities, input was collected primarily through meetings with stakeholder groups and individuals including concerned citizens, ranchers, agricultural organizations, natural resources professionals and managers, state and federal agency representatives, food industry representatives, and Cooperative Extension administrators, specialists and educators.

Experiment Station will also hold several other public events during the year to gather information from stakeholders. Whenever it is feasible, efforts are made to coordinate relevant activities with extension to avoid duplication.

Research project participants obtained direct and indirect stakeholder input through varied avenues. Projects with social science components frequently used questionnaires and surveys. Stakeholder input to some basic science and some applied projects occurred in the form of reviewer inputs to proposals, and from questions, comments and discussions at regional, national and international conferences. Stakeholder input for other projects was collected through comments and questions at workshops and topical meetings for end users.

Nevada Cooperative Extension meets frequently with stakeholders throughout the state. This includes formal presentations to county commissions, the Nevada Association of Counties and community groups. It also includes participation as a member in state panels and commissions and executive boards, such as the Nevada Sagebrush Ecosystem Council, the Nevada Governor's Drought Forum, the Columbia Spotted Frog Conservation Consortium, the Nevada Governor's Council on Food Security, and the Food Bank of Northern Nevada. County-based Extension Educators and Nevada Cooperative Extension administrators meet formally and informally with county commissioners, and public service groups, such as Rotary Clubs. Extension Educators also conduct formal needs assessments involving survey instruments.

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
- Other (Strategic planning)

Brief explanation.

The Nevada Agricultural Experiment Station collected information from stakeholders to adjust issue areas that are influencing Experiment Station's future direction. These stakeholder priorities also directly influenced applied research activity, while influencing which departments or areas of expertise get hiring priority. Successful strategic hires enable us to meet existing needs and at the same time reposition for those on the horizon. Our stakeholders help us see into the future to identify those emerging issues. For example, in the past year the decision to hire faculty focused on agronomy and plant biochemistry. Input from Nevada's cattle and sheep industry reinforced this decision, and the industry was represented on the search committee.

Experiment Station used stakeholder input to make more immediate decisions, such as where to invest funding to direct current faculty and their research into emerging issues such as biofuels and alternative drought resistant crops. Stakeholder input was utilized in other activities such as annual budget allocation, providing feedback to the college, departments and faculty, and most importantly, in setting priorities for our Formula Fund research Call for Proposals and deciding how to allocate these funds.

Nevada Cooperative Extension used local, regional and state needs assessments to design, deliver and evaluate programs. Nevada Cooperative Extension used reports from public meetings and processes, participation on commissions and boards of directors, participation in state and regional conferences to:

- allocate funds from all of Extension's sources
- identify emerging issues to be addressed with new or expanded programs
- redirect Extension programs
- hire staff
- develop action plans and set priorities.

Brief Explanation of what you learned from your Stakeholders

The Nevada Governor's Drought Forum http://drought.nv.gov/News/Nevada_Drought_Forum__Recommendations_Report_-_December_2015/ provided useful recommendations for building resilience to drought, including suggestions for approaching drought with educational, technical, legal and social

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1198444	0	1562492	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1354618	0	1381307	0
Actual Matching	1354618	0	1237431	0
Actual All Other	1354618	0	0	0
Total Actual Expended	4063854	0	2618738	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	505248	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		20%	
103	Management of Saline and Sodic Soils and Salinity	0%		4%	
111	Conservation and Efficient Use of Water	20%		0%	
121	Management of Range Resources	15%		6%	
202	Plant Genetic Resources	0%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		20%	
205	Plant Management Systems	15%		5%	
206	Basic Plant Biology	0%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		0%	
216	Integrated Pest Management Systems	10%		0%	
301	Reproductive Performance of Animals	0%		3%	
302	Nutrient Utilization in Animals	0%		7%	
307	Animal Management Systems	5%		10%	
311	Animal Diseases	0%		3%	
504	Home and Commercial Food Service	0%		6%	
601	Economics of Agricultural Production and Farm Management	5%		0%	
604	Marketing and Distribution Practices	10%		0%	
701	Nutrient Composition of Food	0%		6%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		0%	
806	Youth Development	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	3.0	0.0
Actual Paid	2.6	0.0	2.7	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**
122753	0	463559	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
122753	0	447210	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
122753	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Nevada Cooperative Extension held the following programs to further the goals of NIFA's Global Food Security and Hunger theme:

Alternatives for Climate-Smart Agriculture; Alternative Crop Production in Nevada; Integrated Pest Management (IPM), IR-4 and Pesticide Safety and Education program; Walker Basin Project (Alternative Crops and Disturbed land Reclamation); Herds and Harvest; Nevada Risk Management Education; People of the Land; Beginning Farmers/Ranchers Development Program (Herds and Harvest); Cattlemen's Update 2015; Effects of targeted cattle grazing on fire behavior of cheatgrass-dominated rangeland in Pershing County, Nevada; Improving Farmer/Rancher Profitability and Efficiency; Managing Weeds Safely and Economically; Russian Knapweed Control Study; Local food production and marketing; Risk Management Education for Sustainable Agriculture in Nevada 2015; Agriculture Innovation Forum Series; Eagles and Agriculture; Poultry Workshop; Agriculture and Natural Resource Heritage; Integrated Pest Management; and The Southern Nevada Research Orchard.
These programs involved the following types of activities:

- Publish studies, develop curricula, and teach workshops related to plant production.
- Educate local, state, and regional stakeholders concerning progress in producing plants that are economically viable and environmentally friendly.
- Develop alternative crops best suited for Nevada's climate.
- Conduct trials to optimize greenhouse, hoop house, and high tunnel production.
- Continue research into improving stress tolerance and nutritional values of plants grown in Nevada.
- Establish herbicide demonstration/research plots to evaluate the efficacy of these products under local conditions.
- Expand use of Integrated Pest Management (IPM).
- Coordinate Nevada IPM efforts with other western states.
- Educate Nevada land managers, producers, and general public regarding invasive weed identification

and control.
- Strengthen the cultivation management and marketing skills of new and small acreage producers.
- Utilize multiple demonstrations/applied research plots to explore high-value specialty crops and manage weeds in agronomic crops with results reported at field days, workshops, or annual professional meetings.
- Develop applications for the research on plant production to directly benefit producers.
- Provide risk management strategies to agricultural producers.
- Provide teaching and research outreach to agriculture businesses to provide in-depth information on small business management, farm profitability, and market development.
- Develop new vaccines to protect livestock health
- Develop new livestock management systems to support sustainable livestock production

The Nevada Agricultural Experiment Station conducted the following programs to further the goals of NIFA's Global Food Security and Hunger theme:

Alternative Crop development for high deserts: Teff
Germ plasm was collected (367 accessions), planted, harvested and evaluated for biomass and seed production to determine viable accession best suited for high deserts. Selected accessions were then further tested using varying levels of drought-like conditions. All germ plasm were evaluated in an effort to identify diploid varieties (2 sets of chromosomes, as opposed to 4 sets) to help develop genetic lines less prone to lodging.

Evaluation of Wine Grape Cultivars and Clones
Screening for genotype variation to cold tolerance continues, with 12 varieties being tested over the past year. Bud dormancy and survival were evaluated. In addition, several treatments were evaluated on, the effect of ABA, anti-transpirants, irrigation and wind fences. Differences were detected, but results remain inconclusive for this year and need further evaluation.

In searching for wildtype grapes historically found in the high deserts, 28 locations were visited in Nevada, Utah, and California. Tissue samples were collected from each site and phenotypic and genetic measurements have begun. Thus far, DNA has been extracted from 674 samples and await DNA fingerprinting. In preparation of the drought and salt-tolerance experiments, a graduate student conducted preliminary experiments to determine the level and duration of the experiments. Pot dry-downs (without plants) were conducted in December 2015 to determine moisture release curves. An acute-drought/dry-down experiment is currently underway to assist with determining the duration of the drought for upcoming experiments. In addition, a second group of scientists has developed an extraction protocol for grapevine roots and determined; a baseline suberin composition for Cabernet Sauvignon, Riparia, and Ramsey. Progress has also been made in cloning and characterizing of putative genes of regulators of root suberin from the different grapevine genotypes.

On a third front, ground has been broken for a vineyard in southern Nevada, with irrigation and trellising installed. Salt-tolerant native Nevadan root stock has been grafted to several wine varietals and propagated in greenhouses awaiting transplantation into the new vineyard.

Nutritional Management in Beef Cattle
Investigations into the effects of omega-3 fatty acid rich supplemental grains (flaxseed and chia seed) on ruminal fermentation, digestibility, microbial efficiency, and ruminal nitrogen metabolism were conducted using both artificial ruminal systems and cannulated beef cattle. Findings indicate that chia seed maybe a good alternative to flaxseed supplements.

Researchers were also interested in ruminal fermentation and how partially replacing ground corn in the animal's diet with glycerin affects growth. Using a dual-flow continuous culture system (artificial stomach),

54 different ratios were tested. Results suggest that partially replacing dry ground corn with glycerin may change ruminal fermentation, by increasing total volatile fatty acids, and propionate concentration without affecting microbial efficiency, which may improve amino acids conversion into glucose of beef cattle diets.

In order to assess Forage kochia (an introduced plant used in rehabilitation of rangelands) potential to cause frothy bloat in free roaming cattle, scientists investigated the nutritive value of forage kochia across a grazing season (September-January), and compared in-vitro gas production, foam production, and foam strength with fresh alfalfa. The team has confirmed that foam from forage kochia digestion is likely to be more persistent than typical available forages, potentially leading to frothy bloat development.

Finally, scientists have begun gathering a variety of mega-CAM cactus to determine their nutrient values when used as an alternative forage in desert ecosystems.

Improving the Seed Set Yield of Plants under Heat, Cold and Drought Stress
Scientists at UNR have continued processing RNA-sequence data for a comparison of pollen's heat-stress response in wild type versus a heat sensitive mutant, cngc16 (cyclic nucleotide gated channel 16). This has produced a long list of candidate "stress" genes to test for their role in a pollen heat-stress response. Using a gene knockout strategy, a mutation was identified in the cell wall that helps stressed pollen respond normally in both growth and fertility. There has been a continuing effort to test candidate "stress response genes" for a significant contribution to stress tolerance in pollen. This has been done by either using gene knockouts, or over-expression of candidate genes.

Developing Better Potatoes
A new line of research was started this year with the addition of Dr. Dylan Kosma. Two potato cultivars that differ in wound healing capacity and long term storability were identified. The expression patterns of two different candidate transcription factors were profiled with an obvious winner emerging. The Kosma lab has just begun characterizing the two transcription factors that are likely positive regulators of potato tuber wound suberin deposition (a complex waxy polymer). To the best of our knowledge, these findings represent the first known transcription factors (proteins) that positively regulate wound suberin deposition.

The team has also determined the cuticle composition of Prickly Pear cactus (Opuntia ficus-indica), providing the first description of Prickly Pear cuticle lipid content and composition known to date.

Optimizing High Desert Hoophouses
Three varieties of cold-tolerant figs were planted in both hoop houses and field plots. The team tested direct seeding of watermelon in February and watermelon transplants in March to investigate the potential for accelerating the season for this high value crop. Cool season successional trials were conducted on both greens and root crops. Warm season successional varietal trials and compost composition were conducted on tomatoes and watermelons. Studies of berry production and micro-climate differences between field and hoop house grown plants continued at the Jacobs Family Berry Farm, a commercial operation in Gardnerville, Nevada. Hoop houses and field plots were also outfitted with high-precision climate sensors and water meters.

Urban Hydroponic Fruit and Vegetable Production
Over the past year, Experiment Station scientists investigated the use of hydroponics and levels of bio-active compounds switched from studying leafy greens to fruit bearing plants (e.g., strawberries and raspberries). A series of test were conduct comparing hydroponic berries to their soil-grown counterpart for viability, nutritional quality, and sensory attributes. The team has also begun work on the feasibility of growing hops hydroponically. Finally, the team has successfully established an aquaponic system growing leafy greens, while raising Tilapia.

Animal Health: Domestic Livestock Foraging on Toxic Plants

Field sampling of two species of ephedra (aka, Mormon tea) across a time series were completed in 2015 and were dried, ground, and prepared for analyses. Ephedrine content analysis was conducted by the California Animal Health and Food Safety Laboratory at UC Davis for nutrient value, alkaloid types and alkaloid quantities. The team is now evaluating those results.

Animal Health: Foothill Abortion (Epizootic Bovine Abortion or EBA)
Over the past year, much of the activity associated with this project was connected with educating beef cattle producers regarding the vaccine against EBA. Activities included outlining the requirements for enrollment and working with the rancher's local veterinarian(s) on the correct preparation, timing, recording and administrating of this experimental product. In addition, Experiment Station faculty in conjunction with UC-Davis collaborators, administered vaccines, collected pregnancy data and blood samples in herds that are being monitored as part of this USDA approved expanded vaccine trial. To date, Experiment Station faculty (University of Nevada and UC-Davis) have vaccinated approximately 7,500 heifers in NV and CA with the experimental vaccine. In preparation for the 2016 breeding season, unexposed heifers have been selected and segregated for tests that will examine late-term pregnancy exposure.

2. Brief description of the target audience

The target audiences for these programs include scientific community, agriculture producers, veterinarians, local organizations, backyard hobbyists, as well as students taking classes or participating in research activities, beginning and existing small acreage operators and large-scale crop and livestock (primarily beef/dairy/sheep) producers. Specific programs target American Indian, Latino/Hispanic, and women and youth agricultural producers. USDA agencies and other government entities that conduct work in this area are an audience and frequently a program partner. Additional audiences include agricultural service industries, lenders, and policy makers at the local, state, and federal levels.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	18408	0	110348	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	3	27	30

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Undergraduate Students Involved in Research.

