2014 University of Nevada Research Annual Report of Accomplishments and Results

I. Report Overview

1. Executive Summary

The Nevada Agricultural Experiment Station (NAES) 2014 annual report will focus on select program impacts which reflect unique benefits to a diversity of clientele and stakeholders in Nevada.

The 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, the NAES priority 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 state funding. In 2013-2014, 1.39 million dollars in state appropriations were leveraged by faculty to generate 2.45 million dollars in external fund expenditures.

The research programs address the five thematic areas defined by NIFA, as well as two additional areas defined by Nevada's stakeholders as critical to Nevada and the Western United States. The overarching goals of the NAES include:

Global Food Security - Agricultural Production in a Semi-Arid Environment
This program takes into account the fact that Nevada has a semi-arid to arid climate. NAES research efforts have been directed towards improving stress tolerance (cold, heat and drought) in plants, evaluating cultivars and clones, assessing new technologies to be used in the greenhouse industry, exploring alternative finishing diets for swine, and improving the nutritional value of certain alternative crops.

Animals and Their Systems
Research activities included investigation into cattle health and disease; safeguarding the survival of endangered/threatened species; the decline of mule deer in Nevada; wildlife guzzler effects on survival and recruitment of Nevada's ungulate populations; identifying Nevada bighorn sheep diseases across the genetic landscape; and impact of agrochemical and environmental contaminants on avian species.

Natural Resource Management & Environmental Sciences in the Great Basin & Sierran Ecosystems
To address these critical issues, NAES research focused on evaluating long term vegetation changes in the Great Basin; protecting forests through the use of insect pheromone biochemistry; evaluating livestock grazing for weed management; compatibility of wildlife and livestock grazing; evaluating post wildland fire restoration and grazing systems; gauging forest wildfires and ecosystems recovery; studying soil transport properties on burned soils; and mechanims by which plants plants might be used to restore salt-laden soils.

Nutrition and Health
Our goals are to conduct research to better understand healthy life style habits, and to build educational programs that focus on healthy life style habits. NAES research is focusing on the role of nutrition in determining triglycerides levels and potential for cancer, the beneficial effects of functional foods on health and nutrition, and factors promoting regional diseases like relapsing fever.

Economic Development with Emphasis in Rural Areas
Nevada economists have continued to conduct economic analyses of various rural labor and public policy issues, while fostering economic development through the University's Center for Economic Development. Non-market evaluations on Nevada natural resources were performed to improve risk-management for land owners and to reduce damage to Great Basin/Sierran ecosystems.

Sustainable Energy
Investigations focused on Nevada's highly prolific rabbit brush as a good candidate for production of industrial products (i.e., rubber, plastics, coatings, lubricants and adhesives) and energy feedstock (i.e. biodiesel and cellulosic-based liquid fuels). Camelina, curly top gumweed, and prickly pear cactus are also being evaluated as alternative crops for biofuel and other plant-derived products.

The research program and facilities of NAES provide the foundation for graduate training activities and undergraduate research opportunities in Agricultural Science, Biochemistry and Molecular Biology, Biotechnology, Natural Resources and Environmental Sciences, Nutrition, Rangeland & Forestry Management, and Veterinary Science.

Through an outreach program involving town hall meetings, rural tours, impact reporting, news releases, web-based reporting of research progress, pamphlets, booklets and a directed advisory committee, the progress of the NAES research program is communicated with stakeholders on a regular basis and feedback is obtained to provide direction to future research projects.

Some of this year's highlights include:

Global Food Security

   1. Increasing vitamin B1 (thiamine) content in the model plant Arabidopsis and transferring this and other traits into new germplasm derived from Camelina.
   2. In wine grapes, the development of a rapid dehydration assay that provides a simple and reliable way of phenotyping plant responses to water loss.
   3. Evaluations of commercial hydroponic nutrient solutions revealed that using as little as 25% of the manufacturer suggested amounts is as effective on plant growth as using 100%.

Animals and Their Systems

   1. A program has been set up to advise homeowners on how to reduce their exposure to Relapsing Fever.
   2. Foothill Abortion vaccine trials have been approved by the USDA to include an additional 2,000 head of cattle.
   3. An alternative forage for range cattle (Forage Kochia) has been shown to function as well as alfalfa and orchard grass in providing several key nutrients and crude protein.
   4. Migratory birds' exposure to neurotoxic compounds levels has been shown to be much lower than current EPA LD50's.

Natural Resources and Environmental Science

1. The USDA Agricultural Research Service is now taking into account important root traits identified by NAES-sponsored research that improve seedling establishment and survival for reseeding disturbed lands in the Great Basin.

2. A long-term study on Sierran forest recovery is being used by the USFS for environmental assessments and environmental impact statement reports, while the Lake Tahoe Basin Management Unit and the Nevada Division of Forestry are using the data for projected fuel loads.

Economic Development

1. A ranch simulation model to derive financially acceptable practices was developed for different trichomoniasis management scenarios.

2. Another ranch simulation model was developed to estimates the probability of financial survivability of a ranch affected by public land closures to grazing, e.g. due to the endangered species act, drought, or fire.

Sustainable Energy

1. Gumweed propagation protocols have been improved to achieve 85% survival.

2. Varietal trials on Camelina have found three likely candidates best-suited to northern Nevada.

3. In dealing with the polyploidy nature of prickly pear cactus, methods for creating very high quality transcriptome assemblies were devised.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	19.0	0.0
Actual	0.0	0.0	7.1	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

2. Brief Explanation

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
- Targeted invitation to selected individuals from general public
- Other (Conduct field days at our field stations across the state)

Brief explanation.

We have and will continue to conduct tours throughout the state for the purpose of obtaining stakeholder input. During these tours we invite participants to town hall meetings through general press coverage in the local newspapers, and we invite stakeholder groups and individuals through personal contact (i.e., email, telephone, direct mailings, and social media) to attend.

An advisory board has been established to counsel NAES 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.

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
- Open Listening Sessions
- Needs Assessments
- Other (Informal discussions with key stakeholders)

Brief explanation.

We currently have a broadly based NAES/CABNR 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.

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
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Meeting specifically with non-traditional groups
- Other (Conduct Field Lab Day for stakeholders and meet with Cooperative Extension to coordinate input)

Brief explanation.

In development and strategic planning of NAES 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 UNCE administrators, specialists and educators.

NAES 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.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

Information collected from stakeholders was used to adjust issue areas that are influencing NAES'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.

NAES 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.

Brief Explanation of what you learned from your Stakeholders

Inputs from stakeholders confirmed that the following issues were still of critical concern:

1. Development of alternative crops such as grapes, hops, teff, Camelina, and prickly-pear cactus
2. Reducing investment risk in hoop house/greenhouse industry
3. Water quality and quantity
4. Invasive species and biosecurity
5. Rural development and ranch production
6. Development of bioenergy opportunities especially for small farming systems

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	1574808	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	1484938	0
Actual Matching	0	0	1414758	0
Actual All Other	0	0	0	0
Total Actual Expended	0	0	2899696	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	548796	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger - Agricultural Production in a Semi-Arid Environment
2	Animals and their Systems
3	Natural Resource Management and Environmental Sciences in the Great Basin and Sierran
4	Nutrition and Health
5	Economic Development with Emphasis in Rural Areas
6	Sustainable Energy
7	Food Safety
8	Childhood Obesity
9	Climate Change

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger - Agricultural Production in a Semi-Arid Environment

☑ 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			25%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			38%	
206	Basic Plant Biology			14%	
502	New and Improved Food Products			5%	
504	Home and Commercial Food Service			2%	
511	New and Improved Non-Food Products and Processes			13%	
701	Nutrient Composition of Food			3%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	1.5	0.0
Actual Paid	0.0	0.0	2.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	264049	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	247981	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

Engineering Plants for Increased Nutrition and Improved Stress Tolerance
This year significant progress has been made in engineering thiamine production in the model plant Arabidopsis. The team engineered Arabidopsis seed with >8 fold increase in seed thiamine continent. Improved seed mass of thiamine enriched plants by 25% over wild types, increased seed oil continent by 10%, increased carbohydrates by 30%, and proved to be more tolerant to paraquate and salt induced oxidative stress. The team has now moved on to engineering the thiamine biosynthetic pathway into Camelina seeds.

Improving the Seed Set Yield of Plants under Heat, Cold and Drought Stress
Scientists at UNR have made significant progress in three areas of stress. The team tested whether stress tolerance can be improved by expressing two different transcription factors that regulate stress responses in vegetative tissues, but are not expressed in pollen. Secondly, they engineered CNGC16 (a cyclic nucleotide-gated channel, critical in stress tolerance of pollen) with mutations in its regulatory domain. Transgenic plants were made and tested for changes in pollen stress tolerance. And finally, transcriptome profiling was used to identify temperature-dependent changes in gene expression that occur in pollen. The team then performed RNA-sequencing analyses for pollen grains harvested from wild type Arabidopsis plants (and CNGC16 mutants), and two tomato cultivars (one being heat tolerant) under control and heat stress conditions.

Enhancing Cell Wall Digestibility To Increase The Productivity Of Biomass And Forage Feedstocks.
A new line of research was started this year with the addition of Dr. Ian Wallace. Wallace's lab has been busy gathering Opuntia (prickly pear cactus) pads for characterization of cell wall sugar composition and enzymatic deconstruction of lignocellulosic biomass using a fungus model. The team has genotyped Arabidopsis REF8 knockout lines to ensure that they are true mutants, and are currently growing mutants for preliminary phenotypic characterization as well as seed bulking for EMS mutagenesis. Additionally, the team has determined that alfalfa is sensitive to isoxaben.

