

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Animal 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			20%	
135	Aquatic and Terrestrial Wildlife			48%	
136	Conservation of Biological Diversity			15%	
301	Reproductive Performance of Animals			2%	
302	Nutrient Utilization in Animals			1%	
303	Genetic Improvement of Animals			2%	
304	Animal Genome			2%	
311	Animal Diseases			2%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			8%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual Paid Professional	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	186786	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	285964	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

Having developed a vaccine for EBA in collaboration with UC-Davis, issues have arisen in regarding the duration of immunity. The NAES research team is now investigating the time intervals between re-infection of the EBA vector. Over the past year, the team has discovered a gene that is being expressed (a cytokine inflammatory mediator associated with T-cell regulation) that correlates directly with protective antibody responses eight weeks following exposure to the vaccine agent. These results will ultimately assist in determining when a heifer should be vaccinated, but trials are now being conducted to determine safety and efficacious.

Rangeland management problems associated with cattle foraging on forage kochia

Nutritive content was determined for forage kochia during fall and winter seasons over the past two years. Foam strength and gas production assessments were also determined using artificial rumen system developed at NAES. To assist producers, fall grazing prescriptions have been developed that minimize the likelihood of mortality events.

Impacts of Cattle and Feral Horses on Sage Grouse Survival

Having selected three major field sites based upon the presence or absences of cattle and feral horses, the research team continues to conduct sage grouse population census, i.e. adult and brood survival and nesting success rates. Over 85 sage hens have been fitted with tracking devised and are currently being tracked. Further censuses were conducted to evaluated population densities and site usage times by both feral horses and cattle. Vegetation samples are being collected to determine nest site preferences. Initial statistical analyses have begun, but with only six months data, results are very preliminary.

Mineral Deficiency or Disease: Wildlife as Indicators for Livestock

Over the past year, NAES wildlife scientists collected baseline data on disease prevalence, trace mineral concentrations, and immune response from 49 mule deer blood samples, along with morphometric and condition metrics, and radio collars were deployed. Necropsies were performed on three symptomatic individuals. Trace mineral analyses were performed on plant samples collected from transects near mule deer habitat. Individual deer were monitored bi-weekly over the summer months to determine habitat use and mortality. Data are now being analyzed, with respect to immune function, trace minerals and stress hormones. The team is also in the process of conducting statistical analysis on data collected for publication.

Genetic Landscape of Big Horn Sheep Diseases

NAES scientists in collaboration with the Nevada Department of Wildlife have collected over 400 Bighorn Sheep tissue samples from across the state. Those samples were then quantified for genetic diversity at both neutral and immunity-related genes in healthy and sick/dead sheep. Initial work has gone into developing a database of individual sheep genotypes associated to disease incidence and location.

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 have begun processing samples for analysis of glucocorticoid levels (a response to the immune system). A new procedure was developed to process hair in preparation for GC extractions. Typical GC assaying kits were calibrated to read hair samples from both mule deer and elk. Finally, scientist have quantified bacteria killing ability and hemolytic complement activity, and begun developing an ELISA test to quantify two antibody levels.

Effects of Provision Water on Juvenile Mule Deer's Survival and Recruitment

NAES scientists in collaboration with National Park Services captured 45 deer within the Mojave National Preserve. Animals were fitted with GPS or VHF radio collars and monitored over the next year. Data collected from the collars has been assembled into a database that reflects habitat selection, movement patterns and use of resources, i.e. provisioned water.

Impact Of Acute Non-Lethal Neurotoxic Compounds Exposure On Migratory Bird Species

This past year, scientists initiated two studies to assess the impact of 1) methyl mercury on avian reproduction and chick development, and 2) to assess physiological condition of adults birds coated in unrefined crude oil collected from the Deep Water Horizon spill. Both studies will use the homing pigeon model (a surrogate for migratory birds) developed here at UNR. Methyl mercury test are completed through four generations. With each round of breeding, the reproductive success in the exposed group decreased from 50% in round one to 17% in round four. Based upon these results the team has initiated a similar study at one half the dosage of methyl mercury. The crude oil flight trials are still underway.

Characterizing Mountain Lion Distribution, Abundance and Prey Selection in Nevada

Tissue samples were collected from 700 lions to delineate genetic boundaries as well as estimate migration between interacting sub-populations. These data in turn have provided the research team with a source-sink model that can be used to determine direction of migration. Tracking collars were placed on 24 adult lions to determine location of kill sites. The team is also quantifying kill rates and prey selection of mountain lions in select sub-populations in Nevada.