Year	Actual
2015	61

Output #2

Output Measure

- Number of Graduate Students or Post-Doctorates Trained.

Year	Actual
2015	26

Output #3

Output Measure

- Workshops, Demonstrations, and Presentations

Year	Actual
2015	110

Output #4

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications

Year	Actual
2015	33

Output #5

Output Measure

- Brochures, Bulletins, Fact Sheets, Newsletter, and Surveys

Year	Actual

2015	6

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2015	2

Output #7

Output Measure

- Digital Media and Web Sites Created or Updated

Year	Actual
2015	6

Output #8

Output Measure

- Leveraged research funds generated

Year	Actual
2015	785835

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of clientele who gain knowledge about improved human, plant, and animal management systems for sustainable agriculture.
2	Number of clientele who implement improved human, plant, and animal management systems for sustainable agriculture.
3	Advance research knowledge, both basic and applied, in the areas of production agriculture to existing and emerging industry and consumer demand regarding genetics, biology, seed production, nutrition, and related topics.

Outcome #1

1. Outcome Measures

Number of clientele who gain knowledge about improved human, plant, and animal management systems for sustainable agriculture.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of clientele who implement improved human, plant, and animal management systems for sustainable agriculture.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Advance research knowledge, both basic and applied, in the areas of production agriculture to existing and emerging industry and consumer demand regarding genetics, biology, seed production, nutrition, and related topics.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Each year crop yields are severely impacted by a variety of stress conditions, including heat, cold, drought, hypoxia, and salt. While stress sensitivity is often visualized impaired growth in vegetative structures, reproductive development in flowering plants is often highly sensitive to hot or cold temperatures, with even a single hot day or cold night sometimes being fatal to reproductive success. In many plants, pollen tube development and fertilization is the "weakest link". The focus of this research is understanding the early signaling pathways that activate physical stress tolerance responses.

What has been done

Scientists at UNR have continued processing RNA-sequence data for a comparison of a pollen heat-stress response in wild type versus a heat sensitive mutant, cngc16 (cyclic nucleotide gated channel 16). This has produced a long list of candidate "stress" genes to test for their role in a pollen heat-stress response. Using a gene knockout strategy, a mutation was identified in the cell wall that helps stressed pollen respond normally in both growth and fertility. There has been a continuing effort to test candidate "stress response genes" for a significant contribution to stress tolerance in pollen

Results

To improve pollen tube development under stressful conditions, two cell membrane lipid pumps have been identified that play critical roles in heat-stress tolerance and vegetative development. A third membrane gene was found that controls hypersensitivity to heat stress. Through knock-out experiments, this third gene was shown to be controlling over 25% of heat-stress dependent changes in pollen.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

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

Nevada's slow economic recovery, in addition to the increasing demand for locally-produced foods, inspired a steady increase in small farm/ranch operations, CSAs, and community and school gardens. Traditional large-scale producers were challenged by severe drought conditions, the spread of invasive weeds, and the emerging management requirements for sage grouse and sage grouse habitat that will be required to avoid listing the sage grouse as a threatened or endangered species. Nevada's fourth year of severe drought led to decreased or non delivery of irrigation water for agriculture. This led to complete disruption of surface water supplied irrigation systems in some parts of Nevada, particularly in the western region. This also led to early withdrawal of public lands grazing permits.

A mistake by one of the field technicians at the research facility dealing with NAES's vineyards was made. He applied an herbicide that damaged many of the vines in one of the two vineyards. This will limit our ability to evaluate these treatments in the coming year, but some useful information is expected to be obtained.

Due to developments in genome editing technology, tradition mutation of strains for short statured Teff will not be conducted. Instead, CRISPR/Cas9 constructs will be designed that target genes involved in regulating plant stature. In order to reduce or avoid regulatory impediments associated with the deployment of transgenic plants here in the US and in Africa, Agrobacterium-mediated transformation approaches will be avoided. Instead, a protoplast electroporation approach will be used to introduce the CRISPR/Cas9 constructs. Thus, regeneration trials of Teff from protoplasts will be initiated.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nevada Extension faculty evaluate the outcomes and impacts of programs largely through participant/stakeholder self-evaluations. Evaluations of selected Global Food Security and Hunger programs in 2015 included horticulture classes focused on efficient residential and commercial landscape use, alternative crops, and small-scale urban food production. Evaluations included pre- and post-event comparative surveys with participants. With respect to knowledge gain, workshops held to discuss results of alternative crop field trials indicated a gain in knowledge by the participants of between 30 to 45 percent.

Results from Nevada Agricultural Experiment Station are as follow:

Teff research - After a 90 day drought simulation, followed by a seven day rewatering, six candidate drought-tolerant lines were identified (out of 367 accessions) and one line displayed both drought- and chlorophyll desiccation-tolerance.

Native southern Nevada grape plants were locate in 28 locations in yielding 600+ rootstocks. The team has developed an extraction protocol for grapevine roots and determined; a baseline suberin composition for Cabernet Sauvignon, Riparia, and Ramsey has been obtained.

Cattle supplement study indicate that flaxseed, chia seed, and glycerin do not impair ruminal fermentation, digestibility, microbial efficiency, and ruminal nitrogen metabolism. Overall, chia seed appears to be as effective as flaxseed as a fat source when added to ruminants' alfalfa hay-based diets. Adding glycerin in place of ground corn increases total volatile fatty acids, and propionate concentration without affecting microbial efficiency, which improves the growth potential of beef cattle.

To improve pollen tube development under stressful conditions, two cell membrane lipid pumps have been identified that play critical roles in heat-stress tolerance and vegetative development. A third membrane gene was found that controls hypersensitivity to heat stress. Through knock-out experiments, this third gene was shown to be controlling over 25% of heat-stress dependent changes in pollen.

To the best of our knowledge, the work on wound healing in potatoes represent the first

known transcription factors (proteins involved in converting DNA into RNA) that positively regulate suberin deposition. The same team has also determined the thick waxy skin composition of Prickly Pear cactus, providing the first description of Prickly Pear cuticle lipid content and composition.

Plant sampling of Ephedra (Mormon Tea) has been completed from areas where sheep are experiencing problems with the forage. Ephedra content analysis was completed and evaluation of the results are underway in preparation of in vitro trials spring 2016.

Veterinarians from both Nevada and California have vaccinated approximately 7,500 heifers in NV and CA with the experimental vaccine that prevents foothill abortion (EBA) in heifers or unexposed cows. Cattle producers in EBA endemic areas have been enrolled in an expanded study that will be used by USDA during its approval process.

Key Items of Evaluation

With regards to water use efficiency and drought resiliency, our evaluations from several workshops indicate that irrigation needs to start earlier in the season to avoid unnecessary production decreases associated with reduced evapotranspiration associated with dry soils. Our information about this collected in 2015 is slated to be presented to irrigation officials and the public in February 2016. The number of acres of teff production increased slightly in Fish lake Valley during 2015 from slightly over 450 acres in 2014 to just under 500 acres in 2015. This was the top producing area for teff grain in Nevada in 2015.

The sales of fresh produce grown in Lincoln County increased sales into the urban Las Vegas area in 2015. The interest and participation of new growers has increased, with three farms in the plans/process of expanding their production base by 20 to 40% for the 2016 season.

Nevada Agricultural Experiment Station "Key Items" as follow:

- An elite line of drought-tolerant teff (cereal grain) has been identified
- New protocol was designed to determine grape-root epidermis characteristics
- 674 examples of drought-tolerant grapes were collected from southern Nevada
- New evidence suggest that beef cattle digestion can be improved through the use of chia seed or glycerin supplements
- To improve pollen tube development under stressful conditions, two cell membrane lipid pumps have been identified that play critical roles in heat-stress tolerance and vegetative development. A third membrane gene was found that cause controls hypersensitivity to heat stress.
- New discoveries in potato skin's ability to heal from wounds and cactus cuticle
- Our aquaponics research team is successfully raising Tilapia and growing leafy greens using both commercially available and home grown systems
- Vaccine trials on bovine foothill abortion has inoculated over 7,500 cows and a small vaccine manufacturer is now interested in manufacturing the vaccine when FDA has given approval.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change, Natural Resource Management, & Environmental Sciences

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		22%	
111	Conservation and Efficient Use of Water	15%		0%	
112	Watershed Protection and Management	5%		8%	
121	Management of Range Resources	20%		34%	
122	Management and Control of Forest and Range Fires	25%		0%	
123	Management and Sustainability of Forest Resources	0%		5%	
133	Pollution Prevention and Mitigation	0%		4%	
135	Aquatic and Terrestrial Wildlife	0%		13%	
136	Conservation of Biological Diversity	0%		4%	
141	Air Resource Protection and Management	0%		5%	
205	Plant Management Systems	10%		0%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
605	Natural Resource and Environmental Economics	25%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	5.0	0.0
Actual Paid	3.7	0.0	2.6	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**
196047	0	515761	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
196047	0	500374	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
196047	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

In 2015, University of Nevada Cooperative Extension addressed the NIFA theme of Climate Change and Natural Resources with the following programs, listed here by title: Horticulture/Master Gardener Program; Bioplastic Container Cropping Systems; Commercial Landscape Horticulture; Grow Your Own, Nevada; Intermountain Regional Evaluation and Introduction of Native Plants (WERA1013); IPM in Urban/Consumer Environments; Lyon County Master Gardener and Horticultural Program; Basic Principles of Landscape Management ; the Desert Bioscape Program; Awareness Week and Media Campaign for Nevada Flood Hazards; BMP Retrofit Partnership Group, Building Contractors Training; the Carson River Watershed and Floodplain Education Program; Flash Flood Education and Citizen Group; the North Lake Tahoe Demonstration Garden; Water and Land American Indian Program; Alternatives for Climate Smart Agriculture; Sage-grouse Conservation; Sustainable Living; Collaborative Resource Stewardship - Columbia Spotted Frog Technical Team; Collaborative Resource Stewardship - Shoesole Resource Management Group; Natural Resources Education for Youth (reported in some previous years as Nevada Youth Range Camp); Range Management School; Riparian Proper Functioning Condition ("Creeks & Communities"); Vegetation Management; Weed Management; Know Nevada Insects; Nevada Naturalist Volunteer Training Program; Humboldt County Noxious Weed Control and Management; Rangeland Resources and Range Management Education; California Lake Tahoe Basin Fire Adapted Communities Project; Living With Fire Community Workshops; Nevada Network of Fire Adapted Communities; and Nevada Wildfire Awareness Month.

The Nevada Agricultural Experiment Station conducted the following programs to further the goals of NIFA's Climate Change, Natural Resource Management, & Environmental Sciences theme:

Identifying Sources of Atmospheric Ozone, Mercury, and other Trace Metals in Nevada
Investigators have collected aerosol chemistry samples (particulate matter) using a Rotating Drum instrument pioneered by UC-Davis faculty Tony Van Curen. This instrument collected aerosols in 8-size fractions that are now being analyzed for trace elements, currently 26 elements have been found. This data is providing a means of tracking sources of air pollution coming into Nevada (and other areas). To facilitate future research the data currently being collected along with the past five years of data collected through the Nevada Rural Ozone Initiative are now housed in a new database, and should be available to interested parties in 2016.

Identifying At-Risk Water and Forest Resources To Changes in Snowpack Dynamics
In order to quantify the response of snowpack dynamics and streamflow partitioning to short and long-term

climate variations, two models have been developed. The first model looks at changes in snow to rain effect the hydrologic partitioning (e.g., canopy interception, infiltration, evaporation, recharge, runoff, stream flow) in Nevada and California. The second model is examining spatial patterns of snow disappearance and their potential impacts on stream flow.

Testing Competitiveness of Native Plant Verses the Invasive Species "Cheatgrass"
Over the past year, researchers have completed the data analysis, which involved the planting of multiple wild populations of perennial plants in the Elymus grass family (related to rye and wheat) into five field sites. This effort manifested into a second manuscript from the project. Results were presented at multiple management and academic conferences. Additionally, the team set the stage for future work in this system, collecting seeds from multiple native species at collection sites used for the current project. Finally, researchers assisted the Winnemucca BLM field office in screening wild collected plants for use in restoration and will provide information on the most promising seed sources directly to the field office.

Bighorn Sheep: Genomic-Scale Perspective On Diversity And Differentiation Across The Landscape
The team of Experiment Station scientists have explored the species-environment relationship within highly managed bighorn sheep populations by quantifying genetic variation and characterizing niche-based variables in the translocated mountain ranges. They have documented the genetic differentiation among three traditional management units of bighorn sheep that now occupy the Great Basin and northern Mojave deserts, while identifying limited hybridization among these groups. Data from this work is now been built into a genomic-scale database, while further refinements in the bioinformatics tools were made. This information has also been presented to both the Nevada Department of Wildlife and Nevada Bighorns Unlimited.

Impact of Feral Horses and Cattle on Sage Grouse Habitat
After three years of field work, investigators have estimated sage-grouse breeding propensity (446 nest), nest success, chick & adult survival, habitat use in relation to vegetation variables (610 locations), and habitat use by horses and/or livestock. The team has also developed GIS layers of horses and livestock use based on feces presence (20,717 samples). By the end of the 2015 reporting period, the team was in the process of identifying habitats used by sage-grouse during key seasons: nesting and brood-rearing.

Bovine Viral Diarrhea Virus in Free-Ranging Population of Ungulates
To determine the effect of BVD infection in mule deer, elk, mountain sheep, and mountain goats, Experiment Station scientists have been processing blood and hair samples collected over the past two years for immune and stress hormone assays. The team continues to collect fresh samples of blood and hair, building upon the current dataset. Comparisons have also begun on immune functions of individuals that are positive BVD with non-BVD individuals to determine immune functions relative to body condition and stress hormones. A primer in eco-immunology and immunology for wildlife research and management has been developed and published, providing wildlife managers guidance.