Evaluation of Wine Grape Cultivars and Clones
Screening for genotype variation involved in water use efficiency were conducted on 13 varieties of wine grapes. From this massive undertaking one region was of the genome was discovered (NCED1) and sequenced. A rapid dehydration assay was developed that provides a simple and reliable way of phenotyping plant responses to water loss. Stomatal responses were then tested among known drought-tolerant varieties and compared to field trials.

Research was conducted to determine transcriptomics responses (the complete set of RNA transcripts

that are produced by the genome, under specific circumstances) to dehydration of mature leaves of three varying drought tolerant genotypes.

The plant hormone abscisic acid was investigated to determine how it regulates various developmental process and stress responses over short time frames (i.e. hours). In order to understand the transcriptional regulatory, different organs of grape (berries, shoot tips, leaves, roots and cell cultures) were studied. Whole genome microarrays for genes of grape vines were used to determine the effects of ABA on organ-specific mRNA expression patterns. The biochemical pathways affected by ABA were analyzed using the Cytoscape program with the BiNGO plug-in software.

Hydroponics impact on Content of Bioactive Compounds
Work was conducted to determine whether culinary greens can be successfully grown using continuous flow systems (hydroponics) with varying levels of nutrients. Scientists examined the difference in yield at high, medium, and low levels of commercial hydroponic nutrient solutions in order to optimize the cost-benefit relationship in the growth of leafy greens. The team also determined the feasibility of an "organic" self-prepared nutrient solution for leafy green growth.

Optimizing High Desert Hoophouses
During the first year of this project, four hoophouse were construction and instrumentation. Though originally planned for year two, two warm season crops were planted. Production potential and efficiency were determined using soil water saturation when grown in an average humidity of 49.8%.

2. Brief description of the target audience

The scientific community, agriculture producers, local organizations, backyard hobbyists, as well as students taking classes or participating in research activities.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	765	0	200	0

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

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	7	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

● Peer reviewed journal articles, chapters, or books

Year	Actual
2014	9

Output #2

Output Measure

● Non-peer reviewed publications

Year	Actual
2014	2

Output #3

Output Measure

● Presentations

Year	Actual
2014	44

Output #4

Output Measure

● Demonstrations and workshops conducted

Year	Actual
2014	6

Output #5

Output Measure

● Leveraged research funds

Year	Actual

2014	652415

Output #6

Output Measure

● Web sites created or updated

Year	Actual
2014	1

Output #7

Output Measure

● Number of graduate students and post-doctorates trained

Year	Actual
2014	7

Output #8

Output Measure

● Number of undergraduate students involved in research program

Year	Actual
2014	30

Output #9

Output Measure

● Databases, Models, Protocols, and Research Materials

Year	Actual
2014	1

Output #10

Output Measure

● New Germplasm

Year	Actual
2014	1

V(G). State Defined Outcomes

	V. State Defined Outcomes Table of Content	
O. No.	**OUTCOME NAME**	
1	New fundamental or Applied knowledge	
2	Improved skills of students, post-doctorate, and stakeholders	
3	New or improved methods	
4	Adopt and use new methods or improved technology	
5	Greater productivity in food provisions	
6	Increase economic competitiveness	
7	Adopt new improved skills	
8	Apply improved fundamental or applied knowledge	
9	Increasing Seed Set Yields in Stressed Plants	
10	Urban Hydroponic Fruit And Vegetable Production: Optimizing Nutrient Solutions	
11	Engineering Plants For Increased Nutrition And Increased Stress Tolerance	

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

New or improved methods

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Adopt and use new methods or improved technology

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Greater productivity in food provisions

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increase economic competitiveness

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Adopt new improved skills

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Apply improved fundamental or applied knowledge

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Increasing Seed Set Yields in Stressed Plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Each year crop yields are severely impacted by a variety of stress conditions, including heat, cold, drought, hypoxia, and salt. Reproductive development in flowering plants is 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 on developing two strategies to improve stress tolerance in pollen production.

What has been done
In the past year, NAES scientists tested whether stress tolerance can be improved by expressing two different transcription factors that regulate stress responses in vegetative tissues, but are not expressed in pollen. Cyclic nucleotide-gated channels (CNGC16) plants were made (transgenics) and tested for changes in pollen stress tolerance. Finally, profiling sets of RNA molecules to identify temperature-dependent changes in gene expression that occur in pollen. The team performed RNA-sequencing analyses for pollen grains harvested from wild type Arabidopsis plants (and CNGC16 mutants), and two tomato cultivars (one being heat tolerant) under control and heat stress conditions.

Results
NAES scientists in collaboration with an Italian lab, produced work that provides biochemical evidence to establish the auto-inhibited Ca^{2+}-ATPases (ACA12) as the first example of an ACA-type calcium pump that appears to be constitutively active.

The discovery that knocking out an enzyme involved in cell wall functioning (TBL14) has provided the first genetic evidence that links a specific calcium signaling pathway with the function of a specific protein involved in plant cell wall biogenesis.

NAES scientists obtained genetic evidence that the complete loss plasma membrane calcium pumps is not lethal to the model plant Arabidopsis, but does result in a phenotype in which the plant fails to bolt and produce reproductive structures.

Finally, the team uncovered genetic evidence that increased stress tolerance can be obtained by expression of a galactinol synthase gene. This research has provided preliminary evidence that will allow scientists to manipulate the complete set of small-molecule chemicals found within pollen to improve reproductive fitness under stress conditions.

4. **Associated Knowledge Areas**

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

Outcome #10

1. **Outcome Measures**

Urban Hydroponic Fruit And Vegetable Production: Optimizing Nutrient Solutions

2. **Associated Institution Types**

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Greenhouse agriculture has the potential for improving yield and vegetable quality in sub-optimal environments. Despite increased frequency of greenhouse vegetable production, basic information on optimal nutrient growing solutions and other environment factors for production of commercial vegetables is lacking. Nutrient and fertilizer delivery is a high-cost component to production, especially in hydroponic systems which often use proprietary blends of chemical fertilizers. Organic fertilizers are gaining in popularity, but need to be standardized and tested in hydroponic systems before they are widely used.

What has been done
Hydroponic systems were manipulated to investigate the influence of aqueous media on vegetable production. In this research, the team tested the feasibility of using low levels of commercial (General Hydroponics Flora series) nutrients on green leafy vegetable production. In subsequent tests, the team created an organic nutrient solution and compared the yield to both the high and low level conventional nutrient treatments.

Results
NAES scientists determined that regardless of level of commercial hydroponic nutrient solutions - 1,200 (manufacture recommendation), 600, 400, and 300 ppm - leafy greens growth was similar. Producers could reduce their nutrient input cost by 25% and should still see normal growth in both bok choy and lettuce.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
701	Nutrient Composition of Food

Outcome #11

1. Outcome Measures

Engineering Plants For Increased Nutrition And Increased Stress Tolerance

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Thiamin (Vitamin B1) is an essential plant derived nutrient in human and animal diets. While not limiting in typical Western diets, thiamin deficiencies are common in developing countries where people subsist on diets consisting primarily of polished grains and seed products. By increasing thiamin levels in the seeds of important subsistence crop species such as rice and wheat, we can make a positive impact on human nutrition and global food security.

What has been done
Using standard molecular biology techniques, the open reading frames corresponding to the Arabidopsis enzymes (HET-P synthase, HMP-PP synthase and TMPPase), complementary DNA sequences were sub-cloned behind the rapeseed's napin and oleosin promoters, and the soybean glycinin promoter, respectively. Mature seed from each line were analyzed for seed thiamin content using reverse phase HPLC. The team obtained a cDNA clone corresponding to the sesame seed thiamin binding protein and created constructs that were transferred into first Arabidopsis and then into Camelina. To assess stress tolerance in the transgenic plants with elevated seed thiamin, the team used the highly sensitive root growth assay developed for Arabidopsis in an earlier NAES HATCH project.

Results
This year significant progress has been made in engineering thiamine production in the model plant Arabidopsis. The team engineered Arabidopsis seed with 8+ fold increase in seed thiamine continent. Improved seed mass of thiamine enriched plants by 25% over wild types, increased seed oil continent by 10%, increased carbohydrates by 30%, and proved to be more tolerant to paraquate and salt induced oxidative stress. Finally, the team has genetically engineered False Flax (Camelina sativa) with three thiamine biosynthetic genes cloned behind seed specific promoters.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
502	New and Improved Food Products
701	Nutrient Composition of Food

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

The Experiment Station is still recovering from the 31 hard money positions lost after the 2010 circulation review. Until a number of critical areas are re-staffed the agricultural program will be severely hampered. Nevada annual average precipitation continues to decline, with past winter 6% of average surpassing the 1970's record. Work on the protective properties of abscisic acid on grape's tolerance to cold was completely ineffective, so research will now look at dehydrational effects on cold tolerance. The optimizing hoop house project has been impeded due to graduate student departure from the program during last year.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Significant progress was made in the development of improved thiamine production in the model plant Arabidopsis. The team engineered Arabidopsis seed with a greater than 8 fold increase in seed thiamine continent. Improved seed mass of thiamine enriched plants by 25% over wild types, increased seed oil continent by 10%, increased carbohydrates by 30%, and engineered plants proved to be more tolerant to the herbicide paraquate and salt induced oxidative stress.

A rapid dehydration assay was developed that provides a simple and reliable way of phenotyping wine grape vines responses to water loss. Our varietal trials continue to produce cultivars with higher drought tolerance and lower demands for water inputs.

Commercial hydroponic nutrient solutions were shown to yield similar vegetative growth regardless of dilution levels.