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

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

Patent Applications Submitted

Year: 2013
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	19	0

V(F). State Defined Outputs

Output Target

Output #1

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

Output #2

Output Measure

- Demonstrations, Field Days, and Workshops Conducted

Year	Actual
2013	8

Output #3

Output Measure

- Newsletters Produced

Year	Actual
2013	3

Output #4

Output Measure

- Leveraged Research Projects

Year	Actual
2013	635936

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2013	3

Output #6

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2013	0

Output #7

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2013	6

Output #8

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
2013	19

Output #9

Output Measure

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

Year	Actual
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2013 4

Output #10

Output Measure

- Digital Media Created or Updated

Year	Actual
2013	54

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Peer reviewed scientific publications, publications in natural resource and environmental organization publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings, and leveraged funds.
2	Bull Behavior and the Relationship with Paternity
3	Nutrient Content Of Forage Kochia and Potential for Causing Frothy Bloat
4	Characterizing Mountain Lion Distribution, Abundance, And Prey Selection In Nevada
5	Determining How the Tick-Borne Disease "Relapsing Fever" Is Maintained in Nature

Outcome #1

1. Outcome Measures

Peer reviewed scientific publications, publications in natural resource and environmental organization publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings, and leveraged funds.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Bull Behavior and the Relationship with Paternity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The beef cattle industry is a major economic producer and the number one agriculture commodity in the state of Nevada. Most beef cattle operations utilize a natural service breeding program and allow multiple bulls to be released in pastures with cows and heifers. In recent years, DNA technology has allowed producers to know the paternity of their calves and understand the production of each of their bulls. While these techniques can help to identify which bulls are siring certain offspring, it is still not widely understood why certain bulls are successful in the field. Past research that has measured behavior in order to predict bull fertility often use tests outside of the breeding season and in artificial arenas, both of which have been shown to be unreliable in predicting bull fertility. Thus, intensive behavioral studies on bull social behavior in the field are needed in order to understand why some bulls are successful at securing paternity, and others are not.

The main objective of this study is to observe bull behavior in the field during the breeding season in order to determine 1) why bulls are successful at securing matings and subsequent paternity and 2) what behavioral measures and physical characteristics are correlated to bull reproductive success.

Initially, ranchers of Northern Nevada have asked UNR to look into methods for determining paternity in open-range operations. Using genetic techniques, researchers at UNR had determined that there was high variability in success rates in fathering calves. This leads one to ask, what makes one bull more successful than another? A large body of work has looked at this variability, measure a number of physical characteristics (age, scrotal circumference, tenure, etc.), but it does not seem to tell the whole story.

What has been done

Over the past couple of years, DNA has been collected from bulls, cows and calves. All bulls were semen tested to verify sound reproductively. Then over the past two years several hundred hours of behavioral observations were performed. 600 cows and 28 bulls were measured through 2012-13.

Results

This knowledge will increase our understanding of reproductive behavior of bulls, which is still relatively under researched, and can improve cattle operations, specifically bull management, in the state of Nevada.

One of the important finds from this project was a confirmation that physical characteristics do not correlate with paternity success rates. Accepts for age or tenure and testosterone levels which were positively correlated to success rates. What was found in the first year of the study was that bull that had greatest percentage time spent next to a female, or standing, and the amount of signaling were all behaviors associated with success. The second year of the study, with nearly double the sample size of bulls, what was found is that sexual behaviors are not associated with paternity success rates. A carry over result from last year was proximity to female. Again, time spent next to a cow translated into great success of fathering calves.

The bottom line to this project is that it serves a very practical purpose, do you buy the \$5,000 bull that avoids copulation or the \$1,800 bull that services all your females.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals

Outcome #3

1. Outcome Measures

Nutrient Content Of Forage Kochia and Potential for Causing Frothy Bloat

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dormant season forage for grazing animals both wild and domestic in Nevada, is often in short supply and sometimes low in nutrient content. For this reason, a great deal of resources has been brought to bear on the challenge. A number of non-indigenous species have been major constituents of rangeland restoration and fire rehabilitation projects. One species, forage kochia has been a key species included in number of seed mix prescriptions. It now occurs widely across northern and central Nevada.

What has been done

Nutritive content was determined for forage kochia during the fall and winter seasons. Fermentation products were determined using a dual flow continuous culture system. To determine the potential for developing frothy bloat, foam production, foam strength and gas production were measured.

Results

The project has fostered development of a cattle grazing prescription that minimizes the likelihood of mortality events for ranches that depend on forage kochia during the fall grazing period. Through a state-wide tour of Nevada, hosted by the Nevada Chapter of Cattlemen's Association, over 450 ranchers and Bureau of Land Management personnel were provided information for better management of their herds to minimize animal losses. The same presentation is currently being given to both Arizona and Idaho Cattlemen's Association members.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

Outcome #4

1. Outcome Measures

Characterizing Mountain Lion Distribution, Abundance, And Prey Selection In Nevada

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As Nevada's largest predator, mountain lions share complex interactions with species they prey upon including mule deer, elk, mountain sheep, and wild horses. Maintaining healthy rangeland ecosystems includes predator-prey dynamics and mountain lions are an integral part of western forests and rangelands. Effective management of mountain lion populations is critical to dynamics of both mountain lion prey populations, especially large prey species. Other than location, age, and sex of harvested lions, little is known about mountain lion demographics, movement patterns, other sources of mortality, or rates of predation on large mammal prey.