Land Use Practices and Climate Change Effects on Mule Deer Populations
Three years of data collection have been completed. Experiment Station scientists have begun the quantitative analysis of migration costs for mule deer in Nevada and are determining which variables are important that affect migratory behavior. Four ecological models have been developed to better understand: migratory behavior in relation to seasonal changes in climate; energetic costs correlation to migratory strategies; body condition, forage quality, and migratory distance on survival; and, the cost of landscape fragmentation on migratory corridors.

Building Ecological Site and Condition Based Management to a Scale Relevant for Western Land Managers
Experiment Station scientists have published State-and-Transition Models (STMs) for both the claypan and loamy ecological sites within NRCS's Owyhee High Plateau. The team has preliminarily identified the

State and Community phases of both project locations prior to and post wildfire using quantitative data collected during 2013 to 2015. The team is now introducing the concepts of STMs to diversity of rangeland audiences and how ecosystem services can be integrated into the process to determine value of management outcomes guided by STMs.

Hydrologic and Vegetative Response to Pinyon-Juniper Treatment at the Watershed Scale
This project adds to an ongoing project that represents the first, fully instrumented watershed-scale research effort in Nevada. Over the past year, the Ground-water and Surface-water Flow model of the Porter Canyon Experimental Watershed was completed. Four modeling scenarios considered combinations of climate change and pinyon-juniper harvest were produced. Additionally, telemetry was added to the suite of instrumentation at the watershed, allowing for real-time download of a majority of data arrays. Thus, improving efficiency of scientific inquiry. Furthermore, 200 acres of P-J were harvested up-slope of instrumentation, thus representing the end of the pre-treatment phase of data collection. Additionally, sagebrush rainfall simulation plots were located and vegetation characteristics were measured in preparation for rainfall simulation research in 2016. Finally, LIDAR data and high resolution imagery was captured encompassing the watershed to facilitate modeling efforts.

Identifying rates and proximate controls of soil methane flux in arid ecosystems
This project is only six month old, but the Experiment Station scientists have identified four sites that form an elevation gradient from 5,000 to 8,000 feet where methane samples will be collected. Starting in early fall, samples were drawn ever three week through the end of this reporting period. A gas chromatograph has purchased and initial samples have been analyzed for methane content.

Post Fire Riparian Monitoring For Return Of Livestock Grazing
Focusing on post wildfire riparian responses, activities include gathering field data, tabular grazing data and digital spatial data from 25 streams in eight separate fires within the Great Basin. A team of Experiment Station technicians measured stream gradients, sediment size, cross sectional measurements, vegetation species composition and stream bank stability. Grazing data has been obtained through BLM grazing allotment applications. Global Information System (GIS) data on the geology, watershed, and fire severity for each stream was procured and post-fire stream response variables layers were created.

Sustainability of Mowing Fuel Breaks: Resilience of Sagebrush Rangelands
During the summer of 2015, 69 individual study locations across 12 different Nevada counties were revisited by the Experiment Station team. Foliar cover was measured for the second time at each of these sites. In addition, perennial herbaceous density and soil profile data were collected. Vegetation and soil data were used to identify Ecological Site Descriptions for each study location. Foliar cover, sagebrush canopy volume, perennial herbaceous density, soil, and site attribute data for all of the site/year combinations were entered into database to facilitate the manipulation of the raw data. Initial data analysis has begun and will continue into 2016 reporting year.

Influences of livestock grazing and wild horse use on meadow function in sage-grouse habitat
Researchers from Experiment Station worked with BLM and USFS on the development of lentic meadows sampling methods to be used for the study. Researchers established 25 field sites across Nevada where cattle grazing management plans are in place. Field trials were conducted to test camera and GPS equipment and assessment of riparian area levels of proper functioning condition were gathered.

Bark Beetle Management through Biochemistry - controlling invasive forest species
Over the past year, scientists are attempting to identify biochemical differences between mountain pine beetles and Jeffrey pine beetles (sibling species) by exploring enzymes involved in resin detoxification and pheromone production in each insect. Scientists established conditions to use oxoplate assays to monitor cytochrome P450 activity on various substrates. They have functionally cloned and expressed the gene CYP6DH3 from the mountain pine beetle. RNA sequencing data has been returned to the team and

annotation, clean-up and analysis are in progress.

Transitioning from Unmanaged Rangelands to Irrigated Agricultural Affects Soils' Carbon.
The first year of this project saw site selection of 10 permanent plots. The team installed sensors for continuous measurement of soil temperature, moisture and salinity, along with soil CO_2. Once instrumented, the team conducted an intensive soil sampling of surface soils and measured soil texture, total carbon and nitrogen and other soil chemical and physical characteristics. In addition, density fractionation was conducted to separate out organic carbon associated with heavy and light soils.

Long-Term Influences of Adaptive Management Practices on an Eastern Sierran Pine Forest
The Experiment Station research team spent last year collecting field data pertaining to bark beetle demography, mistletoe infestation, stand growth, and understory community development. Data pertaining to tree mortality, mistletoe infestation, and bark beetle colonization both across and within the diameter at breast height classes were then analyzed and written up for the Journal of Forest Research.

On a second project that is a continuation of a long-term study that begun in 2003 with the initial treatments of thinning, mastication, and prescribed burns, data was collected post-treatment in 2004 on fuel loads, forest health, soil nutrients, and runoff water quality. Over the past year, the same data was collected to determine the effects of these management practices. A pivotal paper has come from these efforts (Walker et al., Forest Research 2015 4:159) and is now being used by the USFS, Nevada Division of Forestry, and Lake Tahoe Basin Management Unit for environmental assessments and environmental impact statements.

Monitoring Changes in Nevada's Pinyon-Juniper Woodlands
For 2015, Experiment Station researchers have made even further progress in refining remote sensing methodology for mapping changes in pinyon-juniper canopy cover over the past 30 years. The process of calibrating remote sensing methods using field data has resulted in the "Robert's Creek Range Model" that can now be applied to the rest of Nevada.

A second research effort is resampling permanent plots established back in 2004-2005. This Experiment Station team of scientists has resampled 100 of the 172 plots, across 11 mountain ranges. Sampling was augmented from the 2005 sampling in that the team used high-resolution GPS to position each tree; marked each tree using labeled aluminum tags; increased the precision of diameter and height measurements; quantified microsites of tree seedlings and of sampled quadrats; quantified cover of individual plant species (not just functional types), and estimated tree age classes from morphological measurements. As a result our sampling effort was more rigorous, at the cost of visiting fewer sites than in 2005.

2. Brief description of the target audience

The target audience includes agricultural producers and ranchers, mining industry representatives, sport hunters, environmentalists, green industry professionals, small acreage owners, general public, federal and state natural resource management agencies, and other resource managers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	10810	0	5831	0

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

Patent Applications Submitted

Year: 2015

Actual: 1

Patents listed

Tittiger, C., Figueroa-Teran, R., Blomquist, G., US 8404825 B2 ?Method for producing monoterpene and monoterpinoid compounds and use thereof", Regular, United States

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	8	49	57

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2015	51

Output #2

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2015	130

Output #3

Output Measure

- Workshops, Demonstrations, and Presentations

Year	Actual
2015	141

Output #4

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications

Year	Actual
2015	69

Output #5

Output Measure

- Brochures, Bulletins, Fact Sheets, Newsletter, and Surveys

Year	Actual
2015	12

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2015	0

Output #7

Output Measure

- Digital Media and Web Sites Created or Updated

Year	Actual
2015	10

Output #8

Output Measure

- Leveraged research funds generated

Year	Actual
2015	3567693

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who gain knowledge about improved human, plant, and animal management systems that relate to climate change and/or natural resource use.
2	Number of clientele who implement improved human, plant, and animal management systems as related to climate change and/or natural resource use.
3	In conjunction with companion agencies and organizations, advance research in rangeland and forest management and ecology to promote advances in best management practices
4	Reduce ecological losses due to wildfires and invasive weeds that destabilize the health of Nevada's rangelands
5	Meet federal and state needs for research data related to Nevada ecosystems as the demand arises.
6	Advance research knowledge, both basic and applied, in the areas of rangeland and forest management to existing and emerging industry and consumer demand regarding genetics, biology, seed production, nutrition, and related topics.
7	Meet local groups, community, USDA, USDI, and other stakeholder demands for scientific knowledge to inform existing and emerging issues/practices in wildlife including wildlife health, human wildlife use/conflicts, and human to human conflicts related to wildlife and use.

Outcome #1

1. Outcome Measures

Number of individuals who gain knowledge about improved human, plant, and animal management systems that relate to climate change and/or natural resource use.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Northern Nevada has experienced major destructive floods approximately every 10 years for the past 160 years. Climate scientists predict that rivers in the western United States will produce larger and more destructive floods in the decades to come. The Carson River Watershed Regional Floodplain Management Plan (RFMP) recommends flood outreach education for the general public, including an annual Flood Awareness Week. The rapid growth of the Hispanic population of Nevada has created a need in the green service industry for bilingual training related to landscape maintenance. Sustaining agricultural production (crop, food, livestock) on tribal lands will become progressively more challenging in the future due to decreased water availability, extended droughts, changes in precipitation amounts and timing, surface water availability, and declining groundwater supplies. Close cultural and economic ties to natural resources, geographic, remoteness, and economic challenges have led some to characterize American Indian agriculturalists as some of the most vulnerable populations to climate change impacts. Improvement of sagebrush ecosystem condition across the Great Basin is critically important to all endemic species, and all commercial and recreational users. The issue goes beyond avoiding listing of the sage-grouse as a threatened or endangered species. The true issue is maintaining multiple use on public lands and enhancing the health of our sagebrush ecosystems. Wildlife and livestock grazing are controversial rangeland issues of high priority in northeast Nevada. Grassroots collaborative approaches to resolution of these issues are gaining momentum in many western communities. Land users, the general public, livestock producers and staff in both state and federal agencies often lack knowledge about the concepts of plant growth, plant response to grazing; ecological site potential; the processes of vegetation change and its implication for rangeland management and the role and effect of fire and other disturbances on Great Basin rangelands. Management decisions made without incorporating the full research base can have unnecessary adverse effects for the range livestock industry, a suite of wildlife species, and local economies that depend upon access to federally administered rangeland resources. The wildfire threat to Nevada communities is growing. It is important that

communities become proactive and implement pre-fire activities to reduce the loss life and property due to wildfire.

What has been done

In 2015, University of Nevada Cooperative Extension addressed the NIFA theme of Climate Change and Natural Resources with the following programs, listed here by title: Horticulture/Master Gardener Program; Bioplastic Container Cropping Systems; Commercial Landscape Horticulture; Grow Your Own, Nevada; Intermountain Regional Evaluation and Introduction of Native Plants (WERA1013); IPM in Urban/Consumer Environments; Lyon County Master Gardener and Horticultural Program; Basic Principles of Landscape Management ; the Desert Bioscape Program; Awareness Week and Media Campaign for Nevada Flood Hazards; BMP Retrofit Partnership Group, Building Contractors Training; the Carson River Watershed and Floodplain Education Program; Flash Flood Education and Citizen Group; the North Lake Tahoe Demonstration Garden; Water and Land American Indian Program; Alternatives for Climate Smart Agriculture; Sage-grouse Conservation; Sustainable Living; Collaborative Resource Stewardship - Columbia Spotted Frog Technical Team; Collaborative Resource Stewardship - Shoesole Resource Management Group; Natural Resources Education for Youth (reported in some previous years as Nevada Youth Range Camp); Range Management School; Riparian Proper Functioning Condition (Creeks & Communities); Vegetation Management; Weed Management; Know Nevada Insects; Nevada Naturalist Volunteer Training Program; Humboldt County Noxious Weed Control and Management; Rangeland Resources and Range Management Education; California Lake Tahoe Basin Fire Adapted Communities Project; Living With Fire Community Workshops; Nevada Network of Fire Adapted Communities; and Nevada Wildfire Awareness Month.

Results

Nevada Cooperative Extension began field trials to determine biodegradability in Nevada soils of the most recent bioplastic container prototypes. Nevada Extension also launched a national consumer preference survey (N=1524) on the acceptability of different kinds of bioplastic and other biorenewable plant pots. Nevada Extension held two workshops about invasive weed species in northern Nevada for green industry professionals (100 total attendees), and Hispanic Landscape Training Classes, and a workshop titled Keeping Your Trees Alive during a Drought. Nevada Cooperative Extension offered a series of classes on Growing Grapes in Nevada. Given the warming effects of climate change on our region, the recent passage of Nevada State Assembly Bill 4 removing county population restrictions on winery operation, and the potential economic boost wine-grape production could bring to our communities, Nevada Cooperative Extension is planning to offer these classes annually. Demand is high, and initial response to course offerings has been extremely positive. As Nevada Flood Awareness Week approached, Nevada Extension held a major community flood open house at the new Douglas County Community Center. This event featured displays and demonstrations from several agencies, including UNCE, and it was called the most successful event of the 2015 Flood Awareness Week by the State Floodplain Manager. Nevada Extension taught the basic range management school curriculum (emphasizing plant growth principles, timing and duration management of livestock grazing, and cooperative livestock monitoring) to ranchers and agency specialists associated with the Sustainable Alliance of Northeast Elko County (SANE). Nevada Extension initiated a 26-part series about the 25 weeds of greatest agricultural concern across Nevada's 17 counties. Each article discusses the weed's basic biology and lifecycle; how these attributes affect potential control methods with herbicides, mechanical approaches, cultural techniques, biological control agents; the role of integrated weed management to control each species, and the active ingredients labeled for use in nine landscape/crop settings common in Nevada. Nevada Extension published 11 articles (average of 7-9 pages each) in the Nevada Rancher (1,500 monthly subscribers and 500 news-stand copies) and the Progressive Rancher (7,000 print

copies per issue and >30,000 electronic views). This completes the first 24 installments of this 26 part series. Two additional articles are in preparation for 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
205	Plant Management Systems
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Number of clientele who implement improved human, plant, and animal management systems as related to climate change and/or natural resource use.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A Fundamentals of Horticulture Class was designed to teach landscape principles and to create a foundation for landscape professionals. The rapid growth of the Hispanic population of Nevada has created a need in the green service industry for bilingual training related to landscape maintenance. Northern Nevada has experienced major destructive floods approximately every 10

years for the past 160 years. The Carson River Watershed Regional Floodplain Management Plan (RFMP) recommends flood outreach education for the general public, including an annual Flood Awareness Week. Because of the impacts of resort and residential development on the natural environment at Lake Tahoe, there is a critical need for landscape design that integrates defensible space, water quality BMPs, the use of native and adaptive plants, the control of invasive weeds and efficient irrigation. Improvement of sagebrush ecosystem condition across the Great Basin is critically important to all endemic species, and all commercial and recreational users. The issue goes beyond avoiding listing of the sage-grouse as a threatened or endangered species. The true issue is maintaining multiple uses on public lands and enhancing the health of our sagebrush ecosystems.