Our forage biochemists have determined that Medicago truncatula (clover-like legume) is sensitive to herbicide isoxaben used in vineyards and orchards.

Key Items of Evaluation

- Three journal articles were published on grapevine responses to dehydration.
- One journal article was published on dilution effects of commercial nutrient solutions on the hydroponically grown vegetables.
- A new germplasm was genetically engineered with three thiamine biosynthetic genes

V(A). Planned Program (Summary)

Program # 2
1. Name of the Planned Program

Animals and their Systems

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
121	Management of Range Resources			10%	
135	Aquatic and Terrestrial Wildlife			42%	
136	Conservation of Biological Diversity			24%	
301	Reproductive Performance of Animals			2%	
302	Nutrient Utilization in Animals			13%	
307	Animal Management Systems			2%	
311	Animal Diseases			5%	
722	Zoonotic Diseases and Parasites Affecting Humans			2%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	2.5	0.0
Actual Paid	0.0	0.0	6.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	325722	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	300658	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

Epizootic Bovine Abortion Immunity Responses Longevity Trials
Over the past year, the team has been developing and validating an indirect fluorescent antibody test for determining exposure to the EBA. The expectation is this test will serve as a useful tool in the management of this disease. The serology assay is rapid, reproducible, and unaffected by fluid color or opacity. Total fetal immunoglobulin (antibody) was also evaluated as an aid for diagnosing EBA. The presence of IgG is a sensitive indicator of EBA and increases the specificity of serologic diagnosis when concentration of antibodies found in the animal are between 10 or 100. Taken together, serology and IgG analyses suggest that the incidence of EBA may be underestimated.

Understanding the Role of Animals in Maintaining and Transmitting Relasping Fever in Humans
UNR scientists in collaboration with Northern Arizona University, ran 284 microsatellites sequenced on 11 genes of Eastern Sierras chipmunks. Simulations were put through analysis of subpopulation structure through the program STRUCTURE, and Structure harvester. Model selection was then preformed within and between simulations and a single model was chosen to represent the results.

Analysis to pick up subpopulation structure in the sites separated on the basis of domestic versus wild habitat type suggests that while domestic sites may experience greater rates of migration, they do represent detectable subpopulations especially in comparison with the surrounding areas. Since the tick vectors for relapse fever stay at their nest or birthplace for a long time after birth, these locations may act as the focal point from which infection spreads to the surrounding areas. This could be the most important finding of this analysis due to its implications with public heath, and mitigation strategies to curb, or prevent spillover events from the wild population.

Rangeland Management Problems Associated With Cattle Foraging On Forage Kochia
This project has moved from focusing on the range science aspects of Forage Kochia as a viable forage to the animal nutrition laboratories of UNR. Two concurrent projects were conducted to clarify National Animal Nutrition Programs' Nutritional Requirements (2000) nutrient values of Forage Kochia in the Great Basin. A dual-flow continuous culture system was used to determine dry matter, organic matter, neutral detergent fiber, acid detergent fiber, ether extract, ash, fatty acids, and bacterial purines.

The second project utilized cannulated cattle to obtain omasal true digesta. Analyzes for total nitrogen, absolute dry matter, ash, organic matter, neutral detergent fiber, acid detergent fiber, neutral detergent insoluble nitrogen, and acid detergent insoluble nitrogen were conducted on feed samples as determined by prior In Vitro studies.

Alternative Production Systems: Growing-Finishing Swine Northern Nevada Pastures
A growing interest in small farm swine production has led to the Experiment Station investigating cost effective methods to raise and finish hogs. Over the past year, Main Station Field Lab has improved its infrastructure to accommodate swine production. Animals were purchased, pins, sheds, and fencing have been installed. Feeding trials will begin spring of 2015.

Genetic Landscape of Big Horn Sheep Diseases
NAES scientists in collaboration with the Nevada Department of Wildlife have all genetic samples in hand and have developed collaborations and protocols for genotype-by-sequencing approaches to be used in this project. Analysis of the correlation of genetic diversity and population connectivity with disease prevalence was started using high-throughput sequencing and will continue into the spring 2015.

Impacts of Cattle and Feral Horses on Sage Grouse Survival
At the conclusion of the 2014 season, UNR's research team has marked a total of 843 sage-grouse. With data thus far, a multitude of population models have been designed (+2,800), used in predicting survival rates of adults, juveniles, chicks, and eggs. Vegetation models were also constructed using nest-side samples (+240) and random plots (+360) to determine favored nest site selection on part of the parents.

Land Use Practices and Climate Change Effects on Mule Deer Populations
Over the past year, NAES wildlife scientists have radio-collared approximately 600 mule deer distributed across several study areas throughout Nevada to monitor and determine causative agents for declines in mule deer populations related to nutrition, environmental conditions, habitat use, migration, dispersal, and predation in adult and juvenile mule deer. The team has collected nutritional information on 500+ mule deer in 3 major study areas across the state. They continue to collect fine-scale movement data on 300+ adult mule deer. Energetics modeling have been developed and await final acquisition of GPS collar information. Finally the team continues to monitor and quantify predation and other related causes of mule deer population declines of 135 mortality events during 2013 and 2014.

Bovine Viral Diarrhea Virus in Free-Ranging Population of Ungulates
To determine the effect of BVDV infections in mule deer in regard to reproductive failures, fawn mortalities and herd recruitment, NAES scientists are still processing sample for analysis of glucocorticoid levels (a response to the immune system). Scientists have quantified bacteria killing ability and hemolytic complement activity, and are currently testing for two antibody levels (IgM & IgG) in deer serum. Finally, the team has begun analyzing samples for presence of BVDV in elk serum. Those samples are currently being processed for antibodies for BVD.

Effects of Provision Water on Juvenile Mule Deer's Survival and Recruitment
During 2014, NAES wildlife scientists captured 31 adult mule deer and 22 neonates and monitored those individuals for survival. The team also continued monitored adults collared the prior year (45) to understand selection of resources in three study areas within the Mojave National Preserve. Neonates were monitored intensively for the first three months and then weekly for the rest of the first six months when expandable collars dropped. Adults were monitored year around and any mortalities were collected and radio collard retrieved. Radio collars were programmed to drop off each individual adult in November 2014.

Impact Of Acute Non-Lethal Neurotoxic Compounds Exposure On Migratory Bird Species
In 2013, our scientists initiated studies to access the impact of methyl mercury on avian reproduction using the homing pigeon model (a surrogates for migratory birds). Findings were reported in 2014 for exposure at 1.0 mg/kg body wt/day. This year the team conducted a similar study at lower dosages in order to assess a dose-dependent response. They conducted reproductive studies at 0.5 mg MeHG/kg body wt/day, or half the dosage tested the previous year. New for this year was the inclusion of reproductive success and chick survival rates.

<u>Forage Evaluation Of Ephedrine Content And Nutritional Quality</u>
The primary goal of this study is to assist Nevada ranchers (especially sheep operations) in dealing with a rangeland management problem associated with domestic livestock foraging on Ephedra species. Planning efforts were completed with the first sample period beginning in December 2014.

2. Brief description of the target audience

Target audiences include US Fish & Wildlife Services, Nevada Department of Wildlife, sport hunters, livestock owners, local residents, numerous wildlife oriented NGOs, land-use planning agencies, and the scientific community in general.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	130	0	0	0

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

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	9	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Demonstrations, Field Days, and Workshops Conducted

Year	Actual
2014	3

Output #2

Output Measure

● Newsletters Produced

Year	Actual
2014	1

Output #3

Output Measure

● Leveraged Research Projects

Year	Actual
2014	690212

Output #4

Output Measure

● Web Sites Created or Updated

Year	Actual
2014	2

Output #5

Output Measure

● Manuals and Other Printed Instructional Materials Produced
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	6

Output #7

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	53

Output #8

Output Measure

● Peer reviewed journal articles, chapters, or books.

Year	Actual
2014	14

Output #9

Output Measure

● Non-peer reviewed publications

Year	Actual
2014	1

Output #10

Output Measure

● Presentations

Year	Actual
2014	41

Output #11

Output Measure

● Databases, Models, Protocols, and Research Materials

Year	Actual
2014	2808

V(G). State Defined Outcomes

	V. State Defined Outcomes Table of Content	
O. No.	**OUTCOME NAME**
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	New or improved methods
4	Adopt and use new methods or improved technology
5	Greater productivity in food provisions
6	Use new or improved animal varieties
7	Actively apply practical policy and decision-making knowledge
8	Testing a Vaccine for Epizootic Bovine Abortion (a.k.a. Foothill Abortion)
9	Rodents Role in Maintaining the Tick-Borne Disease "Relapsing Fever" in Nature
10	Impact of Low Level Mercury Exposure on Reproductive and Development in Birds
11	Quantifying Nutritional Values of Alternative Forages Found in Nevada

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

New or improved methods

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Adopt and use new methods or improved technology

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Greater productivity in food provisions

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Use new or improved animal varieties

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Actively apply practical policy and decision-making knowledge

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Testing a Vaccine for Epizootic Bovine Abortion (a.k.a. Foothill Abortion)

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Epizootic Bovine Abortion (EBA), commonly known as Foothill Abortion, is one of the major diseases responsible for reducing calf production on ranches in western and northern Nevada, California, southern Idaho and southern Oregon. Although infected pregnant cows do not show visible signs of illness, many of them abort their fetuses at six to nine months of gestation. A significant number of infected cows carry their calves to term, but the calves delivered are weak, fail to thrive and tend to die within the first weeks of independent life.

