

**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			11%	
103	Management of Saline and Sodic Soils and Salinity			14%	
112	Watershed Protection and Management			13%	
121	Management of Range Resources			24%	
122	Management and Control of Forest and Range Fires			5%	
123	Management and Sustainability of Forest Resources			1%	
133	Pollution Prevention and Mitigation			20%	
135	Aquatic and Terrestrial Wildlife			1%	
211	Insects, Mites, and Other Arthropods Affecting Plants			11%	
	<b>Total</b>			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	3.9	0.0
Actual Paid Professional	0.0	0.0	6.0	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	524206	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	340968	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. This year a unique microsomal fatty acid enzyme was discovered to be involved in making the precursor fatty acids to methyl-branched hydrocarbons. This unique microsomal FAE and a soluble FAE were cloned in order to isolate genes involved in this synthesis. The team has assembled the genes and sequenced the enzyme's 7,000 base pairs. These clones are now being growing in SF9 host cells.

Another research effort is approaching the problem by looking at controlling anti-diuretic peptides in beetles. Thus far, the research team has cloned five important receptor sites in the insect excretory and osmoregulatory systems thought to disrupt molting. The team has also completed the expression of one of these receptors in the Human Embryonic Kidney cell lines and work is being conducted using these same techniques to express the other receptors.

The final research effort is working to better understand the biochemical mechanisms beetles use to detoxify turpentine resin found in pine forests. To date, this team of scientists has clarified substrate preferences and product profiles for four enzymes catalyzing detoxifying reactions.

Methyl Mercury Production And Inputs From Irrigation Drains In Nevada

Mercury concentrations in water and sediments were monitored in irrigation drains seasonally for the past two years, along with water bodies above and below drain inputs, for the three primary watersheds in Northern Nevada. Five study areas were chosen based on the presence of agricultural activity, accessibility, and partner cooperation. At each sampling location, water samples were collected for methyl mercury analyses along with phosphate, sulfur, nitrogen, dissolved organic carbon and water condition. The team has completed laboratory analyses and continues to analyze the data generated from this study.

Testing Competitiveness of Native Plant Verses the Invasive Species Cheatgrass

Using greenhouse, field, and long-term natural experiments, NAES scientists have demonstrated that there are particular traits associated with successful establishment in invaded systems, and that in some cases, native populations are evolving increased frequencies of favorable traits in invaded areas. To date, the team has found that specific phenological and phenotypic traits increase the ability of native grasses to tolerate competition from Cheatgrass, and have found that some of these traits are more frequently found in invaded communities. Root characteristics are now the main focus of the project. Using four grasses from 25 different populations, emergence and survival trials are now underway and will be

monitored in 2014.

A second line of research is to understand the roles of water and nitrogen acquisition in the competitive interactions between cheatgrass and native rangeland species. Three greenhouse experiments were conducted to examine the competition between two species of native grasses and cheatgrass. The team determined which below-ground characteristics of native grasses were competitive with cheatgrass, related to water and nitrogen acquisition. They established how directional selection effects native grasses evolution, driving plants to produce less above-ground biomass, while increasing root biomass. Finally, the team related leaf nitrogen content to assimilation rates in cheatgrass growing under greenhouse and field conditions.

#### Sustainability Of Mowing Fuel Breaks: Resilience Of Sagebrush Rangelands

Investigators are currently studying the characteristics of lands subjected to ongoing multiple use management that cause them to increase or decrease resilience when treated by mowing to create fuels breaks. The team has finished the preliminary data collection, data inventory, and data entry into a spatially-explicit database of land treatments conducted primarily on federal lands in the Great Basin from 1950 to present. They have begun analytical comparisons of the vegetative responses to wildfire and mowing of sagebrush to create fuel breaks by measuring changes in 13 parameters.

#### Long-Term Influences of Adaptive Management Practices on an Eastern Sierran Pine Forest

To date, this project has monitored the pre- and post- prescribed fire treatments of two forests that neighbor Lake Tahoe region and the effects of different methods of forest thinning for more than ten years. The 10th 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 and that collected at mid study to continue the analyses of intermediate and long-term forest responses to treatment.

#### Modeling Salt Loving Plants to Improve Environmental Quality and Ag Production

Thus far, the research team at UNR has reviewed and tested eight plant production models. A final decision was made to go with the APEX model. A module has now been developed that incorporates salinity as a whole into the working APEX model and parameterized. Data collect from both the Great Basin region and Uzbekistan' farming region have been now loaded into the improved model. At this point in time, simulations are being conducted to fine-tune parameters.

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

The target audiences for research and educational programming are livestock producers, veterinarians, environmentalists, local governments, agency personnel, and biotechnology companies.

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

eXtension was not used in this program

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

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

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1308	0	0	0

**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	43	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

<b>Year</b>	<b>Actual</b>
2013	25

**Output #3**

**Output Measure**

- Newsletters Produced

<b>Year</b>	<b>Actual</b>
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2013 3