What has been done

72 Master Gardeners have contributed more than 3,696.75 hours valued at $ 83,361.71, based on estimated value of volunteer time at $22.55 per hour. Nevada Cooperative Extension began field trials to determine biodegradability in Nevada soils of the most recent bioplastic container prototypes. Nevada Cooperative Extension launched a national consumer preference survey (N=1524) in May on the acceptability of different kinds of bioplastic and other biorenewable plant pots. Nevada Cooperative Extension presented the results of the national bioplastics consumer preference survey at the Bioplastic Container Cropping Systems conference held in Ames, IA. Nevada Cooperative Extension hosted ?Keeping Your Trees Alive during a Drought? with external support from the Nevada Division of Forestry, May 1 (51 attendees in 2 counties). In response to the drought Nevada Cooperative Extension offered the Nevada Shade Tree Council Arborist Prep Course on ?Soil Science and Water Management of Trees.?

Results

33 participants learned up to date USDA food handling procedures taught by certified food preservation instructors. As per evaluations, 100% of the participants gained food safety and canning knowledge along with receiving research based information. Given the warming effects of climate change on our region, the recent passage of Nevada State Assembly Bill 4 removing county population restrictions on winery operation, and the potential economic boost wine-grape production could bring to our communities, we are planning to offer these classes annually. Demand is high, and initial response to course offerings has been extremely positive. This spring, we offered two workshops to help novice growers get started. Hands-on vineyard training and pruning classes are planned for spring 2016. Began on-site training at MGM Casino for staff horticulturalists, presenting a total of 8 classes to 179 students. Taught four 3-hour classes (bilingual) to a total of 352 students (two in Reno and four in Las Vegas).

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife

Outcome #3

1. Outcome Measures

In conjunction with companion agencies and organizations, advance research in rangeland and forest management and ecology to promote advances in best management practices

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Few state wildlife agencies test for the prevalence of the bovine viral diarrhea (BVD) in the actual wildlife population. Thus, the prevalence of BVD in free-ranging populations of wildlife is generally unknown. Mule deer are an economically important species of big game to most western states, and substantial funds are invested in both hunting and management of those species. Wildlife populations infected with BVD not only could transmit the virus back to domestic stock, but economic losses from the virus reducing productivity of wildlife populations may be substantial as well.

What has been done
To determine the effect of BVD infections in mule deer, elk, mountain sheep, and mountain goats, Experiment Station scientists have been processing blood and hair samples collected over the past two years for immune and stress hormone assays. The team continues to collect fresh samples of blood and hair, building upon the current dataset. Comparisons have also begun on immune functions of individuals that are positive BVD with non-BVD individuals to determine immune functions relative to body condition and stress hormones.

Results
A primer in eco-immunology and immunology for wildlife research and management has been developed and published, providing wildlife managers and other scientist much needed guidance on this subject.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife

136 Conservation of Biological Diversity

Outcome #4

1. Outcome Measures

Reduce ecological losses due to wildfires and invasive weeds that destabilize the health of Nevada's rangelands

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Armies of tiny bark beetles are ravaging drought-weakened pine trees throughout Sierra-Nevadan forest in a fast spreading epidemic that could soon turn catastrophic. Local, state and federal officials are virtually helpless against the pestilence, which has turned hundreds of thousands of acres of forest brown, leaving huge fire-prone stands of dead wood. Our scientist at the Nevada Agricultural Experiment Station are studying the insect's own pheromone system for mechanisms to genetically control the population.

What has been done
Over the past year, scientists are attempting to identify biochemical differences between mountain pine beetles and Jeffrey pine beetles (sibling species) by exploring enzymes involved in resin detoxification and pheromone production in each insect.

Results
In the fight to preserve Sierra-Nevadan forest, scientists determined conditions to use oxoplate assays to monitor enzyme (cytochrome P450) activity on various substrates of the mountain pine beetle. They have functionally cloned and expressed the cytochrome gene CYP6DH3 from the beetle, as well.

4. Associated Knowledge Areas

KA Code	Knowledge Area
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #5

1. Outcome Measures

Meet federal and state needs for research data related to Nevada ecosystems as the demand arises.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Approaches to Sierra-Nevada forest thinning have improved substantially in recent years due to the introduction of machines that traverse steep slopes with little disturbance, affording such choices as cut-to-length systems, which feature extremely low soil impacts, and whole-tree harvesting, an approach noted for reducing fuel loads. Prescribed fire in the form of controlled under-burning in Jeffrey pine stands may, with the exception of the fiber and biomass yield, provide many of the same benefits as thinning. However, prior to widespread use of either of these practices in the eastern Sierra Nevada, an assessment of their long-term impacts on stand health and productivity, nutrient cycling, and water quality is required to optimize their use for maximum benefit.

What has been done
The Experiment Station research team spent last year collecting field data pertaining to bark beetle demography, mistletoe infestation, stand growth, and understory community development. Data pertaining to tree mortality, mistletoe infestation, and bark beetle colonization both across and within the diameter at breast height classes were then analyzed and written up for the Journal of Forest Research.

On a second project that is a continuation of a long-term study that begun in 2003 with the initial treatments of thinning, mastication, and prescribed burns, data was collected post-treatment in 2004 on fuel loads, forest health, soil nutrients, and runoff water quality. Over the past year, the same data was collected to determine the effects of these management practices. A pivotal paper has come from these efforts (Walker et al., Forest Research 2015 4:159) and is now being used by the USFS, Nevada Division of Forestry, and Lake Tahoe Basin Management Unit for environmental assessments and environmental impact statements.

Results
The datasets collected on mechanized thinning, mastication and prescribed burns in the eastern sierras is the only resource of USFS and Nevada Division of Forestry conducting environmental assessments and environmental impact statements. And now also include bark beetle and mistletoe infestation effect as well.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Advance research knowledge, both basic and applied, in the areas of rangeland and forest management to existing and emerging industry and consumer demand regarding genetics, biology, seed production, nutrition, and related topics.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In an effort to reduce the conversion of native sagebrush steppe into annual communities, the Bureau of Land Management reseeds rangelands after fire at very large scales, seeding tens of thousands of acres per year in extreme fire years. These seeding efforts have mixed success. One factor that may affect the establishment of seeded species in invaded areas is the choice of seeds used in restoration.

What has been done
Over the past year, Experiment Station faculty have completed the data analysis of the second field study, which was a planting of multiple wild populations of Elymus grasses. The team also assisted the Winnemucca BLM field office in screening wild collected plants for use in restoration. We began screening these collections for the seed and seedling traits found to be important in our field studies, and will provide information on the most promising seed sources directly to the field office.

Results
With three years of building a seed collection and collecting data on native plants' seedling traits and competitiveness, our range scientist have amassed a respectable physical collection of Nevada grown seeds that will help in any future research. As well as, developed a database to handle seedling trait and plant competitiveness in both garden and wild types.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
205	Plant Management Systems
605	Natural Resource and Environmental Economics

Outcome #7

1. Outcome Measures

Meet local groups, community, USDA, USDI, and other stakeholder demands for scientific knowledge to inform existing and emerging issues/practices in wildlife including wildlife health, human wildlife use/conflicts, and human to human conflicts related to wildlife and use.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Flash floods happen in the summer from monsoon patterns that occasionally cause intense thunderstorms over Nevada mountain ranges. These storms can cause damaging floods to the communities at the foot of mountain canyons. River flooding typically occurs with a warming which causes rain to melt the snow pack in the winter and early spring. In both flash flooding and river flooding it is a critical to inform citizens about the hazards and how to be best prepared. Burned area revegetation, wildlife, and livestock grazing are the controversial rangeland issues of highest priority in northeast Nevada. Grassroots collaborative approaches to resolution of these issues are gaining momentum in many western communities. Approximately 78% of respondents to a survey indicated that livestock forage is important to very important as a sustainable use of rangelands and that wildlife and livestock are compatible on rangelands. Questions regarding pest control are common for extension offices to encounter, but access to peer reviewed, educational information for pests that is specific to Nevada is not available. Educational materials from other states are distributed instead. Nevada specific educational materials have been desired without any one with the knowledge to create them. The wildfire threat to Nevada communities is growing. It is important that communities become proactive and implement pre-fire activities to reduce the loss life and property due to wildfire.

What has been done

Based on recent requests from the general public and the Nevada Vines and Wines nonprofit organization (devoted to promoting viticulture and winemaking in northern Nevada), Grant Cramer (College of Agriculture, Biotechnology and Natural Resources) and I collaborated to offer a series of classes on Growing Grapes in Nevada. Given the warming effects of climate change on our region, the recent passage of Nevada State Assembly Bill 4 removing county population restrictions on winery operation, and the potential economic boost wine-grape production could bring to our communities, we are planning to offer these classes annually. Demand is high, and initial response to course offerings has been extremely positive. This spring, we offered two workshops to help novice growers get started. Hands-on vineyard training and pruning classes are planned for spring 2016. The Southern Area horticulture team is converting a Master Gardener training program to an online format, which will be offered statewide in fall 2016. The online program will extend the reach of the UNCE Master Gardener program to remote areas of the state not currently served.

Results

Nevada Cooperative Extension met with small groups of citizens in the neighborhoods and helped them form a communication network to share their experience and work on ways to improve their flood safety. Extension helped organize and facilitate multiple meetings with officials at the Bureau of Land Management and Douglas County. This led to a Citizen's Task Force, which made recommendations on a Master Drainage Plan for one of Nevada's western counties. The county commission accepted these recommendation. Nevada Cooperative Extension made 11 presentations related to vegetation management in 8 venues, reaching at least 416 adults. Audiences included diverse constituents via a national webinar (by invitation), international, regional, and state conferences/workshops, Great Basin College natural resource classes, and a regional consortium conference (also by invitation). An invited webinar presentation on diversifying crested wheatgrass seedings was viewed live by 56 participants from 8 states and Washington, DC, including resource specialists from 9 state and federal agencies, 1 mining company, 1 conservation district, 2 universities, and 1 consulting firm. Nevada Cooperative Extension's vegetation management presentations are often related to habitat for sage-grouse and other sagebrush ecosystem obligate and facultative wildlife species.

4. Associated Knowledge Areas

KA Code	Knowledge Area

135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Some areas of drought affected public lands used for grazing were withdrawn earlier than planned because of fears about permanent ecological damage. Climate change continues to be an important topic to discuss and to approach for Extension. However, state and federal support for Extension's entry into this sometimes controversial subject area has not been forthcoming.

NAES faculty had the following issues:

Due to abrupt and unprofessional termination of a contract with the Nevada Division of Environmental Protection and inadequate funding from the HATCH program the first year, data being used to accomplish the goals of this project has changed from being 3 hour resolved trace element chemistry to using particulate matter concentrations, mercury concentrations and chemistry, lead concentrations and isotopic ratios, ozone concentrations, and a variety of atmospheric modeling tools.

Soil carbon studies were delayed due to the initial field site unsuitability. The managed site relied on having active crop production. Nevada's fourth year of drought resulted in no irrigation water for growing crops.

Theft of trail cameras Theft of trail cameras used in wildlife, livestock, and feral horse monitoring at critical sage grouse habitat locations.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Pre and post program evaluations showed knowledge gains in participants in Master Gardener classes, riparian management classes, drought workshops, flood management workshops, weed management presentations, web-based interactions, volunteer trainings and public events. On October 7, 2015, the U.S. Fish and Wildlife Service (FWS) determined that the Columbia spotted frog did not warrant federal protection under the Endangered Species Act (ESA). The FWS also removed the frog from the ESA candidate species list after

an analysis of the best available scientific data. A pilot test project for the Nevada Conservation Credit System newly implemented by the Governor's Sagebrush Ecosystem Council involved 1,339 acres of public and private land on which invasive species have already been controlled and fences have been installed to improve and protect meadow habitat. The Nevada Youth Range Camp participants indicated improved understanding of topics including soils, vegetation identification and monitoring, riparian function and surface and ground water principles. Participants who were part of the riparian proper functioning condition (PFC) workshops indicated increases in knowledge. As a result of PFC classes in Nevada, the U.S. Environmental Protection Agency (EPA) has embraced PFC as a fundamentally useful tool for improving water quality. They have taught PFC to numerous tribes in California and Arizona and hosted a regional PFC class in Las Vegas. Tribes trained in PFC assessment now understand connections between water quality and land and water management. PFC concepts are also being integrated into numerous EPA publications. Extension's involvement in the statewide discussion about protecting habitat of the Greater Sage Grouse, helped to determine a holistic approach to protecting this wildland bird without using the enforcement mechanisms available through the Endangered Species Act. In September 2015, the US Fish and Wildlife Service issued a decision that the greater sage-grouse would not become a federally protected species under the Endangered Species Act, indicating that regulatory mechanisms and proposed conservation actions, if implemented, are now sufficient to ensure suitable habitat for the species. The Weed Summit, an annual event, indicated that participants gained significant understanding of weeds and weed issues. Participants in the Range Management School also indicated very positive gains in knowledge as a result of this week-long training.