Following an abortion due to EBA, the effected cow appears to be refractory to subsequent abortion for an undetermined period. This protective immunity appears to wane unless the cows

are periodically re-infected by the tick vector. The purpose of this project is to determine the length of time that this immunity remains protective following an EBA induced abortion.

What has been done
NAES scientists, in collaboration with UC Davis, developed and validated an indirect fluorescent antibody test (iFAT) capable of detecting antibodies specific for the agent of EBA. Sensitivity and specificity were determined by comparing antibody titers from 114 fetuses infected with EBA with 68 fetuses diagnosed with alternate infectious set of causes. Total fetal immunoglobulin (Ig)G was also evaluated as an aid for diagnosing EBA.

Results
The iFAT-based serology assay is rapid, reproducible, and unaffected by fluid color or opacity. Data established specificity at 100% and sensitivity at 94.7% when cutoff criteria for a positive test were assigned at a concentration of greater than 1,000. The presence of immunoglobulin (Ig)G is a sensitive indicator of EBA and increases the specificity of FAT-based serologic diagnosis. Taken together, serology and (Ig)G analyses suggest that the incidence of EBA may be underestimated. Based upon these and other supporting data, the USDA has opened testing to include an addition 2,000 head of cattle from both Nevada and California.

The economic impact from one ranch participating in the vaccine trials (Quinn River Ranch, CA) has reported that naive heifer reproductive success was almost 100% (66 additional animals), up from a 60% loss prior to vaccination.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
311	Animal Diseases

Outcome #9

1. Outcome Measures

Rodents Role in Maintaining the Tick-Borne Disease "Relapsing Fever" in Nature

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Relapsing fever is a zoonotic disease described across the world in which human cases typically present as an undulating fever with many non-specific symptoms including headache, myalgia, and arthralgia. In the USA, tick-borne relapsing fever occurs throughout the mountainous west and southwestern deserts because of infection by spirochete bacteria found in soft tick, the transmission vector. Human infection risk is associated with rodent infestation of a home or cabin, especially after seasonal periods of vacancy. This study surveyed wild rodents infected with spirochetes (B. hermsii) around Big Bear Lake, southern California, identifying and genotyping the species of bacteria found in the hosts from this region.

What has been done

In 2014, 284 chipmunks from the Eastern Sierra Nevada Mountains had microsatellites sequenced at 11 diploid loci. The resulting data split into two simulations, one where only site locations was used, and one where the locations were separated on the habitat type nested with each site. Simulations were put through analysis of subpopulation structure through the program STRUCTURE, and Structure harvester. Model selection was then preformed within and between simulations and a single model was chosen to represent the results.

Results

Since the tick vectors for relapse fever stay at their nest or birthplace for a long time after birth, these locations may act as the focal point from which infection spreads to the surrounding areas. This could be the most important finding of this analysis due to its implications with public heath, and mitigation strategies to curb, or prevent spillover events from the wild population.

In Big Bear and Twin Lakes, California homeowner association meetings now invite NAES scientists to give annual updates on the prevalence of the disease in their area and ask questions on prevention. Through these meeting, a program was developed for homeowners that spells out what needs to be done when opening up homes and cabins after a winter closure. Since these efforts, outbreaks of the disease in these area have dropped to zero over the past year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
722	Zoonotic Diseases and Parasites Affecting Humans

Outcome #10

1. Outcome Measures

Impact of Low Level Mercury Exposure on Reproductive and Development in Birds

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The NAES team has developed a model which we believe is useful in testing whether low-dose exposure to environmental and agrochemical contaminants has an adverse effect on migratory birds. We use the homing pigeon as our avian model to determine the impact of various environmental and agrochemical exposures to migratory birds. Although a wide-ranging number of studies have detailed bioaccumulation and adverse effects on avian physiology and reproduction, the effect of non-lethal, low-dose exposures has not conversely been studied at length.

NAES's prior work has shown that at low methylmercury concentrations, flight times of homing pigeons from a particular distance are greatly affected. For the purposes of this study, the project assess effects on reproduction and development at levels lower than those that may cause behavioral abnormalities in adults.

What has been done
In 2013, assessment of the impact of methyl mercury on avian reproduction using the homing pigeon as our model. Findings were reported for exposure at 1.0 mg/kg body wt/day. For 2014 the team conducted a similar studies at lower dosages in order to assess a dose-dependent response (0.5 mg MeHG/kg body wt/day), or ½ the dosage tested the previous year.

Results
The results of this research indicate that even at significantly lower exposure levels to methyl mercury offspring were taking longer to fledge and were overweight. These findings have now been appended to the national models. The Avian Model developed here at the University of Nevada, as well as the information collected on environmental contaminants' effects on birds has now been incorporated into the US Department of Interior's Natural Resource Damage Assessment and Restoration Programs as it relates to migratory birds. The US Fish and Wildlife Service has also included our avian model into their assessments of avian toxicology related to the Deepwater Horizon oil spill.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

| 301 | Reproductive Performance of Animals |
| 311 | Animal Diseases |

Outcome #11

1. Outcome Measures

Quantifying Nutritional Values of Alternative Forages Found in Nevada

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nutritional management affects beef cattle growth, reproductive performance, and health. In order to feed animals to meet their nutritional needs it is critical to know the nutritional value of plants. Information on the nutritional value of some specific plant species found in the state of Nevada such as kochia, cheatgrass, coyote willow, crested wheatgrass, meadow brome, and Great Basin wild rye are mostly inexistent in the scientific literature. The goal of this project was to characterize the nutritional value of plants commonly found in the state of Nevada that may have potential as feed for beef cattle.

What has been done
Two concurrent projects were conducted to clarify National Animal Nutrition Programs? Nutritional Requirements (2000) nutrient values of Forage Kochia in the Great Basin. Using both plastic cow stomachs (dual-flow continuous culture systems) in the lab and cannulated cattle in the field, NAES scientists evaluated the nutritional value of a common perennial shrub Forage Kochia. Samples were analyzed to determine dry matter, organic matter, neutral detergent fiber, acid detergent fiber, ether extract, ash, fatty acids, and bacterial purines.

Results
The alternative forage for range cattle (Forage Kochia) has been shown to function equally in eight key nutrient values as alfalfa and orchard grass. Also, crude protein levels are equal to or greater (winter season) than most available grasses found on the range. Forage kochia has proven to be an adapted, highly palatable forage species for livestock and wildlife. It is competitive with cheatgrass and much more fire resistant. With all things considered, forage kochia deserves greater use when seeding Nevada rangelands, especially localized areas in which conventional forages may not grow well.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
302	Nutrient Utilization in Animals

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities

Brief Explanation

As mentioned earlier, the Experiment Station is still recovering from the 31 hard money positions lost after the 2010 circulation review. Until a number of critical areas are re-staffed the animal science program will be severely hampered. Nevada annual average precipitation continues to decline, with the past three winters scoring some of the driest on record. Without adequate water supplies the competition between livestock and wildlife for resources could prove to be deadly.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Assessment of a fluorescent antibody test for the detection of antibodies against epizootic bovine abortion has revealed that T Helper cells (regulate immune responses) are very important in clearing dames infected with EBA.

Results from relapse fever positive small mammal population structures analysis reveals important finding due to its implications with public heath, and mitigation strategies to curb, or prevent spillover events from the wild population.

Results from the forage kochia analysis has provide sufficient evidence that with addition of certain nutrient supplements, can be used as a primary forage source.

Work on sage grouse survival, with and without large herbivores (cattle and/or horses), has started to reveal a number of trends. The data has found that survival in general is lowest in the fall season and that highest survival rates are beginning to show correlations with areas that only have single species of mammals.

Our finding on migratory bird species exposure to non-lethal amounts of neurotoxic compounds indicate there are significant effects on homing, reproductive abilities, and the learning abilities of offspring in subsequent generations. These finds are based upon exposure levels far below the normal tests for acute toxicity in migratory birds.

Key Items of Evaluation

- A journal article was published on the detection of epizootic bovine abortion (EBA) using antibodies.
- Development of a serological assay for determining exposure to EBM
- An article on relapse fever was published in the Journal of Medical Entomology
- A microsatellite library was built for Sierra Nevada chipmunks for use in studying relapsing fever.
- Created protocol for pelletization of cheatgrass for use in forage analysis
- A database was constructed to hold sage grouse biometrics, nest success parameters, and habitat choices.
- Built a microsatellite dataset for the three species of Big Horn Sheep found in the Great Basin that provides full genomic coverage, disease status of genotyped individuals, and climate and environmental variables.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Natural Resource Management and Environmental Sciences in the Great Basin and Sierran Ecosystems

☑ 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			14%	
112	Watershed Protection and Management			4%	
121	Management of Range Resources			41%	
122	Management and Control of Forest and Range Fires			10%	
123	Management and Sustainability of Forest Resources			10%	
133	Pollution Prevention and Mitigation			10%	
211	Insects, Mites, and Other Arthropods Affecting Plants			10%	
216	Integrated Pest Management Systems			1%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	2.5	0.0
Actual Paid	0.0	0.0	5.0	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	404466	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	401324	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

Bark Beetle Management through Biochemistry - controlling invasive forest species.
Research efforts have been directed towards understanding hydrocarbon production in bark beetles' exoskeletons (shells) that eventually leads to desiccation and animal death. Over the past year, Cytochrome P4G55 and P4G56 were cloned, then fused together to create on long protein that serves as a fatty acid enzyme. This fused protein is now being expressed in Sf9 cells (a cell derived from Armyworms). The team continues to assay these genes for their ability to convert aldehydes to hydrocarbons. In addition, two fatty acid syntheases, one of which is believed to be involved and producing methyl branched fatty acids has been expressed and the team is in the process of assaying them.