**Output #4**

**Output Measure**

- Leveraged Research Projects

<b>Year</b>	<b>Actual</b>
2013	2978173

**Output #5**

**Output Measure**

- Web Sites Created or Updated

<b>Year</b>	<b>Actual</b>
2013	8

**Output #6**

**Output Measure**

- Manuals and Other Printed Instructional Materials Produced

<b>Year</b>	<b>Actual</b>
2013	1

**Output #7**

**Output Measure**

- Number of Graduate Students or Post-Doctorates Trained

<b>Year</b>	<b>Actual</b>
2013	18

**Output #8**

**Output Measure**

- Number of Undergraduate Students Involved in Research

<b>Year</b>	<b>Actual</b>
2013	30

**Output #9**

**Output Measure**

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

<b>Year</b>	<b>Actual</b>
2013	21

**Output #10**

**Output Measure**

- Digital Media Created or Updated

<b>Year</b>	<b>Actual</b>
2013	71

**Output #11**

**Output Measure**

- Lay or Popular Publications

<b>Year</b>	<b>Actual</b>
2013	54

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

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

O. No.	OUTCOME NAME
1	Peer reviewed journal articles, presentations at scientific meetings, articles in natural resource and environmental science magazines, presentations at stakeholder, Native American and agency meetings.
2	Determining Native Grasses Competitiveness Against Cheatgrass Invaded Rangelands
3	Developing Organizational Tools to Facilitate Riparian Restoration In The Walker River Basin

## **Outcome #1**

### **1. Outcome Measures**

Peer reviewed journal articles, presentations at scientific meetings, articles in natural resource and environmental science magazines, presentations at stakeholder, Native American and agency meetings.

Not Reporting on this Outcome Measure

## **Outcome #2**

### **1. Outcome Measures**

Determining Native Grasses Competitiveness Against Cheatgrass Invaded Rangelands

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

- 1862 Research

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

Change in Knowledge Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2013	0

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

#### **Issue (Who cares and Why)**

Restoration of cheatgrass invaded rangelands is among the largest management challenges in the Intermountain West. In an effort to reduce the conversion of native sagebrush steppe into annual communities, the Bureau of Land Management reseeds rangelands after fire at very large scales, seeding tens of thousands of acres per year in extreme fire years. These seeding efforts have mixed success. One factor that may affect the establishment of seeded species in invaded areas is the choice of seeds used in restoration. Earlier research has demonstrated that plants vary in their ability to tolerate competition with Cheatgrass. This research will compare the relative performance of native grasses, collected from field sites close to the area to be restored, with commercially-available seeds.

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

The team has conducted field plantings with native seeds, which were wild-collected, as well as commercially available seeds, which were screened for early-root growth characteristics by growing seedlings for 10 days in a greenhouse environment. Siblings of these seeds were planted back into their home site. Root characteristics strongly affected performance on squirreltail in Northern Nevada rangelands. Additionally, the team conducted collections of seeds

from 25 additional populations of native grasses and screened them for root characteristics. These were planted into five different sites in Fall 2013, and will be monitored for emergence and survival in 2014.

**Results**

Federal and state agencies are now beginning to recognize the importance of the evolutionary potential found in genetically diverse restoration material.

This research sheds light on how native plants can adaptively respond to cheatgrass competing, via phenotypic plasticity. In turn, this will allow restorationists to identify native plant populations that may become locally adapted to persist in the face of disturbance from Cheatgrass.

Ultimately, the results of this research will better inform restorationists of where to look for such locally adapted genotypes as plants from these locations can serve as a source of seed production and collection and thus the improvement of current restoration practices. Through the efforts and guidance of the project's principle investigator, the BLM Surprise Valley field office is now commissioning their own local adapted seeds for restoration projects in Northern Nevada.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
121	Management of Range Resources

**Outcome #3**

**1. Outcome Measures**

Developing Organizational Tools to Facilitate Riparian Restoration In The Walker River Basin

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

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

**Issue (Who cares and Why)**

Over the past decade numerous research projects have been conducted to restore the Walker River Basin. However, despite the highly collaborative nature of Walker Basin research to date, information resides in multiple laboratories and is not seamlessly integrated in the context of providing decision support for Walker Basin restoration. GIS-based decision support systems

have emerged as a method for allowing stakeholders to balance the needs of multiple competing interests while crafting management plans. There is need for integration of existing information into a functional database that may be accessed by multiple entities.

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

The team developed an integrated geodatabase of Walker Basin spatial information derived from various studies and compiled data sources. Next, the team built spatially-explicit data layers for habitat modeling of birds and invasive weeds to quantify ecologically based reference conditions for restoration of irrigated fields and riparian sites. Finally, an application was developed allowing researchers, managers, and the general public to access relevant data sources relating to Walker Basin ecosystem restoration.

#### **Results**

This decision support system uses a three step framework. First, assessing the condition of sites along the river. Next, gauging the feasibility of restoration. Finally, calculating the costs and benefits associated with restoration activities.

This spatial database begins to address the scientific basis for current and future decisions regarding ecological restoration and management of the Walker River Basin. Through the linkages of the spatial database to future conservation will help to identify gaps in our data and understanding that should prove useful for guiding future research.

Integration of spatial data sets with predictive models for a range of ecosystem attributes will help to prioritize locations most suitable for passive and active restoration and will provide a basis for assessing tradeoffs associated with particular restoration scenarios, with respect to diverse restoration goals.

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

<b>KA Code</b>	<b>Knowledge Area</b>
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife

#### **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**

The extreme weather conditions during last year's season delayed or greatly diminished some of the research projects being conducted at our various research centers and publicly owned lands, particularly related to rangeland restoration and invasive weeds. The ongoing economic challenges being faced by Nevada continue to affect this planned program area.

## **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.

- Leveraged over \$297K in extramural funds
- Trained 48 students and post-docs
- Native grass trials are showing great promise in out competing invasive weeds like cheatgrass.
- Building a multi-layered GIS database is helping to prioritize locations most suitable for passive and active restoration in the Walker River Basin

### **Key Items of Evaluation**

Development of geo-database as an organizational tool to facilitate riparian restoration in the Walker River basin.