Nevada Agricultural Experiment Station results are as follow:

Mercury researcher have a working prototype database, the Nevada Rural Ozone that parses out particulate matter creating a trace metal fingerprint.

With three years of collecting seeds and data on native plants' seedling traits and competitiveness, our range scientist have amassed a respectable physical collection of Nevada grown seeds that will help in any future research. As well as, developed a database to handle seedling trait and plant competitiveness in both garden and wild types.

A primer in eco-immunology and immunology for wildlife research and management has been developed and published, providing wildlife managers and other scientist much needed guidance on this subject.

The GSFlow (Ground-water and Surface-water Flow) model was completed of the Porter Canyon Experimental Watershed. The first, fully instrumented watershed scale research effort in Nevada. A concise Database for Inventory, Monitoring, & Assessment (DIMA) was created and all 2013, 2014, and 2015 vegetation data was included. Additionally, Barrick Gold has planned to incorporate State-and-Transition Model thresholds when determining how best to spend restoration dollars.

In the fight to preserve Sierra-Nevadan forest, scientists determined conditions to use oxoplate assays to monitor cytochrome P450 activity on various substrates of the mountain pine beetle. They have functionally cloned and expressed the gene CYP6DH3 from the beetle, as well.

Data sets collected on mechanized thinning, mastication and prescribed burns in the

eastern sierras is the only resource of USFS and Nevada Division of Forestry conducting environmental assessments and environmental impact statements. And now includes bark beetle and mistletoe infestation effect as well.

Our long term studies on changes to Pinyon-Juniper woodland over the decades has resulted in a working model that has greater power to explain deviations in field sites (Roberts Creek Range Model &asymp66%). The predictive power is much improved over existing published products when applied to the study area (Landfire 32.5% and National Land Cover Dataset 41.1%).

Key Items of Evaluation

As a result of riparian proper functioning condition (PFC) classes in Nevada, the U.S. Environmental Protection Agency (EPA) has embraced PFC as a fundamentally useful tool for improving water quality. They have taught PFC to numerous tribes in California and Arizona and hosted a regional PFC class in Las Vegas. Tribes trained in PFC assessment now understand connections between water quality and land and water management. PFC concepts are also being integrated into numerous EPA publications.

In September 2015, the US Fish and Wildlife Service issued a decision that the greater sage-grouse would not become a federally protected species under the Endangered Species Act, indicating that regulatory mechanisms and proposed conservation actions, if implemented, are now sufficient to ensure suitable habitat for the species.

The Nevada Agricultural Experiment Station key items are as follow:

- Development of a new method for measuring reactive mercury and lead isotopes along with particulate matter, simultaneously
- Three publications on mercury and ozone levels in Nevada
- Two database on native grasses (seedling traits on plant performance, and wild-collection seeds)
- Creation of a grass seed collection for use in future research projects
- Three presentation on State-and-Transition Models to major stakeholder
- Database for Inventory, Monitoring and Assessment at the watershed scale was built
- Barrick Gold is incorporating State-and-Transition Model thresholds to determine how best to spend restoration dollars
- A succinct Database for Inventory, Monitoring, & Assessment (DIMA) was created
- Educational video on Porter Canyon Watershed Research Efforts.
- Research on sage grouse research was leverage into three additional grants
- RNA-Seq database of de novo assembled Jeffrey Pine Beetle mRNA - the first for this species
- Novel, high-throughput method to measure P450 enzyme activity based on O2 monitoring in real time
- Predictive power of NAES pinyon-juniper model has shown an substantial improvement over existing published products (Landfire, National Land Cover Dataset, and Greenwood & Weisberg)
- First documentation of widespread canopy decline associated with drought in pinyon pines in central Nevada.
- Developed laboratory protocols for soil organic matter density fractionation.
- Patent - Tittiger, C., Figueroa-Teran, R., Blomquist, G., US 8404825 B2 "Method for producing monoterpene and monoterpinoid compounds and use thereof", Regular, United States

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		6%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		20%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		60%	
204	Plant Product Quality and Utility (Preharvest)	0%		6%	
206	Basic Plant Biology	0%		8%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	2.5	0.0
Actual Paid	0.0	0.0	1.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	223034	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	112121	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

Nevada Cooperative Extension is not involved in this NIFA theme.

The Nevada Agricultural Experiment Station conducted the following programs to further the goals of NIFA's Sustainable Energy theme.

Camelina (false flax): a new biofuel and forage for Nevada
Varietal trials with eight named varieties (e.g., Blaine Creek, Calena, Celine, Cheyenne, Columbia, Ligena, Suneson, and Yellowstone) were conducted again during the spring of 2015 (the fifth and final year of the trial). Seed oil content was determined for all 2001-2014 varieties using Bruker Minispec NMR system.

Ethylmethane sulfonate mutant populations of Camelina were produced as a major output of this project and continue to undergo screening on a persistent basis. To date, 5,243 second generation lines of seeds have been collected from a total of ~7,000 first generation lines. A total of 250 third generation lines have been screened for altered fatty acid composition using gas chromatography to isolate mutants with high oleic acid and low uric content. Several new promising mutants have been isolated with potentially useful agronomic traits including more rapid completion of ontology and reduced pigment content for greater light penetration through the canopy, which could allow greater planting densities.

Transformation trials using the hygromycin selectable marker gene are in progress for several interesting target genes. Research efforts have focused on the herbicide and drought-tolerance traits during the current reporting period. A total of 23 independent glyphosate resistant second generation Camelina lines have been produced, of which, nine have been confirmed in the third generation to be tolerant to glyphosate herbicide.

Camelina transcriptome characterization using paired-end Illumina sequencing has been completed, which consisted of ~300 million single-reads from a time course study consisting of 96 samples of leave and root samples collected over a three day period under well-watered or water-deficit stress conditions using hydroponically grown plants.

Prickly Pear Cactus a Novel Biofuel Feedstock
To complement previous RNA transcriptomic sequencing and to overcome the challenge of creating a de novo transcriptome assembly of octoploid cactus (8 sets of chromosomes), our scientists have completed eight DNA sequences of complementary DNA from the cactus' flat leaf-like branches. Artificial DNA constructs consisting of two genes have been completed that are driven by inner tissue specific promoters derived from the common ice plant. The dual gene construct was sequenced, verified, and tested using an agro-bacterium to insert the gene into Nicotiana benthamiana (a relative of tobacco). This experiment successfully produced oil droplets inside a plant that normally never produces oil.

Pads of the three different species (Opuntia ficus-indica, O. cochenillifera, and O. streptacantha) under evaluation continue to be expanded by vegetative propagation under greenhouse conditions to provide adequate replacement pads for the field trial. Total above ground biomass was collected and analyzed from the Southern Nevada field site representing year 1 biomass production.

Curly Top Gumweed Biofuel Potential
Preliminary experiments have been performed using whole gumweed plants as feedstock at various temperatures (240 to 250 °C) with and without super-critical methanol. The resulting bio-crude was chemically analyzed with gas chromatography-mass spectrometry, and fourier transform infrared spectroscopy, as well as the product's energy value and density. A bi-functional catalyst, tungstated

zirconia supported palladium, was designed for the catalytic conversion of gumweed bio-crude in a watery phase solutions into hydrocarbon fuel. Due to complications in the bi-functional catalyst, a new conversion strategy was developed (bi-phasic tandem catalytic process) and tested on a model hydrocarbon compound (terpenoid).

In the development of a suitable agronomic method to produce gumweed, the second year of field trials on plant spacing and irrigation resulted in an increase dried biomass yield of 21 percent.

Accumulation of Hydrocarbons in Plants - making biofuels
Continuing with the efforts to transfer insect genes known to produce hydrocarbons into plants, trials utilizing the model plant Arabidopsis are moving forward. Four transgenes were created and tested for their ability to produce different hydrocarbons when expressed in plants. No detectable changes in hydrocarbon production were observed. A fifth strategy has been designed based on a newly identified gene that shows greater activity when tested in an in-vitro system.

2. Brief description of the target audience

The project results and outcomes are being targeted to the scientific community at national and international scientific meetings, specifically to research scientists and undergraduate and graduate students and post-doctoral researchers conducting research on alternative crops for arid lands. Also included are the general public, energy and chemical industry, and potential producers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	100	200	300	0

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

Patent Applications Submitted

Year:	2015
Actual:	1

Patents listed
Cushman, J. C., Lim, S. D., "Engineered Tissue Succulence in Plants", Provisional, United States. Date of Patent Application: November 13, 2015

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total

Actual	0	6	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2015	11

Output #2

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2015	11

Output #3

Output Measure

- Workshops, Demonstrations, and Presentations

Year	Actual
2015	28

Output #4

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications

Year	Actual
2015	3

Output #5

Output Measure

- Brochures, Bulletins, Fact Sheets, Newsletter, and Surveys

Year	Actual
2015	0

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2015	0

Output #7

Output Measure

- Digital Media and Web Sites Created or Updated

Year	Actual
2015	1

Output #8

Output Measure

- Leveraged research funds generated

Year	Actual
2015	1474665

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who gain knowledge about sustainable energy and environmentally responsible lifestyles.
2	Number of individuals who implement practices related to or in support of sustainable energy and environmentally responsible lifestyles and practices.
3	Programs in this area will develop strategies to engage producers, industrial partners, and consumers groups resulting in effective leadership-oriented partnerships.
4	Annually the program will report, in conjunction with industrial partners, non-proprietary research gains made to the consuming public to garner interest in adoption of new products and processes when released.
5	Increased understanding of energy alternatives, resources and project support.

Outcome #1

1. **Outcome Measures**

   Number of individuals who gain knowledge about sustainable energy and environmentally responsible lifestyles.

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

   Number of individuals who implement practices related to or in support of sustainable energy and environmentally responsible lifestyles and practices.

   Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

   Programs in this area will develop strategies to engage producers, industrial partners, and consumers groups resulting in effective leadership-oriented partnerships.

   Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

   Annually the program will report, in conjunction with industrial partners, non-proprietary research gains made to the consuming public to garner interest in adoption of new products and processes when released.

   Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

   Increased understanding of energy alternatives, resources and project support.

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Camelina (False Flax) is already relatively cold tolerant, rapidly maturing, and thus could be adapted to late fall or early winter cropping systems in Nevada. Camelina requires less water, lower fertilizer and herbicide inputs than other oilseed crops, and it can also be grown on marginal land or in rotation with other crops so that it will not necessarily displace food crops. Reduced inputs means that Camelina can be inexpensive to grow, while producing a renewable fuel that creates new sources of revenue and jobs for farmers. Camelina seeds have a naturally high oil content making it suitable as either an edible oil or a biodiesel feedstock for local and regional biofuel markets thus having a significant economic impact on the Nevada state economy. After oil extraction, the seed meal can also be used as an animal feed supplement. Currently, the major rate limitation for increasing biofuel production is feedstock availability.

What has been done
Ethylmethane sulfonate mutant populations of Camelina sativa (False Flax) were produced and continue to undergo screening on an ongoing basis. To date, seeds have been collected for a total of 5,243 second mutant generation (M2) lines from a total of ~7,000 M1 lines. M2 lines were replanted and 2,700 M3 lines have been grown out. Of these, seed for 1,700 M3 lines have been cleaned. A total of 474 M3 lines were screened for mucilage defect using the Ruthenium red staining protocol.

Results
In the search to find mucilage-free lines of Camelina, that is a line of Camelina that doesn't gum up equipment, one line has been isolated and found to exhibit a stable mucilage-free defect through six generations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology

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

The Nevada Agricultural Experiment Station experienced the following problems:

The transformation and regeneration method described in Silos-Espino et al. 2006 has been attempted using Agrobacterium injection of individual areoles and Agrobacterium co-cultivation of several thousand immature cladode explants cladode explants. No transformants have been recovered to date suggesting that this approach is unlikely to be successful. Thus, a modified transformation protocol has been developed and is currently undergoing testing and will be tested during the next reporting period.

The major problem Nevada research team has faced is herbivory by local fauna including rabbits and gophers that find prickly-pear cactus cladodes quite palatable.

Field germination of seeds of gumweed continues to be erratic, and the successful plot studies were completed only with greenhouse germinated seeds, followed by transplanting the seedlings into the field plots.

Due to complications in processing gumweed into bio-diesel with a bi-functional catalyst, a new conversion strategy was needed.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nevada Agricultural Experiment Station results are as follow:

Camelina research is progressing. Selection for herbicide resistance (glyphosate) have produced 23 lines that retain resistance in the second generation. Two hundred and fifty, third generation mutant lines were produced that may have useful agronomic traits including more rapid completion of ontology and reduced pigment content for greater light penetration through the canopy, which could allow greater planting densities.

Artificial DNA constructs, derived from the inner tissue of ice plants, were successfully inserted into a model plant (N. benthamiana) that in turn produced oil droplets. This result provides a genetic mechanism to transfer oil production into non-oil producing plants.

A bi-functional catalyst was designed for the catalytic conversion of gumweed bio-crude in the aqueous phase into hydrocarbon fuel. A second conversion strategy was also

developed, due to complications in the bi-functional catalyst.