A second research effort is working to better understand the biochemical mechanisms beetles use to detoxify turpentine resin found in pine forests. Mountain Pine Beetle (MPB) and Jeffrey Pine Beetle (JPB) are sister species that co-exist in the Sierra Nevada, but infest different host trees. Thus, they provide an excellent opportunity for comparative analysis. Genomic resources for MPB were completed in prior years. To date, JPB were collected and RNA was extracted and currently being analyzed using Illumina-base RNA-sequencer.

Testing Competitiveness of Native Plant Verses the Invasive Species Cheatgrass
Root characteristics are now the main focus of the project. The team has completed field data collection across five common garden sites (3 in NV, 1 in OR, 1 in ID), where they tested the performance of seeds from 25 wild populations in natural settings. The team screened each population for early-root growth characteristics by growing seedlings for 10 days in a greenhouse environment, and then assessed performance in natural settings. Data analysis is ongoing.

Application & Utility of the Ecological Site & Condition Concept for Monitioring Rangeland Ecological Status
This project is testing the vegetative response of post-burn plant communities to different grazing treatments at the disturbance response group level - that is, a level that is to scales relevant to land managers. The team has finished state and transition models for clay-pan and loamy ecological sites with the NRCS's Owyhee High Plateau (MLRA 25). Quantitative data collected from these ecological sites in 2013 and 2014 have been used to identify State (stable, long-term ecological conditions) and Community Phases (dynamic ecological conditions) prior to and post wildfire burns.

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. Two sagebrush sites were instrumented for sap flow monitors during summer

2014 for a total of 16 sagebrush plants. A GSFlow model of the groundwater recharge at the watershed scale was completed and is being utilized to support development of a watershed scale water budget. The NRCS SCAN weather station was upgraded to a SNOTEL station thus providing snow information. PhenoCams were strategically located to provide photos of vegetation green up and photos of snow depth.

Sustainability Of Mowing Fuel Breaks: Resilience Of Sagebrush Rangelands
Investigators have located 18 individual sagebrush mowing projects conducted within the Carson City and Ely BLM Districts totaling over 12,800 treated acres. Through the use of GIS to determine feasibility and appropriateness of sites, 9 projects totaling 1,600+ acres were included in the Carson City BLM District and 9 projects totaling 6,200+ acres in the Ely BLM District. Following the data collection protocols developed by Ag Experiment Station, basal and foliar cover data were analyzed to determine the differences between mowed and unmowed paired locations.

Post Fire Riparian Monitoring For Return Of Livestock Grazing
Riparian multiple indicator monitoring methodology (Burton et al. 2011) has recently become a new standard for measureable riparian monitoring by the BLM. This research was designed to inform practitioners of MIMM about the rates of change and some of the factors that would influence those rates. Focusing on post wildfire riparian responses, data was collected from 25 streams in eight separate fires within the Great Basin using the MIMM. Preliminary analysis has begun, but further data is needed to build a robust argument as to whether or not this is a reasonable estimate of when to return livestock.

Long-Term Influences of Adaptive Management Practices on an Eastern Sierran Pine Forest
To date, this project continues monitoring pre- and post- prescribed fire treatments of two forests that neighbor Lake Tahoe region and the effects of different methods of forest thinnings. The 11th annual evaluation of long-term stand health, productivity, soil nutrients, watershed hydrological parameters, and understory fuel loads was conducted to better understand the effects of controlled burn sites and a combination of thinning practices. Data collected this past year has been combined with similar pre-treatment data collected at mid study to continue the analyses of intermediate and long-term forest responses to treatment.

Monitoring Changes in Nevada's Pinyon-Juniper Woodlands
For 2014, NAES researchers have made good progress in refining remote sensing methodology for mapping changes in pinyon-juniper woodlands tree canopy cover over the past 30 years, and have also begun to develop methods for simultaneous mapping of understory vegetation and bare ground cover. The team is using spectral mixture analysis (SMA) of Landsat imagery as the primary approach to remote sensing classification, and are comparing lab-derived with image-derived spectra for vegetation and land cover types. Protocols for atmospheric, geometric and topographic correction have been resolved, along with starting the process of calibrating remote sensing methods using field data on vegetation cover that the team has previously collected.

A second research effort is resampling permanent plots established back in 2004-2005. This NAES team of scientists has resampled 37 of the 172 plots, across 3 of the 11 mountain ranges, collecting data for over 1000 trees. Individual trees were marked and delineated with permanent understory transects. The team also obtained precise GPS locations for each tree, to facilitate detailed analysis of woodland structure using point pattern analysis. Additional sampling protocols were also implemented that were not used in 2004 - 2005, including more detailed quantification of pinyon pine and juniper seedling regeneration, allowing for more in-depth regeneration dynamics studies.

2. Brief description of the target audience

The target audiences for research and educational programming are livestock producers, veterinarians,

environmentalists, local governments, state and federal agency personnel, and biotechnology companies.

3. How was eXtension used?

NAES rangeland scientist Sherm Swanson is jointly appointed with Nevada Cooperative Extension.

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	265	0	210	0

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

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	17	0

V(F). State Defined Outputs

Output Target

<u>Output #1</u>

Output Measure

- Peer reviewed scientific publications, publications in natural resource and environmental organization publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.
Not reporting on this Output for this Annual Report

<u>Output #2</u>

Output Measure

- Demonstrations, Field Days, and Workshops Conducted

Year	Actual
2014	7

Output #3

Output Measure

● Newsletters Produced

Year	Actual
2014	1

Output #4

Output Measure

● Leveraged Research Projects

Year	Actual
2014	612017

Output #5

Output Measure

● Web Sites Created or Updated

Year	Actual
2014	2

Output #6

Output Measure

● Manuals and Other Printed Instructional Materials Produced
  Not reporting on this Output for this Annual Report

Output #7

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	6

Output #8

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	33

Output #9

Output Measure

● Databases, Models, Protocols, and Research Materials

Year	Actual
2014	5

V(G). State Defined Outcomes

O. No.	OUTCOME NAME
	V. State Defined Outcomes Table of Content
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	New or improved methods
4	Adopt and use new methods or improved technology
5	Actively apply practical policy and decision-making knowledge
6	Increase economic competitiveness
7	Improve water quality and a sustainable environment
8	What Seeds to Plant in the Great Basin?
9	Effects of Management Practices on Eastern Sierran Pine Forest

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

New or improved methods

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Adopt and use new methods or improved technology

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Actively apply practical policy and decision-making knowledge

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increase economic competitiveness

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Improve water quality and a sustainable environment

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

What Seeds to Plant in the Great Basin?

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Implementing successful restoration in the Great Basin is challenging, especially in the driest and more resource-limited areas. Agronomic suitability, site appropriateness, and restoration performance are important for selecting plant material of the highest quality and usefulness. The goal of this project is to provide information about the current state of wildland seedings in the Great Basin.

What has been done
NAES scientists collected data on the frequency and amount of seeds used in recent seedings (2006-2009), focusing on post-fire rehabilitation projects, a major source of seeding in the Great

Basin, which took place on public US Bureau of Land Management lands in Nevada over a four-year period. Next they presented information on traits highlighted in descriptions of most of the commercially available grass, forb, and shrub cultivars and other native plant releases commonly used as seed materials in the Great Basin, gathering data from plant release documents and plant brochures. Finally, they conducted a series of field and greenhouse experiments that were designed to discern which phenological and morphological traits increase perennial native grass performance in disturbed Great Basin systems, and summarized the fit between these results and current restoration practice.

Results

Maintaining diverse native plant communities in the Great Basin under continuing disturbances such as invasive species, changing climate and fire regimes, and shifts in grazing pressure is a challenge for land managers. Improvements to restoration through changes in seed source selection are relatively attainable.

Traits prioritized in commercially available cultivars and native seed material releases included, in order of frequency: forage quality and yield, seed yield, seedling vigor, ability to establish and persist, and drought tolerance, with many other traits mentioned with less frequency. Traits that had consistent support for improving native perennial grass performance in the field were related to early phenology, small size, and higher root allocation.

NAES range scientists have published their finding and made it available to both ARS and NRCS for future considerations of site appropriate seed. ARS's in Logan, Utah is now looking at root allocation when considering seeding candidate plants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources
122	Management and Control of Forest and Range Fires

Outcome #9

1. Outcome Measures

Effects of Management Practices on Eastern Sierran Pine Forest

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014   0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A prominent forest type in the eastern Sierra Nevada is that of Jeffrey pine, and at mid and low elevations where soils are typically dry during the growing season, these pine forests dominate. Because of extensive harvesting during the Comstock era, coupled with fire exclusion during the 20th century, many Jeffrey pine stands today are of poor quality with large numbers of small stems, little spacing between trees, and high canopy closure.

Thinning removing weak stems so that desirable trees have greater access to water and nutrients, wildfire mitigation, increased water yield, and enhanced wildlife habitat. Also, because this practice produces commercial wood fiber and/or biomass suitable as an alternative energy feedstock, a monetary return on the investment can be realized that offsets implementation costs.

Approaches to forest thinnings have improved substantially in recent years, affording such choices as cut-to-length systems and whole-tree harvesting. Prescribed fire in the form of controlled under-burning may, with the exception of the fiber and biomass yield, provide many of the same benefits as thinning. Prior to widespread use of either of these practices in the eastern Sierra Nevada, however, 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
This project is the continuation of a long-term study that began 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.