State legislative bill (AB 256) was proposed to classify mountain lions as an unprotected mammal in Nevada, and the controversy surrounding that bill, which failed, exemplified the need for detailed information on mountain lion populations and how they affect prey populations in Nevada. This project will clarify many of the questions and possible misconceptions surrounding mountain lions and their prey in Nevada.

What has been done

The NAES research team has delineated genetic population structure of mountain lions throughout Nevada and determined meta-population structure. Having collected over 700 tissue samples from hunter harvested mountain lions, the team delineated genetic boundaries of mountain lion populations in Nevada as well as estimated the rate of migration between interacting sub-populations. This allowed the team to identify source and sink populations by estimating the rate and direction of effective migration between populations. By quantifying kill rates and prey selection in select sub-populations across Nevada, this project provided quantitative evidence for maintaining balance between mountain lions and prey.

Results

This project highlights the innovative genetic techniques investigators used to identify source-sink dynamics of mountain lions in the Great Basin at a landscape scale.

"It would have been difficult to analyze source-sink dynamics and its potential causes at a large spatial scale in a large mammal predator using conventional methods such as population surveys, mark-recapture experiments, radio-tracking or GPS collars", states Dr. Kelley Stewart, University of Nevada, wildlife ecologist.

Leading ecological geneticists Dr. Rolf Holderegger and Dr. Felix Gugerli are strong advocates for the use of Dr. Stewart's methods to infer directional measures of contemporary or recent

migration or gene flow, in future landscape genetic studies. Dr. Holderegger remarks "this study shows that the incorporation of asymmetrical measurements of migration in landscape genetics adds substantially to this field's relevance for application." Dr. Gugerli said, "Similar insights relevant for conservation management of wild populations could be envisioned by Dr. Stewart's widespread application of approaches measuring contemporary or recent migration in other species."

Finally, results from this project can now be used by Nevada and California wildlife managers to create biologically meaningful management boundaries that incorporate the level of immigration occurring between populations.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Determining How the Tick-Borne Disease "Relapsing Fever" Is Maintained in Nature

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Relapsing fever has affected citizens of Nevada and California alike and is transmitted to individuals through the bite of an infected tick. Tick borne diseases such a relapsing fever, epizootic bovine abortion and human granulocytic anaplasmosis are endemic in the eastern Sierra Nevada making this ecosystem an important laboratory for the study of many of these threats to human and animal health. In addition, there is evidence that strains of relapsing fever spirochetes in California and Nevada may be increasing in virulence. This increase is either due to ecological, evolutionary, or epidemiological factors. A full evaluation of these diverse relapsing fever agents, their genetic complexity, and their ecological maintenance in reservoir species has yet to be performed.

What has been done

Having collected over 1,500 small mammals from both Nevada and California, cytochrome B sequencing and subsequent microsatellite analysis were ran to identify infected samples. To determine what strains of bacteria were present in infected samples, the team sequenced three specific genes. Finally, the team ran statistical comparisons and analysis of molecular variance in order to evaluate relationships between population structure and dispersal in chipmunk species and comparing them to the prevalence and strain composition of relapsing fever bacteria existing in the same sites.

Results

This project has established important foundational results for ongoing research being applied to a little understood and often misdiagnosed disease endemic throughout the eastern Sierra Nevada Mountains. The findings are now helping epidemiologists and health care personnel in California and Nevada better understand the ecology of other endemic zoonotic diseases including hantavirus and plague. Residents of the Great Basin and Sierran ecosystems are served when physicians and public health officials make decisions based on current scientific research regarding these life-threatening diseases. This project has shown that site with human habitation (i.e. cabins, outbuilding, etc.) are serving as sinks for rodent immigration, thus fostering healthier populations of bacteria responsible for relapsing fever, which in turn may be the leading cause for increased virulence.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
311	Animal Diseases

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities

Brief Explanation

Nevada annual average precipitation continues to decline, with past two 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

Nevada's research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

- Provided ranches with tools to evaluate bull potential for being good breeders on open range.
- Provided ranchers with a grazing prescription that minimizes frothy bloat in cattle.
- Have begun instructing rural residence of the Sierras on how to minimize their chances of incurring relapsing fever.
 - Expanded the knowledge base on Nevada's top predator.
 - Leveraged over \$635,000 in extramural funds
 - Trained 25 students and post-docs

Key Items of Evaluation

The use of animal behavior research in determining potential bull fecundity is a novel approach that ranchers can easily learn.