Key Items of Evaluation

The Nevada Agricultural Experiment Station key items are as follow:

- Mutant line of camelina showing generational resistance to herbicides
- Oil production genes were successfully transferred to model plants, which in turn started producing oil droplets
- Two conversion strategies were designed for the catalytic conversion of gumweed bio-crude in the aqueous phase into hydrocarbon fuel.
- Opuntia ficus-indica transcriptome database was created
- Patent - Cushman, J. C., Lim, S. D., "Engineered Tissue Succulence in Plants", Provisional, United States. Date of Patent Application: November 13, 2015

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity, Nutrition, & Health

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
610	Domestic Policy Analysis	5%		0%	
702	Requirements and Function of Nutrients and Other Food Components	0%		75%	
703	Nutrition Education and Behavior	25%		0%	
704	Nutrition and Hunger in the Population	25%		0%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		25%	
724	Healthy Lifestyle	25%		0%	
802	Human Development and Family Well-Being	10%		0%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	1.5	0.0
Actual Paid	2.6	0.0	0.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
170089	0	130560	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
170089	0	112121	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
170089	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Nevada Cooperative Extension conducted the following programs in 2015: Healthy Eating Active Living: Mapping Attributes using Participatory Photographic Surveys (HEAL MAPPS) ; Calcium It´s not Just Milk; Eat Smart Live Strong; Expanded Food and Nutrition Education Program; and Healthy Eating on a Budget.

These programs incorporated the following types of activities:

- research with respect to obesegenics, health, and nutrition.
- nutritional research and education to enhance human nutrition and nutrition-related behavior.
- intensive, high-dosage educational activities for preschool children about nutrition, physical activity, and social acceptance of diverse body shapes and sizes.
- workshops and one-on-one interventions to educate parents of preschoolers about their child's development and how these issues impact their behavior.
- research-based programs focused on health and nutrition.
- partnering with professional educators to educate youth and families to improve health and nutrition.
- Publishing curricula, journal articles, and fact sheets pertaining to health and nutrition.

The Nevada Agricultural Experiment Station conducted the following programs to further the goals of NIFA's Childhood Obesity, Nutrition, & Health theme:

Beneficial and Adverse Effects of Grape Seed Extract on Human Health
Experiment Station scientists have revealed novel underlying molecular mechanisms that contribute to the action of grape seed procyanidin extract (GSPE) in lowering serum triglyceride levels. The study that was published in Molecular Nutrition and Food Research (featured on the cover of the April 2016 issue) determined that GSPE inhibits intestinal bile acid absorption by differentially modulating the expression of genes associated with bile acid uptake and transport in an FXR-dependent manner. These gene changes ultimately result in reduced uptake of bile acids from the intestinal lumen, leading to a reduction in the amount of bile acids being returned to the liver, and consequently increasing the amount excreted via the feces.

A second study, utilized the fructose-fed rat model to induce high triglyceride levels and fat accumulation within the liver, was conducted to show the protective effects of GSPE by down-regulating the expression of genes associated with fat and triglyceride production and increased hepatic cholesterol syntheses.

The third study was designed to determine the triglyceride-lowering effect of GSPE in the presence of the

bile acids. This study provides novel and innovative insight into the molecular regulatory interactions between GSPE and the bile acid cholestyramine that could prove to be a valuable therapy for elevation of plasma cholesterol and/or triglycerides levels.

Improving Polyphenol Extraction Methods from Grape Seeds
Over the past year, Experiment Station investigators have continued to optimize the extraction methods from three different varieties of grape seeds. The team has utilized two methods for extracting low molecular weight procyanidins from grape seeds and tested two different extraction solvent systems. The team has optimized an in-house extraction technique using whole seeds for the isolation of low molecular weight procyanidins by using ethyl acetate as the extraction solvent. Efficient extraction techniques that specifically enrich for low molecular weight procyanidins could provide a value added product from the waste generated during the wine-making process.

Rodents Role in Maintaining the Tick-Borne Human Disease "Relapsing Fever" in Nature
To date 340 small mammals were collected, sampled and identified during 2015 field season. Twenty-two infected individuals have been identified at this point, but prevalence may increase following completion of 2015/2016 field season. In addition to testing rodent hosts for Borrelia hermsii infection (the cause of relapsing fever in humans in the western US), Experiment Staion investigators have been obtaining DNA sequences for all positive individuals and have been performing microsatellite analysis on chipmunks collected at sites across California and Nevada in order to determine their population genetics and to estimate parameters such as rates of dispersal, immigration or emigration. Over the past year, the team has also begun to obtain location data of all small mammals caught in live traps using GPS. Infection status was then tracked, producing maps of each collection site that show zones of infected and non-infected rodent hosts. Although statistical analysis to test for clustering must still be completed, it appears that infected individuals appear to have a tendency to be grouped within each of the study sites.

2. Brief description of the target audience

The primary target audience is pre-school and grade school children and their families. Secondary audiences are senior citizens, health care professionals, professional educators and childcare providers. Programs also target women struggling with substance abuse.

The target audience for Experiment Station's research and educational programming is consumers, health care personnel, agency personnel, nutrition support groups, state and county public health and vector control agencies.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	18408	0	110348	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	1	2	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2015	1

Output #2

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2015	1

Output #3

Output Measure

- Workshops, Demonstrations, and Presentations

Year	Actual
2015	3

Output #4

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Brochures, Bulletins, Fact Sheets, Newsletter, and Surveys

Year	Actual
2015	0

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2015	0

Output #7

Output Measure

- Digital Media and Web Sites Created or Updated

Year	Actual
2015	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who gain knowledge about nutrition and health.
2	Number of individuals who implement behaviors to improve health and nutrition.
3	Apply new knowledge to programs at the field level with a goal of significant long term weight loss and overall improvement of health in those who participate.
4	To identify research activities such as new data sources, improved techniques for data analysis, and improved hypotheses for obesity research questions.

Outcome #1

1. Outcome Measures

Number of individuals who gain knowledge about nutrition and health.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The problem of obesity in children is in the forefront of nationwide research efforts, and there are documented physical and mental health outcomes associated with childhood obesity that contribute to lifelong chronic health problems which may disproportionately affect people living in rural places. Living in a rural areas tends to increase the risk of overweight and obesity for children and adults. Helping children develop healthy habits and providing healthy eating and activity supports to balance their energy intake with energy expenditure is an important aspect to maintaining healthy weight, preventing overweight and obesity and minimizing chronic disease risk. Most evidence-based strategies to battle the childhood obesity epidemic have been developed and tested in urban or non-rural settings and target either individuals or environments. The overall goal of the Generating Rural Options for Weight-Healthy Kids and Communities (GROW HKC) project is to learn more about the factors influencing health behaviors in rural communities in order to prevent obesity in rural children by improving their behavioral environments, at home, in school and in the community to make healthy eating and activity an easy and preferred choice. The Healthy Eating Active Living Mapping Attributes using Participatory Photographic Surveys (HEAL MAPPS) is an evidence-based engagement and assessment tool used to examine and map community features that support and/or hinder healthful eating and physical activity among community members. It integrates photography, participatory community mapping using global position system (GPS) technology and residents? voiced perceptions of their community place to explore, understand, and improve community livability. Children and senior citizens are below the national average in consuming the daily recommended amounts of fruits and vegetables. Diets high in fruits and vegetables that are naturally high in nutrients reduce the risk for obesity and related chronic diseases. Efforts to increase fruit and vegetable consumption in the US population have generally been unsuccessful, and one identified reason for this may be the limited access to and affordability of fruits and vegetables. According to experts, living in a home with an average radon level of 4pCi/l poses as much risk of developing lung cancer as smoking about half a pack of cigarettes a day. About 40%

of the homes tested exceed EPA's action level for radon. A needs assessment conducted by the Nevada Nutrition Network identified children ages 11-14 years and their increased' need for calcium-rich foods as an important Nevada SNAP-ED target audience. Federal law requires that EFNEP target its programming efforts toward limited resource families with children. Low income families are the most vulnerable to both under-nutrition and over-consumption. The 2010 Dietary Guidelines for Americans specifically emphasize consumption of low-fat, nutrient-dense foods, limited sugars, and increased physical activity. In contrast, food consumption research shows low-income families often consume low cost, high fat, high calorie foods that provide more calories for less money. EFNEP plays a critical role in bringing nutrition education to families most in need in a practical, hands-on, applied way. The Dietary Guidelines for Americans specifically emphasizes consumption of low-fat, nutrient-dense foods, limited sugars, and increased physical activity. In contrast, food consumption research shows low-income families often consume low cost, high fat, high calorie foods that provide more calories for less money.

What has been done

Nevada Cooperative Extension conducted several programs to address these issues, several of which are reported here. The Healthy Eating Active Living Mapping Attributes using Participatory Photographic Surveys (HEAL MAPPS) is an evidence-based engagement and assessment tool used to examine and map community features that support and/or hinder healthful eating and physical activity among community members. It integrates photography, participatory community mapping using global position system (GPS) technology and residents voiced perceptions of their community place to explore, understand, and improve community livability. Nevada Cooperative Extension conducted the five-lesson Eat Smart Live Strong series for seniors at the Overton Senior Center.

Federal law requires that EFNEP target its programming efforts toward limited resource families with children. Low income families are the most vulnerable to both under-nutrition and over-consumption.

Nevada's EFNEP program targets limited resource families primarily through schools and zip code locations. Nevada's EFNEP program partners with schools with at least 50% of students eligible for free or reduced price lunches to provide programming to parents and youth. Veggies for Kids promotes vegetable consumption and healthy living habits among youth.

Results

Measurable increases were seen in the recognition and taste of vegetables presented during the Veggies for Kids program. Participants were able to correctly recognize the health and nutrition benefits of vegetables in several categories and reported increased physical activity. Healthy Eating on a Budget reached 391 family members. The race/ethnic breakdown of the participants was 90% White, 2% multiple races, 2% American Indian and 5% other. Five percent identified themselves as Hispanic. Twenty-two percent indicated they receive SNAP benefits, 5% receive Child Nutrition benefits, 32% receive commodity foods and 44% participate in one or more food assistance programs. Results of the pre/post-test evaluations were based on 39 matched responses from participants. 92% of participants in the EFNEP program showed improvement in one or more food resource management practices (i.e. plans meals, compares prices, does not run out of food and uses grocery lists) from entry to exit evaluation. Participants in the Health Eating on a Budget program reported increased consumption of vegetables and fruits, greater attention to food safety, and greater attention to nutrient contents of processed foods appearing on product labels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle
802	Human Development and Family Well-Being

Outcome #2

1. Outcome Measures

Number of individuals who implement behaviors to improve health and nutrition.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Apply new knowledge to programs at the field level with a goal of significant long term weight loss and overall improvement of health in those who participate.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

To identify research activities such as new data sources, improved techniques for data analysis, and improved hypotheses for obesity research questions.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Grape see extract is marketed as a health product that can be incorporated into dietary

supplements or functional foods. Consequently, since the extract can potentially aid in the eradication of factors associated with heart disease, such as high serum triglyceride levels, its use as a nutritional supplement to aid in lowering the prevalence of CVD is of particular relevance to the citizens of the State of Nevada.

What has been done

Researchers in the Nevada Agricultural Experiment Station have performed three studies that bring to light the effects of grape seed extract on heart disease. To better understand how GSE lowers triglyceride levels a study was conducted to explore how our genes are effect by GSE. A second study was done to see how hyperglycemic rats reacted to GSE both from a triglyceride level and fat accumulation with the liver. A final study was conducted to see how GSE reacts in the presences of the bile acid Cholestyramine.

Results

The research team has elucidated two novel underlying molecular mechanisms that contribute to triglyceride and cholesterol lowering action of grape seed extract (GSE). The elucidation of these novel mechanism of action has provided a new insight into the molecular effects exerted by this natural compound, providing avenues for further research as a fat lowering agent. Consequently, GSE may be valuable as a potential combinational therapy with bile acid for the treatment of dyslipidemia. These findings are being published in the Molecular Nutrition and Food Research journal, receiving the prestigious cover story in the April 2016 issue.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
724	Healthy Lifestyle

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.)
- Other (Grant availability)

Brief Explanation

Unemployment rates, wage levels and family stability affect outcomes. Nevada's urban centers improved with respect to the first two factors. However, Nevada's rural areas continue to lag behind urban areas, in part because of fluctuations in the mineral extraction economy. These have a direct effect on Nevada's ability to successfully address these concerns.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In FY 2015, Healthy Eating on a Budget reached 460 participants with 1,991 family members affected by programming. The race/ethnic breakdown of the participants was 34% Black, 38% White, 8% multiple races, 3% Asian, 2% Native Hawaiian or other Pacific Islander, 2% American Indian and 14% other. Nineteen percent identified themselves as Hispanic. Eighty-four percent indicated they receive SNAP benefits, 40% receive Child Nutrition benefits, 4% participate in Head Start, 68% receive TANF benefits, 33% receive WIC benefits, and 19% receive TEFAP. Ninety-four percent of the participants receive one or more food assistance programs. FY 2015 was the first year that evaluation data could be extracted from the online WebNEERS system for further analysis. The entry and exit program evaluation data was recoded and paired sample t-tests were conducted in both Excel and SPSS to determine self-reported entry/exit program behavior change. Results of the entry and exit program evaluations with the adult audience (N=433) showed significant (p<.001) self-reported behavior change on all questions. For the Veggies for Kids program with all participating schools combined, results of the student pre- and post-test evaluation (N=2,980) showed a significant improvement (p &le 0.0001) in all answers to all questions with regard to the core curricular concepts related to (a) knowledge and understanding of calcium and growth, bone health, distribution of calcium in the body, importance of physical activity and disease prevention; b)knowledge of the calcium intake recommendation for their age group; c) identification of calcium-rich foods; d) recommended types of milk and milk products for consumption; and e) interpretation of food labels to identify calcium-rich foods. All objectives were met. With modifications to the curriculum this year, results showed that 50% of the students were able to identify the combination of four foods that would provide them with the most calcium. This is an improvement from only 12% answering the question correctly on the pre-test to 50% answering the question correctly on the post-test. Following curriculum modifications in 2013, we continue to find increased improvement that students recognize the importance of weight-bearing physical activity in bone health: FY 2012 results - 71%, FY 2013 - 84%, FY 2014 - 90%, FY 2015 - 94%.