Results
Information gathered over the past decade on the management practices in eastern Sierran pine forest has led to seven scientific publications in 2014. This set of data is the only fuel numbers available for the entire Sierra Nevada Mountains. Now available to the public, forest recovery data is being used by the USFS for environmental assessments and environmental impact statement reports. Lake Tahoe Basin Management Unit and the Nevada Division of Forestry are using the data for projected fuel loads.

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

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges
- Other (Budgetary Restraints)

Brief Explanation

Nevada annual average precipitation continues to decline, with the past three winters scoring some of the driest on record. This extreme drought is effecting a number of our rangeland studies, examples include: native seed establishment trials, seed coating trials, effectiveness of herbicides in limiting invasive annual grasses, developing water budgets for pinyon-juniper watersheds, post-fire monitoring for the return of livestock grazing.

A currently lack the funding resources to pursue how fuel conditions and potential fire risk change over the course of Pinyon-Juniper woodland stand development will not be completed. This was not expressed as a priority by BLM staff.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Quantitative data collected from ecological sites within NRCS's Owyhee High Plateau (MLRA 25) has identified State (stable, long-term ecological conditions) and Community Phases (dynamic ecological conditions) prior to and post wildfire burns.

A GSFlow model (couples ground and surface water flow, vegetation coverage, and topography) at the watershed scale was completed and is being utilized to support development of a watershed scale water budget for BLM. The team has also begun modeling snow supplimation for Pinyon-Juniper woodlands - current models are based on pine forest.

To test the applicability of MIMM's use in rangeland riparian systems, data was collected on 25 riparians from 8 different wildfires.

Data sets collected on mechanized thinning and prescribed burns in the eastern sierras is one-of-a-kind resource of USFS and Nevada Division of Forestry conducting environmental assessments and environmental impact statements.

Our long term studies on changes to Pinyon-Juniper woodland over the decades has resulted in a method for simultaneous mapping (GIS) of canopy, understory, and bare ground coverage using spectral mixture analysis from Landsat imagery. Protocols were established for correcting remote sensing issues due to atmospheric, geometric and topographic. The team has resampled 37 of the 172 original sites, geo-tagging over 1,000 trees, and collecting understory and soil samples.

Key Items of Evaluation

- Published the findings on the influence of roots traits of native grass species in competition with the invasive species cheatgrass.
- Constructed a database to store native grasses competitive performances and seedling traits against invasive cheatgrass.
- State and Transition Models were completed for clay-pan and loamy ecological sites within NRCS's MLRA 25
- A GSFlow model of the groundwater recharge at the watershed scale was completed.
- Numerous contributions and upgrades to USDA-ARS's DIMA (database for inventory, monitoring and assessment, a.k.a "the rangeland database")
- Seven peer-review journal articles were published on the effects of mechanized thinning and prescribed burns in the eastern sierras.
- A database for tracking temporal changes in Pinyon-Juniper woodlands was developed.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Nutrition and 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
702	Requirements and Function of Nutrients and Other Food Components			100%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	2.0	0.0
Actual Paid	0.0	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**
0	0	97562	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	95759	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

Beneficial and Adverse Effects of Grape Seed Extract on Human Health
In order to better understand the effects of grape seed extract on serum triglyceride levels, the

investigative team has extended their studies using a human colonic cell line and moved into testing wild type and bile acid receptor knockout mice to determine the mechanism of action by grape seed procyanidin extract in vivo. The team has correlated gene regulatory effects occurring in both the intestine and liver with decreased serum triglyceride and cholesterol levels, thereby elucidating a new mechanism. Finally, work has begun on fractionating the whole extract into monomers, dimers, and trimers, but the protocols need improving if increased yields are important.

Another line of research being conducted is looking into the effects of drought stress on grape seed extract production from Nevada grown grapes. The team has developed and optimized an in-house procedure for extracting the procyanidin flavonoid. This procedure has proven to deliver the greatest yield of procyanidins for subsequent in vitro and in vivo analysis. Using one variety of seeds for the optimization process they have managed to isolate an extract similar profiles with respect to monomeric, dimeric and trimeric procyanidins as a commercially bought extracts. Once the team has scaled up the extraction procedure, they plan to then move on to isolate fractions from the other varieties of grape seeds.

2. Brief description of the target audience

The target audience for research and educational programming is consumers, health care personnel, agency personnel, and nutrition support groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	22	0	0	0

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

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed scientific publications, publications in health and nutrition organization publications, presentations at scientific meetings, presentations at stakeholder, agency, school board, Native American, and local governmental meetings.
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Newsletters Produced

Year	Actual
2014	1

Output #3

Output Measure

- Leveraged Research Projects
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Web Sites Created or Updated
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	1

Output #6

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2014	1

Output #7

Output Measure

● Demonstrations and Workshops Conducted

Year	Actual
2014	1

Output #8

Output Measure

● Manuals and Other Printed Instructional Materials Produced

Year	Actual
2014	0

Output #9

Output Measure

● Databases, Models, Protocols, and Research Materials

Year	Actual
2014	2

Output #10

Output Measure

● Presentations

Year	Actual
2014	2

V(G). State Defined Outcomes

	V. State Defined Outcomes Table of Content
O. No.	**OUTCOME NAME**
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	New or improved methods
4	Actively apply practical policy and decision-making knowledge
5	Directly apply information from publications
6	Better quality of life
7	Safer food supply
8	Improved nutrition and health
9	Increased knowledge of decision-making, life skills, and positive life choices among youth and adults

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

New or improved methods

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Actively apply practical policy and decision-making knowledge

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Directly apply information from publications

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Better quality of life

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Safer food supply

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Improved nutrition and health

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Increased knowledge of decision-making, life skills, and positive life choices among youth and adults

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes

Brief Explanation

As mentioned earlier, the Experiment Station is still recovering from the 31 hard money positions lost after the 2010 circulation review. Until a number of critical areas are re-staffed the nutrition program will be severely hampered.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The NAES nutrition team has correlated gene regulatory effects occurring in both the intestine and liver with decreased serum triglyceride and cholesterol levels when treated with grape seed procyanidin extract, thereby elucidating a new mechanism. The team has also developed and optimized an in-house procedure for extracting the procyanidin flavonoid from Nevada grown grapes. This procedure has proven to deliver the greatest yield of procyanidins for subsequent in vitro and in vivo analysis.

Key Items of Evaluation

- Poster presentation was awarded 1st place in the pre-doctoral student category in the Dietary Bioactive Components Research Interest Section of the American Society for Nutrition

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Economic Development with Emphasis in Rural Areas

☑ 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
112	Watershed Protection and Management			41%	
601	Economics of Agricultural Production and Farm Management			3%	
605	Natural Resource and Environmental Economics			41%	
608	Community Resource Planning and Development			15%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	2.0	0.0
Actual Paid	0.0	0.0	1.7	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**
0	0	110858	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	129184	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Improving the Economic Capacity of Livestock Producers in Addressing Issues Of Biosecurity Actions Against Trichomoniasis.
With successful completion of ranchers' questionnaire, an analysis of factors that investigates adoption of trichomoniasis vaccine by Nevada public land ranchers has been completed. The questionnaire has also provided a means to create a representative rancher analysis that exposes the financial impacts of adopting and not adopting trichomoniasis vaccine. Additionally, different trichomoniasis management scenarios were analyzed in the ranch simulation model to derive financially acceptable practices. Educational materials about the risk of contracting trichomoniasis are now being developed for three groups of ranchers: users of the vaccine, potential users, and non-users.

Determining Whether Rangeland Fragmentation Is Causing Ecological, Economic, and Social Impacts
An augmented ranch level simulation model for an Elko County ranch was developed by NAES economists that estimates the probability of financial survivability of a ranch from alternative public land closures due to protection of Sage Grouse populations.

Developing Geothermal and Solar Energy Cost-Budget Models Unique To Nevada
NAES economists have collect goals and assets of rural communities of Nevada and neighboring Utah. The team has begun empirically examined the education, training and skills of rural workers and making comparisons to the education, training and skills needed for employment in those sectors of the economy that provide high quality employment and are expanding most rapidly. Working with Western Rural Development Center (WRDC), the team is planning a regional meeting on clean energy. They are continuing to work with WRDC to develop outreach materials covering clean energy financial and economic impact analysis.

Tradeoffs with Private Landowners Actions in Protecting Environmental Amenities
To investigate these issues, NAES economists measure the value of wildfire risk reduction to individual wildland-urban interface residents using an experimental design based on a stated preference framework. The team surveyed 678 residents living in 35 rural communities in Nevada that are representative of the different vegetation types, community designs, and population densities found within the Western U.S.. The team then analyze how variation in actual characteristics faced by homeowners as well as responses to survey questions influence "willingness to pay" for private and public investments in mitigation.

2. Brief description of the target audience

General public, local ranchers & producers, educators, community leaders, State & Federal decision/policy makers and development agencies.

3. How was eXtension used?

NAES economist Tom Harris is jointly appointed with Nevada Cooperative Extension.