Nevada Agricultural Experiment Station results are as follow:

Molecular nutritional scientist have revealed the underlying molecular mechanisms that contribute to the action of grape seed procyanidin extract in lowers serum triglyceride levels. The study was published in a tier-one nutritional journal, Molecular Nutrition and Food Research, with supportive evidence in vitro of the protective qualities of grape seed extract. The team has also optimized an in-house extraction technique using whole seeds for the isolation of low molecular weight procyanidins by using ethyl acetate as the extraction solvent.

In efforts to control relapsing fever, rodents in affected areas have been saddled with GPS units. Infection status was then tracked, producing maps showing hot and cold zones of infected and non-infected rodents. These maps are now being made available to local home owners in affected areas.

Key Items of Evaluation

Nevada Agricultural Experiment Station key items are as follow:

- Elucidation of the underlying molecular mechanisms that grape seed supplements have upon serum triglyceride levels.

- The team has optimized an in-house extraction technique using whole grape seeds for the isolation of low molecular weight procyanidins.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

☐ Reporting on this Program

Reason for not reporting

During the reporting year of 2015, either Nevada Agricultural Experiment Station or University of Nevada Cooperative Extension have personnel working in food safety.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	1.0	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

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

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct a statewide assessment to identify specific food safety program topics and further identify

target audiences.
• Provide educational and extension outreach support to market livestock and produce growers, to owners and operators of small and very small plants, and to food preparers and handlers, including minority populations such as Native Alaskans, Asian Pacific Islanders, and American Indians.
• Educate agricultural producers about methods to reduce food contamination and growth of foodborne organisms.
• Conduct In-depth cattle handling workshop to increased production and improved animal health through decreased stress.
• Support the development and transfer of practices and intervention strategies that manage, reduce, or eliminate food safety risk throughout the food chain.
• Educate agricultural producers about farm planning to ensure food safety, direct marketing, including legal, financial, and marketing risks.
• Educate agricultural producers about GAPs and GHPs.
• Provide producers educational and extension support for the implementation of HACCP.
• Partner with Nevada Department of Agriculture to build awareness of volunteer GAP and GHP certification processes.

2. Brief description of the target audience

This program targets:

• Agricultural producers, small acreage operators, and managers/operators of school/community gardens.
• Livestock producers who participate in Beef Quality Assurance (BQA)
• 4-H and FFA youth participating in statewide and local competitive events with market projects
• Food safety programs also target professionals in the retail food industry and custodial food providers in child and senior care facilities.
• Specific individuals or groups who have expressed a need for food safety research and extension information that is to be derived through new research, extracted from on-going research, or is derived from scientific literature.
•
Other scientists, scientific groups and political entities

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	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: 2015

Actual: {No Data Entered}

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2015	0

Output #2

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2015	0

Output #3

Output Measure

- Workshops, Demonstrations, and Presentations

Year	Actual
2015	0

Output #4

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications

Year	Actual
2015	0

Output #5

Output Measure

- Brochures, Bulletins, Fact Sheets, Newsletter, and Surveys

Year	Actual
2015	0

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2015	0

Output #7

Output Measure

- Digital Media and Web Sites Created or Updated

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who gain knowledge about foodborne illness, farm/ranch food safety, and quality assurance.
2	Number of individuals who implement practices to prevent foodborne illness, which include farm/ranch food safety plans and quality assurance practices.
3	Reduce food borne pathogens in the food supply chain.

Outcome #1

1. Outcome Measures

Number of individuals who gain knowledge about foodborne illness, farm/ranch food safety, and quality assurance.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Number of individuals who implement practices to prevent foodborne illness, which include farm/ranch food safety plans and quality assurance practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Reduce food borne pathogens in the food supply chain.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2015 0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- 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.)
- Other (Grant funding available)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Community and Economic Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
122	Management and Control of Forest and Range Fires	15%		0%	
213	Weeds Affecting Plants	20%		0%	
601	Economics of Agricultural Production and Farm Management	25%		15%	
602	Business Management, Finance, and Taxation	25%		0%	
605	Natural Resource and Environmental Economics	0%		34%	
608	Community Resource Planning and Development	15%		51%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	1.0	0.0
Actual Paid	5.8	0.0	0.4	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**
375612	0	48393	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
375612	0	65605	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
375612	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Nevada Cooperative Extension offered the following programs focused on Community and Economic Development:

Improving Farmer/Rancher Profitability and Efficiency; Managing Weeds Safely and Economically ; Russian Knapweed Control Study; Local food production and marketing; Risk Management Education for Sustainable Agriculture in Nevada 2015; Additional Agriculture and Natural Resources Teaching Activities; Agriculture Innovation Forum Series; Eagles and Agriculture; Poultry Workshop; Agriculture and Natural Resource Heritage; Heart and Shield: A Program to End Family Violence; Keeping Kids Safe: Recognizing, Reporting and Responding to Child Maltreatment; Capacity Building for Healthy Communities; Business Retention and Expansion; Economic and Community Development; Area Sector Analysis Process 2015; Fiscal Education for County and Local Governments 2015; Rural Health Works-2015; Stronger Economies Together-SET-2015; University Center for Economic Development Extension Programs-2015; Facilitation Projects; Leadership Douglas County; MLK Panel Forum: A Dialogue on Civil Rights; Moan River Indian Reservation: and Strategic Planning for Non-Profits.

These programs reach communities through the following activities:

- Developing and expanding applicable knowledge of natural resource and environmental economics commensurate with demand from multiple stakeholders for multiple outcomes, e.g. profit, preservation, aesthetics.
- Exploring and advancing theoretical and applied economics of domestic/international trade and development as it relates to Nevada and national needs.
- Enhancing understanding of domestic economic policy analysis in terms of government policy impact on agriculture and natural resources
- Strengthening capacity among community stakeholders to participate in community-development planning, including asset mapping, secondary data analysis, and social network analysis.
- Conducting applied research to assess regional economic development strategies for Nevada.
- Conducting applied research to help rural communities develop business matching models.
- Developing educational resources to build the capacity of elected and appointed officials to support sustainable economic development and viability at the community, county, regional, and state levels.
- Conducting workshops for elected and appointed officials focused on leadership ethics, Nevada's fiscal system, land-use planning, natural-resource management, and economic development.

The Nevada Agricultural Experiment Station conducted the following programs to further the goals of NIFA's Community and Economic Development theme.

In an effort to better understand the consequences of closing rangeland to livestock grazing due to the listing of sage grouse on the Endanger Species List, economists have created an economic model based upon the average sized ranching operation in northern Nevada. Results indicate that the average rancher would either have to acquire more land or consider retiring from the business if +25% of their allotment is closed.

Experiment Station economists developed timely socio-economic and fiscal analyses of potential impacts of changes in public resource management for Nevada county commissioners as requested. Additionally, the University Center for Economic Development's technical bulletins were published that address in a concise and punctual fashion issues of economic development and/or fiscal balances from changes in national, state, and/or local economic activity.

2. Brief description of the target audience

Target audiences for Cooperative Extension include elected and appointed leaders and officials, business owners, general public, youth leaders, land-use planners, and economic development professionals. Experiment Station's audiences included Nevada Cattlemen, Nevada Association of Counties, Nevada State Government, Nevada County Commissioners, and managers of federal lands in the state of Nevada.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20653	0	12776	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	6	4	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2015	7

Output #2

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2015	1

Output #3

Output Measure

- Workshops, Demonstrations, and Presentations

Year	Actual
2015	16

Output #4

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications

Year	Actual
2015	21

Output #5

Output Measure

- Brochures, Bulletins, Fact Sheets, Newsletter, and Surveys

Year	Actual
2015	2

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2015	0

Output #7

Output Measure

- Digital Media and Web Sites Created or Updated

Year	Actual
2015	2

Output #8

Output Measure

- Leveraged research funds generated

Year	Actual
2015	736609

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of individuals who gain knowledge about community and economic development.
2	Number of individuals who implement knowledge about community and economic development.
3	Stakeholders will have the necessary models that will improve on the forecasting of risk, demand, and prices in various commodity sectors leading to enhanced decision making, increased profits, and reductions in uncertainty.
4	Research finding on valuing environmental resources, e.g. lakes, wetlands, river restoration, and how it applies to stakeholder needs for demonstrated gains in profits, resources sustained, and/or actions mitigated.
5	Biological complexity analyses to understand human-nature interactions at the landscape level that informs human enterprises, leading to demonstrated profitability, environmental protection, and/or improvements in quality of stakeholders' lives.
6	Market and non-market valuation of environmental resources that have often lacked economic justification that meets client needs, and informs individual, group, and government decision making.

Outcome #1

1. Outcome Measures

Number of individuals who gain knowledge about community and economic development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Government and non-profit organizations need to expand their capacity to create safe and productive communities. The government and non-profit sectors face challenges in addressing new critical issues, developing effective policies, adapting communications strategies, improving volunteer recruitment, using technology effectively, collaborating with community partners, and managing resources efficiently. Capacity building strengthens an organization's ability to fulfill its mission, develops goals, achieve measurable and sustainable results, and have a positive impact on places where people live, work, play, and learn. The Indian Health Services chief executive officer of the Southern Bands Health Center and the unincorporated town of Jackpot requested that Extension facilitate a strategic thinking and action planning process to meet community challenges. Research shows that up to 86 percent of new jobs are created by existing businesses in a community, rather than businesses attracted to a community. Keeping an existing business in the community is usually easier than recruiting a new business. Therefore, Extension's Business Retention and Expansion program has offerings that help community leaders and communities to work together to identify barriers local businesses face as they try to survive and grow. Rural residents are strongly in favor of creating more jobs and opportunities but fear change and loss of the quiet lifestyle. Economic development programs must consider these fears while creating programs to encourage more business and employment in the county. With the expanding national and state economy from the Recession of 2008, Nevada state government and Nevada counties and communities had faced restrictive fiscal budgets while facing expanding community service mandates. With the federal government owning 87% of Nevada's land mass, federal officials need to be aware of how their actions impact the fiscal balances of Nevada's state, county, and local governments.

What has been done
The Area Sector Analysis Program (ASAP) was used to focus economic development efforts to diversify the local economy in several rural counties. Results of the ASAP model became part of

planning efforts to investigate potential economic targets for mining operations on public lands that have closed.

Results
To design the strategic thinking and action planning process for the Elko Indian Health Services Southern Bands Health Center, Nevada Cooperative Extension met with the key internal decision makers such as the chief executive officer, the medical clinic director, the business services director, the nurse executive, and the medical records administrator to negotiate the overall planning effort and key planning steps, determine their role on the planning team, and obtain commitment of resources to accomplish the effort. Elko Indian Health Services Southern Bands Health Center has updated its three-year plan, identifying new priorities and funding sources to provide additional services to tribal community members. Efforts in rural counties to evaluate workforce readiness and economic development potential led to one-on-one consultation to assess workforce skills, interests, education levels and social barriers in regards to sustainable employment. The needs assessment and education program developed for each individual was expanded to include online skills, interests and a career assessment. They were educated on what they need to do to achieve a fulfilling career starting with the emotional development to build self-worth and hope. Nevada Cooperative Extension held workshops for County Commissioners and local officials and gave presentations to the Nevada Association of Counties.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Number of individuals who implement knowledge about community and economic development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In order to combat the recession, the Western Nevada Development District (WNDD) decided to employ SET to formulate and develop economic targeting programs. Understanding socio-economic data and trends is a necessary part in developing targeted and practical economic development strategies. Also to gain federal funding a federally recognized Comprehensive Economic Development Strategy (CEDS) is necessary. The strategic plan of the SET program provided the WNDD with the socio-economic data and analysis for development of a CEDS that was accepted by the federal government. Currently, the state of Nevada and the Western Nevada Development District has realized a renaissance in local economic growth. With the location of Tesla/Panasonic and Switch in the area economic growth has begun again. Development of research materials to understand this economic growth and impacts to state and local fiscal balances is a need.

What has been done
Nevada Volunteers seeks to obtain public input for the development of a three-year State Service Plan. The Plan serves as a strategic vision for the organization and is approved by the Commission and signed by the Governor. Community engagement and volunteerism are critical ingredients in developing skills, resources and commitment of a community. Due to the shared alignment of fostering and enhancing volunteerism and community engagement to create healthy and sustainable communities in Nevada.

Results
The Lincoln County Regional Development Authority (LCRDA) acquired $105,500 in grants in 2015 for economic development and spent it on assessing power and solar projects, food processing, specialty crop industry development and marketing Lincoln County to businesses. LCRDA has been assisting two biofuels companies to locate in Lincoln County, has been developing a collaborative agreement with BLM for access of biofuel materials, has assisted in the plans for a mountain biking trail system in the county based out of Caliente by supporting grant application development, meetings for collaboration and providing technical information on Lincoln County. Directors teach and consult each other on the possible success and failures for economic development projects, develop plans that have the most likely success in Lincoln County by adapting the projects according to the changes in issues, opportunities and the economic climate at the time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

Stakeholders will have the necessary models that will improve on the forecasting of risk, demand, and prices in various commodity sectors leading to enhanced decision making, increased profits, and reductions in uncertainty.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Trichomoniasis, a cattle disease, can substantially reduce range cattle production and net returns to the Nevada range cattle producers. Alternative range management practices such as inoculating herds with trichomoniasis vaccine, selling of infected herds, etc. can impact the spread of trichomoniasis and the net returns to Nevada cattle producers. Economic models looking at risk aversion, likelihood of adoption, and production costs could enhance the adoption and development of outreach/extension programs to reduce trichomoniasis infections on public land cattle herds.