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	250	0	15	0

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

Patent Applications Submitted

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	3	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed scientific journal articles, publications on economic development , presentations at scientific meetings, presentations at stakeholder, Native American, health care organizations, agency and local government meetings.
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Newsletters Produced
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Web Sites Created or Updated

Year	Actual
2014	1

Output #4

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	2

Output #5

Output Measure

● Leveraged Research Projects

Year	Actual
2014	443548

Output #6

Output Measure

● Manuals and other printed instructional materials produced

Year	Actual
2014	8

Output #7

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	0

Output #8

Output Measure

● Presentations

Year	Actual
2014	17

Output #9

Output Measure

● Peer reviewed journal articles, chapters, or books

Year	Actual
2014	11

Output #10

Output Measure

● Databases, Models, Protocols, and Research Materials

Year	Actual
2014	4

V(G). State Defined Outcomes

	V. State Defined Outcomes Table of Content	
O. No.	**OUTCOME NAME**	
1	New fundamental or Applied knowledge	
2	Improved skills of students, post-doctorate, and stakeholders	
3	New improved methods	
4	Actively apply practical policy and decision-making knowledge	
5	Apply improved fundamental or applied knowledge	
6	Increase economic competitiveness in rural communities	
7	State And Regional Economic Impacts Of Clean Energy Construction And Operation	

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

New improved methods

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Actively apply practical policy and decision-making knowledge

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

With over 87 percent of total land acreage in the state of Nevada under control of the federal government, the impacts of changes in public land management policies and federal land payments will impact the economies of the state of Nevada. Often, changes in public land management policies are not researched or analyzed, especially consequences to the local economy and fiscal balances of government.

What has been done
An augmented ranch level simulation model for Elko County, Nevada was developed that estimated the probability of financial survivability of the ranch from alternative public land closures due to protection of Sage Grouse populations.

Results
Removing cattle from the range has been shown to reduce net income of cattle ranchers. If a herd is reduced below 30% to protect sage grouse habitat, net revenues start to run in the red. Rural county governments are also concerned because property taxes capitalize on number of cattle produced, regardless of public or private land use. Results of this study are providing Nevada's Elko, Esmeralda, Lander, Lincoln, Nye and White Pine counties governmental decision makers information as to potential impacts of alternative public land policies for development of consensus policies.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Apply improved fundamental or applied knowledge

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increase economic competitiveness in rural communities

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

State And Regional Economic Impacts Of Clean Energy Construction And Operation

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With increasing fuel prices and the desire for energy independence, clean or green energy as an energy source has become a target for national and regional economic development. However deriving the costs of these new clean energy sources and technologies and accompanying economic impacts have been somewhat ignored. There are national models such as JEDI which researchers can use. However, the JEDI model is limited and has not been used for all sources of clean energy. For Nevada the JEDI model is quite limited and does not cover biomass, geothermal, micro-hydropower, wind, and solar sources.

What has been done
The JEDI model, as well as products developed by Orr, Johnson, and Badger (2004), Johnson (2004), and Agricultural and Food Policy (2011) were reviewed in order to determine their applicability in developing clean energy budgets. Cost budgets for constructing clean energy projects were formulated and budgets developed. Using input-output models, total economic, employment, and household income impacts were determined from clean energy operations. Also, construction costs of these clean energy projects were developed to estimate construction impacts. Finally, two models were developed for clean energy impact analysis, the stochastic financial simulation model and an inter-industry/occupational-industry model. Feasibility analysis was completed for five hypothetical alternative energy projects.

Results
With the completion of the stochastic financial simulation model, the NAES sponsored Center for Economic Development has made the model available for outside economists. Working with Western Regional Development Center, the team has set up a regional meeting on clean energy. The Nevada Solar Nexus Project Meeting was held that discussed the stochastic financial simulation model for clean energy that was developed for this project.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges

Brief Explanation

As mentioned earlier, the Experiment Station is still recovering from the 31 hard money positions lost after the 2010 circulation review. Until a number of critical areas are re-staffed the economic resource program will be severely hampered.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The development of a stochastic ranch financial simulation model that analyzes the impacts on financial survivability to an Elko County ranches from alternative Sage Grouse Population strategies. This model has proven to be robust enough for utilization in any situation where public lands are having a potential impact on the ranching economy.

A series of rancher surveys were collected and entered in newly created database that is used to derive statistical significant factors in adopting the trichomonaisis vaccine for cattle.

Key Items of Evaluation

- Developed a new stochastic financial simulation modeling tool that is deployed to users via Microsoft Excel.
- Developed a new inter-industry and industry-occupational model for clean energy impact analysis.
- Developed a ranch level simulation model specifically for Elko County, Nevada that looks at financial survival due to land closers associated with protection of Sage Grouse.
- Three versions of the "Willingness to Pay" survey instrument in protecting environmental amenities were created.
- A journal article was published on the Homeowners' willingness to pay for private and public actions to reduce wildfire risk.
- An article on Optimal Livestock Management on Sagebrush Rangeland with Ecological Thresholds, Wildfire, and Invasive Plants was published in the Journal of Land Economics.

V(A). Planned Program (Summary)

Program # 6
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
201	Plant Genome, Genetics, and Genetic Mechanisms			6%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			19%	
204	Plant Product Quality and Utility (Preharvest)			62%	
206	Basic Plant Biology			13%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	0.0	2.5	0.0
Actual Paid	0.0	0.0	3.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	282281	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	239852	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

Curly Top Gumweed Biofuel Potential
The fourth year of biomass field trials is completed. The team has work this past year on improved germination rates protocols, with some methods yielding 85% success rates in greenhouses. Fertilization trials in combination with irrigation trials were conducted in 2014. The team has developed a harvesting protocol that employees a two cutting strategy. Another accomplishment was working out the protocols to decolorize grindelic acid, a bio-crude extracted derived from gumweed.

Improving Camelina as a Biofuel Alternative
Varietal trials with eight named varieties of Camelina (e.g., Blaine Creek, Calena, Celine, Cheyenne, Columbia, Ligena, Suneson, and Yellowstone) were conducted again during the spring of 2014. The team analyzed data for biomass production (aerial, body, and root) and seed production.

Ethylmethane sulfonate (EMS) mutant populations of Camelina sativa were produced as a major output of this project and continue to undergo screening on a continuing basis. To date, seeds have been collected for a total of 5,243 second generation mutant (M2) lines from a total of ~7,000 M2 lines collected. M2 lines were replanted and 1,568 third generation (M3) lines have been grown out. Of these, 353 M3 lines were dried and waiting seed cleaning; 1215 M3 lines have been cleaned. A total of 474 M3 lines were screened for mucilage defect using the Ruthenium red staining protocol. One mucilage-fee line (Cs98) was isolated and found to exhibit a stable mucilage-free defect in the M4-M6 generations. A total of 250 M3 lines have been screened for altered fatty acid methyl ester composition using gas chromatography to isolate mutants with high oleic acid and low uric acid content.

Transformation trials using the hygromycin selectable marker gene are in progress for several target genes of interest. Efforts have focused on the herbicide and drought tolerance traits during the current reporting period. A total of 23 independent glyphosate resistant T2 Camelina sativa lines have been generated of which nine have been confirmed in the T3 generation to be tolerant to glyphosate herbicide.

A massively parallel (454) pyrosequencing was completed to characterize the transcriptome of Camelina sativa in order to identify major genetic determinants responsible for stress-adaptive responses.

Accumulation of Hydrocarbons in Plants - making biofuels
The long-term goal is to develop a technology to increase the accumulation of hydrocarbons in a Nevada biofuel crop. Current efforts to produce mid-chain alkanes in Arabidopsis thaliana and Yarrowia lipolytica (a high oil content yeast) have consisted of overexpressing the cyanobacteria derived alkane biosynthesis enzymes Acyl-ACP Reductase and Aldehyde Deformylating Oxygenase.

Prickly Pear Cactus Feedstock
Transcriptomic sequencing using Illumina RNA-sequencing technology was completed during the previous reporting period. The team has developed methods for creating very high quality, transcriptome assemblies from these Illumina datasets using the Evidential Gene pipeline to deal with polyploidy nature of this cactus. A modified transformation protocol has been developed and is currently undergoing testing.

Field trails are now underway in southern Nevada. Three species of Prickly Pears (Indian fig, Pancake, & Nopal Cardón) were propagated in the greenhouse and transplanted to the field. An irrigation system was installed and rabbit fencing was installed around the perimeter of the field site to prevent herbivory by local mammalian fauna (i.e. gophers, and rabbits).

2. Brief description of the target audience

Those most affected by this research include the general public, fellow scientists, energy and chemical industry, and potential producers.

3. How was eXtension used?

The project has one extension Co-PI on the project, as well as, assisting in the maintenance of prickly pear cactus field trial plots.

V(E). Planned Program (Outputs)

1. Standard output measures

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

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

Year: 2014
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

   Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	5	0

V(F). State Defined Outputs

Output Target

Output #1

   #### Output Measure

   ● Peer reviewed journal articles, publications in commodity group publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.
   Not reporting on this Output for this Annual Report

Output #2

   #### Output Measure

   ● Demonstrations and Field Days Conducted

Year	Actual

2014	2

Output #3

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	11

Output #4

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	20

Output #5

Output Measure

● Research Projects Conducted

Year	Actual
2014	0

Output #6

Output Measure

● Leveraged Research Projects

Year	Actual
2014	56000

Output #7

Output Measure

● Web Sites Created or Updated

Year	Actual
2014	1

Output #8

Output Measure

● Presentations

Year	Actual
2014	23

Output #9

Output Measure

● Databases, Models, Protocols, and Research Materials

Year	Actual
2014	2

Output #10

Output Measure

● Peer reviewed journal articles, chapters, or books

Year	Actual
2014	6

V(G). State Defined Outcomes

O. No.	OUTCOME NAME
	V. State Defined Outcomes Table of Content
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	New or improved methods
4	Adopt and use new methods or improved technology
5	Use new or improved plant varieties
6	Increase economic competitiveness
7	Improve productivity in a semi-arid environment
8	Adopt new improved skills
9	Developing Biofuel Feedstock Tailored to Nevada's Arid Climate

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

New or improved methods

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Adopt and use new methods or improved technology

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Use new or improved plant varieties

Not Reporting on this Outcome Measure

Outcome #6

   1. Outcome Measures

   Increase economic competitiveness

   Not Reporting on this Outcome Measure

Outcome #7

   1. Outcome Measures

   Improve productivity in a semi-arid environment

   Not Reporting on this Outcome Measure

Outcome #8

   1. Outcome Measures

   Adopt new improved skills

   Not Reporting on this Outcome Measure

Outcome #9

   1. Outcome Measures

   Developing Biofuel Feedstock Tailored to Nevada's Arid Climate

   2. Associated Institution Types

   ● 1862 Research

   3a. Outcome Type:

   Change in Knowledge Outcome Measure

   3b. Quantitative Outcome

Year	Actual
2014	0

   3c. Qualitative Outcome or Impact Statement

   Issue (Who cares and Why)

The long-term goal of the proposed research is to develop a number of drought tolerant species (e.g., curly top gumweed, camelina, and prickly pear cactus) into new biofuels and feed crops adapted to our arid western region. Our vision is to create novel biofuel feedstock production platforms with increased energy density within vegetative tissues that is capable of producing biodiesel, renewable diesel, or jet fuel with minimal water inputs required for traditional biofuel feedstocks.