What has been done
Educational materials about the risk of contracting trichomoniasis were developed for three groups of ranchers: users of the vaccine, potential users, and non-users. A regional economic impact model based upon the representative rancher analysis was create that exposes the financial impacts of adopting and not adopting trichomoniasis vaccine.

Results
These results will provide agricultural educators and extension personnel with fact-based solutions that could increase the adoption rates of Nevada cattlemen for the Trichomonaisiss vaccine. This, in turn, could help reduce infection rates of public-land grazing cattle from the Trichomonaisiss.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #4

1. Outcome Measures

Research finding on valuing environmental resources, e.g. lakes, wetlands, river restoration, and how it applies to stakeholder needs for demonstrated gains in profits, resources sustained, and/or actions mitigated.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
For the state of Nevada, approximately 84 percent of land is owned or administered by the federal government. While for the Nevada counties of Esmeralda, Lander, Lincoln, Nye, and White Pine, over 90 percent of the county's acreage is under federal control. Often, changes in public land management policies (e.g. the listing of sage grouse on the US Endangered Species List) are not researched or analyzed, especially consequences to the local economy and fiscal balances of government.

What has been done
A panel of ranchers representative of full-time, moderate to large cow/calf operations in the region were interviewed to obtain specific information for the analysis to obtain the production data and costs for a representative ranch in Northeast Nevada. The methodology for the analysis involves simulating the representative ranch for alternative range management options using the Supply-Constrained Social Accounting Model. The percentage of grazing permits that would be reduced because of habitat protection is unknown. Because the loss of rangeland is an exogenous variable, nine scenarios were analyzed (from 0 to 80 percent of federal land closed). The results showed that should the ranch be forced to reduce the herd size by more than 25 percent, the ranch might have to look at ways to retire or acquire more private or owned land to survive. Economists are now working on a Southern Nevada representative ranch which can derive financial impacts at the ranch level to alternative Southern Nevada federal public land management scenarios.

Results
In an effort to better understand the consequences of closing rangeland to livestock grazing due the listing of sage grouse on the Endanger Species List, economists have created an economic model based upon the average sized ranching operation in northern Nevada. Results indicate

that the average rancher would either have to acquire more land or consider retiring from the business if +25% of their allotment is closed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Biological complexity analyses to understand human-nature interactions at the landscape level that informs human enterprises, leading to demonstrated profitability, environmental protection, and/or improvements in quality of stakeholders' lives.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Market and non-market valuation of environmental resources that have often lacked economic justification that meets client needs, and informs individual, group, and government decision making.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The following factors have the potential to substantially affect outcomes:

Energy prices including petroleum products, water availability, distances between production sites and markets, limited transportation infrastructure corridors, mineral prices, housing availability and prices, Nevada state law limits on real increasing real estate prices and state and federal support for the University of Nevada and Nevada Cooperative Extension.

Nevada Agricultural Experiment Stations specific external factors were:
Lt. Governor is developing a task force to investigate impacts of potential for transferring federal lands into state lands. Changes in federal management of public lands and surface water allocations.

Factors such as education levels, knowledge of trichonomiasis vaccine, neighbor's herds maybe infected, and risk aversion of rancher impacts adoption of trichonomiasis vaccine by Nevada ranchers.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The adult workforce education impact was improved through greater training and employment. Of the participants: 7 became employed, 7 completed occupational training - 5 completed training and received a class 5 commercial driver's license and 2 paralegal certificates. Generally, participants showed strong improvements in elementary and intermediate job seeking skills. One rural county (Lincoln) drew visitors to several events planned with the help of Nevada Cooperative Extension. Results of the ASAP helped the community of Laughlin, Nevada attract industries to their industrial park and to develop economic diversification plans to address economic impacts from the loss of a major local employer.

Nevada Agricultural Experiment Station results are as follow:

In an effort to better understand the consequences of closing rangeland to livestock grazing due the listing of sage grouse on the Endanger Species List, economists have created an economic model based upon the average sized ranching operation in northern Nevada. Results indicate that the average rancher would either have to acquire more land or consider retiring from the business if +25% of their allotment is closed.

Experiment Station economists developed timely socio-economic and fiscal analyses of potential impacts of changes in public resource management for Nevada county commissioners as requested. Additionally, the University Center for Economic Development's technical bulletins were published that address in a concise and punctual fashion issues of economic development and/or fiscal balances from changes in national, state, and/or local economic activity.

Key Items of Evaluation

The Nevada Agricultural Experiment Station key items are as follow:

- Economic model is now being calibrated to investigate the ramifications to the average rancher in southern Nevada
- Economic model was devised that evaluates ranchers' financial impact of adopting or not trichomoniasis vaccine for range cattle.
- Develop a web based program called Regional Economic Analysis Project to analyze U.S. Bureau of Economic Analysis data, State of Nevada Department of Employment, Training, and Rehabilitation data, and State of Nevada Taxation data.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Human and Family Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
802	Human Development and Family Well-Being	60%		0%	
806	Youth Development	40%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	0.0	0.0
Actual Paid	9.1	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
490117	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
490117	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
490117	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Nevada Agricultural Experiment Station is not involved in this NIFA theme.

Nevada Cooperative Extension offered the following programs related to Human and Family Development in 2015: 4-H throughout the state; Heart and Shield: A Program to End Family Violence ; Keeping Kids Safe: Recognizing, Reporting and Responding to Child Maltreatment; Healthy Eating Active Living Mapping attributes using participatory photographic surveys (HEAL MAPPs); Stress Less with Mindfulness; Project MAGIC (Making a Group and Individual Commitment); Yerington Paiute Tribe Maternal, infant and early childhood visiting (MIECHV) Program ; Nevada Youth Range Camp; Youth and Families with Promise; Gear-up with STEM emphasis; Family Storyteller; Little Books and Little Cooks; Read By Grade 3; and Striving Readers.
These programs support:

- research with respect to human and family development issues.
- development of research-based, peer-reviewed curricula and journal articles in support of programs.
- the positive development of at risk youth and young adults through the use of Nevada's Nationally Recognized Evidence-Based Programs, Bootstraps and Project Magic.
- Teaching parents of pre-school and elementary school youth how to increase family literacy.
- 4-H STEM programs to help prepare Nevada youth for success in secondary and post-secondary education and STEM careers.
- Incorporating STEM components into UNCE Nevada GEAR UP program.
- Training professional caregivers the skills necessary to provide safe, positive environments for children.
- Recruiting, screening, and training adult volunteers to work effectively with youth.

2. Brief description of the target audience

Target audiences include youth, young adults, parents/families, childcare providers, and other youth/family professionals. Target audiences also include at -risk families, including military families and seniors.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	33155	0	123877	0

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	4	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of youth, families, and professionals who gain knowledge about positive human and family development.
2	Number of youth, families, and professionals who implement positive human and family development behaviors.

Outcome #1

1. Outcome Measures

Number of youth, families, and professionals who gain knowledge about positive human and family development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Community situational analysis and published findings revealed that the residents in some rural counties rated historical performance of Extension for meeting the educational and research needs as mediocre. The Heart and Shield program helps parents and children exposed to domestic violence strengthen social and emotional skills and prevent the cycle of violence from repeating in future generations. The 4-H program in rural areas throughout the state has been based on agriculture and traditional project areas with little emphasis on project areas that might engage new audiences. More collaboration with other youth-serving organizations could enhance Nevada's 4-H program, reach more youth, and 4-H could provide curriculum and other evidence-based resources to youth workers and programs that need more information on positive youth development. With more emphasis on advanced manufacturing and the need for youth to have firm foundation in science, technology, engineering and mathematics (STEM) education, county 4-H programs need more emphasis on hands-on STEAM (STEM + arts) ts.

What has been done
Extension Educators in rural counties determined that a traditional approach to information dissemination would be the best way to reach county residents. This involves articles local and regional newspapers, and radio broadcasts. The grant-funded Heart and Shield program provides an educational program for former domestic violence victims and their children. The Heart and Shield program, addresses three main components: 1) direct education and non-crisis intervention for children and families who have experienced domestic violence (DV), to promote resiliency and strengthen positive future relationships, 2) educate community members and leaders about the impact of DV and create a supportive community in which DV is not tolerated, 3) develop an on-line law enforcement DV training that addresses the dynamics of DV from the 911 call to successful prosecution. The direct education and non-crisis intervention component provides a 12-week education program for children, youth and parents and a monthly family activity to foster attachment and bonding among family members.

Results
Nevada Cooperative Extension's MAGIC program held training sessions for out-of-state participants interested in replicating the program. The program taught and supported MAGIC instructors who in turn reached out to 290 juvenile offenders and parents for the 20-hour youth program and 12-hour parent program. My instructors taught a total of 15 youth groups of 20 sessions each group. Each session is 1.5 hours for the 154 youth resulting in 3,080 youth contacts. They taught 14 parent groups of 4 sessions each group. Each parent session of 2.5 hours each for 136 parents resulted in 544 parent contacts.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of youth, families, and professionals who implement positive human and family development behaviors.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The 4-H program in many rural counties has been based on agriculture and traditional project areas with little emphasis on project areas that might engage new audiences. More collaboration with other youth-serving organizations could enhance our program, reach more youth, and 4-H could provide curriculum and other evidence-based resources to youth workers and programs that need more information on positive youth development. With more emphasis on advanced manufacturing and the need for youth to have firm foundation in STEM education, the Elko County 4-H program needs more emphasis on hands-on STEAM projects. Needs assessments in some rural counties have indicated that domestic violence (DV) prevention is a high-priority issue for county residents. Nevada ranked number one in the nation in the rate of women killed by men in single victim/single offender homicides. Self-regulation skills such as emotional awareness, anger management, stress management and coping skills, problem solving skills can improve the

well-being of children exposed to domestic violence. Strong evidence links parenting competencies such as parental acceptance and responsiveness, maternal warmth, strong parent-child bonds and emotional support to positive outcomes for children exposed to DV. The positive outcomes for children include decreasing the risk of antisocial behavior, lowering the likelihood of running away and teen pregnancy while improving relationships between children and mothers. The Family Storyteller program targets those families with infants, preschoolers and beginning readers who may have limited language skills and few children's books at home. The program is based on a family literacy framework that focuses on both children and parents.

What has been done

The Family Storyteller program targets those families with infants, preschoolers and beginning readers who may have limited language skills and few children's books at home. The program is based on a family literacy framework that focuses on both children and parents. The Family Storyteller program includes six weekly sessions during which families: discuss key parent/child reading techniques; watch a video that models the techniques; practice reading; learning about extender activities that enhance the value of the reading; and receive a free book and materials to complete the extender activities at home. Carefully selected books are featured in the project and provide the cornerstone for children's emerging literacy and academic skills. The Heart and Shield program is designed to provide direct education to domestic violence survivors and their children over the course of 12 weeks, meeting once each week for two hours. Additionally, families attend an orientation meeting prior to the first session.

Results

The Cuentos en familia grant project has two main evaluation goals. First, parents who participate in the program will enact proven, essential book reading strategies to improve their children?s literacy, language, and learning skills. Parents made statistically significant gains (paired t-tests, $p < .001$) on all 12 of the essential strategies, such as using expression during the read, pointing to pictures and words, asking expansive questions about the story, and building vocabulary. The second evaluation goal is that children who participate in the program will increase time engaged in literacy and learning activities as measured by reported use of the take-home literacy activities. Parents engaged children in an average of 13.4 (83.8%) of the suggested literacy and language activities in the home during the course of the sessions. Across all 387 families that works out to a total of 5,186 parent-children literacy and language activities that otherwise likely would not have been done at home. In other words, children were engaged in nearly 5,200 individual literacy lessons they likely would not have engage in. Also, on a scale from 1 (very little) to 5 (very much), by the end of the series of sessions parents reported feeling confident they could use the skills they learned in the workshops to teach their children ($M = 4.74$), confident that they could help their children succeed in school ($M = 4.71$), prepared to help their children learn ($M = 4.51$), and believed that their children could learn from them ($M = 4.74$). Evaluation of Family Storyteller: From the Beginning workshops in Las Vegas revealed that parents showed a statistically significant improvement (paired sample t-tests) in their knowledge of critical skills in reading with babies and toddlers ($p < .05$): hold baby/toddler close to see book; show front and back of book; point to pictures; ask toddler what picture is; say right word; get baby/toddler's attention; follow baby/toddler's lead; answer baby/toddler's questions; let baby/toddler help turn pages; copy action in books. Pre- and post-test paired sample t-tests found statistically significant increases in number of days reading to children ($t = 2.69$, $p < .05$) and number of picture books at home for children's use ($t = 2.28$, $p < .05$).

4. Associated Knowledge Areas

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

806 Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Grant funding availability)

Brief Explanation

Nevada is recovering from economic recession at a slow rate and fluctuations in energy and extractive mineral prices could have an important effect on inward and outward migration to Nevada. We anticipate that the proportion of Hispanics in the metropolitan Clark County area will be at least 50% of the population by 2020, necessitating language skills and cross cultural training.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nevada Cooperative Extension held Training sessions for out-of-state participants interested in replicating the program. This included the MAGIC instructors who in turn reached out to 290 juvenile offenders and parents for the 20-hour youth program and 12-hour parent program we offer. Nevada Cooperative Extension MAGIC instructors taught a total of 15 youth groups of 20 sessions each group. Each session is 1.5 hours for the 154 youth resulting in 3,080 youth contacts. They taught 14 parent groups of 4 sessions each group. Each parent session of 2.5 hours each for 136 parents resulted in 544 parent contacts. Participants in 4-H training programs indicated positive changes in knowledge and understanding within these training sessions. Nevada Cooperative Extension also documented positive changes in knowledge and understanding among participants in the Heart and Shield trainings.
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Key Items of Evaluation

Nothing to report.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

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