What has been done
The research efforts conducted over the past year are the culmination of numerous activities. In the lab, bacterial enzymes have been introduced into two model plants (mouse-ear cress and Yarrow) to boost the hydrocarbon production. Mutant populations of Camelina (aka, wild flax) were produced that are free of gelatinous mucilage well into the sixth generation of propagation. Third generation mutants were also screened for a suite of promising traits. This includes altered fatty acid compositions, rapid completion of ontology, shade tolerance, and greater plant densities. Addition work was conducted on Camelina mutants tolerant to glyphosate herbicides.

Field and greenhouse varietal trials are well underway for Camelina, Curly Top Gumweed, and Prickly Pear Cactus.

Results
Based upon Camelina field trials for seed production and oil content, our scientist are now recommending that producers of northern Nevada go with Celine, Columbia or Suneson varieties. Research into transgenic lines of Camelina has increase seed size by 40%, which translates into high oil content per seed. This line of research has also created a rapid cycler variety that should serve as an outstanding cover crop.

The biofuels team has created a gas exchange apparatus in collaboration with local manufacturer Tripp Plastics that will assist scientists interested in measuring gases produced during Prickly Pear Cactus development.

Finally, an interactive educational display was created (Bio-Energy Crops for Semi-Arid Environment) that introduces participants to common biofuel feedstocks found in Nevada and the oils produced.

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
- Economy
- Appropriations changes

Brief Explanation

DNA extraction from Prickly Pear Cactus was extremely challenging due to the high pectin content of the cladodes. Numerous DNA extraction methods were attempted before a successful method was discovered. This resulted in delays in the isolation of high-quality DNA. Once again, Nevada annual average precipitation continues to decline, with the past three winters scoring some of the driest on record. Without adequate rainfall, work on gumweed and prickly pear cactus may require alternative sources of water.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The germination rates of Curly Top Gumweed has been improved to 80-85% through improved protocols.

The discovery of a DNA extraction method has resulted in the isolation of high-quality genomic DNA. A critical success of the project to allow for the isolation and characterization of native promoters found in Prickly Pear Cactus.

Varietal trials on Camelina has uncovered a rapid cycling variety that would server well as a fall cover crop.

Key Items of Evaluation

- Bioenergy Crops for Semi-arid Environments" educational display was created
- 23 independent glyphosate resistant second generation (T2) Camelina sativa lines were generated of which nine have been confirmed in the T3 generation to be tolerant to glyphosate herbicide.
- A transcriptome was created to identify major genetic determinants responsible for stress-adaptive responses in Camelina.
- A line of mucilage-fee Camelina (Cs98) was isolated and found to exhibit a stable mucilage-free defect in the M4-M6 generations.
- A DNA extraction method for Prickly Pear Cactus was discovered that gets around the high levels of pectin found in the cladodes (leaves).

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

☐ Reporting on this Program

Reason for not reporting

Currently no faculty to staff specializing 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: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	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

Provide agricultural producers in Nevada with information about the risks associated with food safety in terms of direct marketing, including legal, financial, and marketing risks. In-depth cattle handling workshop are being performed that targets the Spanish speaking workers to increased production and improved animal health through decreased stress.

2. Brief description of the target audience

This program is targeting Nevada's agricultural producers with emphasis on Spanish speakers.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

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

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

Year: 2014

Actual: {No Data Entered}

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed journal articles, publications in commodity group publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.

Year	Actual
2014	0

Output #2

Output Measure

● Research Projects

Year	Actual
2014	0

Output #3

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	0

Output #4

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	0

Output #5

Output Measure

● Leveraged Research Projects

Year	Actual
2014	0

Output #6

Output Measure

● Web Sites Created or Updated

Year	Actual
2014	0

V(G). State Defined Outcomes

O. No.	OUTCOME NAME
	V. State Defined Outcomes Table of Content
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	New or improved methods
4	Actively apply practical policy and decision-making knowledge
5	Increased knowledge of decision-making, life skills, and positive life choices among youth and adults
6	Directly apply information from publications
7	Safer food supply

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

New or improved methods

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014   0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Actively apply practical policy and decision-making knowledge

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{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 #5

1. Outcome Measures

Increased knowledge of decision-making, life skills, and positive life choices among youth and adults

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #6

   1. Outcome Measures

      Directly apply information from publications

   2. Associated Institution Types

      ● 1862 Research

   3a. Outcome Type:

      Change in Action Outcome Measure

   3b. Quantitative Outcome

Year	Actual
2014	0

   3c. Qualitative Outcome or Impact Statement

      Issue (Who cares and Why)
      {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 #7

   1. Outcome Measures

      Safer food supply

   2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes

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 # 8

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

   Reason for not reporting

    Currently no faculty or staff specializing in childhood obesity.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	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

     Scientists are developing a community weight control model for use in Nevada's city clinics. Investigation has begun into the effects of distance to parks, trails, food outlets, etc. in relation to amount of vegetables consumed and obesity. The Washoe County School District has implemented a Student Wellness Policy; researchers are identifying best practices at the school and classroom level, and

reporting on its execution and effectiveness.

2. Brief description of the target audience

Educators, health professionals, general public and policy-makers.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

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

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

Year: 2014
Actual: {No Data Entered}

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed journal articles, publications in commodity group publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.

Year	Actual

| | 2014 | 0 |

Output #2

Output Measure

● Newsletters Produced

Year	Actual
2014	0

Output #3

Output Measure

● Research Projects Conducted

Year	Actual
2014	0

Output #4

Output Measure

● Web Sites Created or Updated

Year	Actual
2014	0

Output #5

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	0

Output #6

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	0

Output #7

Output Measure

● Demonstrations and Workshops Conducted

Year	Actual
2014	0

Output #8

Output Measure

● Leveraged Research Projects

Year	Actual
2014	0

Output #9

Output Measure

● Manuals and Other Printed Instructional Materials Produced

Year	Actual
2014	0

V(G). State Defined Outcomes

O. No.	OUTCOME NAME
	V. State Defined Outcomes Table of Content
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	Directly apply information from publications
4	Increased knowledge of decision-making, life skills, and positive life choices among youth and adults
5	Reduce obesity and improved nutrition and health

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Directly apply information from publications

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014   0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{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 #4

1. Outcome Measures

Increased knowledge of decision-making, life skills, and positive life choices among youth and adults

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year   Actual

2014   0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #5

1. Outcome Measures

Reduce obesity and improved nutrition and health

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{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

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 # 9

1. Name of the Planned Program

Climate Change

☐   Reporting on this Program

      Reason for not reporting

       Currently no faculty to staff specializing in climate change.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	**1890**	**1862**	**1890**
Plan	0.0	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

    Scientists are investigating: avian and forest vulnerability, the effects of elevated nitrogen on forest, the effects of nutrients and carbon fluctuations across aquatic and desert ecosystems, the effects on soils at the rain-snow transition zone, and creating educational programs that stimulates transformative research, education and outreach on effects of regional climate change on ecosystem resources.

2. Brief description of the target audience

Scientific community, resource managers, Nevada System of Higher Education faculty, students, constituents and policy makers.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

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

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

Year: 2014

Actual: {No Data Entered}

Patents listed
{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	14	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed journal articles, publications in commodity group publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.

Year	Actual
2014	0

Output #2

Output Measure

● Leveraged Research Projects

Year	Actual
2014	0

Output #3

Output Measure

● Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2014	0

Output #4

Output Measure

● Number of Undergraduate Students Involved in Research

Year	Actual
2014	0

Output #5

Output Measure

● Web Sites Created or Updated

Year	Actual
2014	0

V(G). State Defined Outcomes

O. No.	OUTCOME NAME
	V. State Defined Outcomes Table of Content
1	New fundamental or Applied knowledge
2	Improved skills of students, post-doctorate, and stakeholders
3	New or improved methods
4	Adopt and use new methods or improved technology
5	Adopt new improved skills
6	Apply improved fundamental or applied knowledge
7	Improve rangeland ecosystems

Outcome #1

1. Outcome Measures

New fundamental or Applied knowledge

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Improved skills of students, post-doctorate, and stakeholders

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

New or improved methods

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014   0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #4

1. Outcome Measures

Adopt and use new methods or improved technology

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{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 #5

1. Outcome Measures

Adopt new improved skills

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{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 #6

1. Outcome Measures

Apply improved fundamental or applied knowledge

2. Associated Institution Types

● 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{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 #7

1. Outcome Measures

Improve rangeland ecosystems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes
- Other (University of Nevada budget cuts)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

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