

**V(A). Planned Program (Summary)****Program # 2****1. Name of the Planned Program**

Food Safety

 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%	
301	Reproductive Performance of Animals			5%	
302	Nutrient Utilization in Animals			10%	
303	Genetic Improvement of Animals			7%	
305	Animal Physiological Processes			5%	
306	Environmental Stress in Animals			5%	
307	Animal Management Systems			11%	
308	Improved Animal Products (Before Harvest)			5%	
311	Animal Diseases			15%	
315	Animal Welfare/Well-Being and Protection			7%	
503	Quality Maintenance in Storing and Marketing Food Products			5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			5%	
902	Administration of Projects and Programs			5%	
903	Communication, Education, and Information Delivery			5%	
	<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	73.2	0.0
Actual Paid Professional	0.0	0.0	56.3	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	395442	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	2755296	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	3163703	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

- Create databases accessible to researchers and producers to share research results readily available
- Distribute papers and research results at state nutrition conferences, field days, county meetings, and state conventions
  - Prepare research articles, fact sheets, and news releases for scientists and state media
  - Hold strategic planning meetings with state agricultural groups
  - Develop systems that ensure food safety and agricultural security
  - Integrate, where possible, best practices for beef quality assurance in programs

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

- State agencies, animal health companies, and state commodity groups
- Ranchers, seedstock industry, colleagues, and related stakeholders
- Crop and livestock producers in Montana
- Participants in extension and commodity group meetings, conventions, conferences, and field days
- State of Montana
- Montana Department of Agriculture, BLM, USFS, and other government entities
- Montana Stockgrowers Association and the Montana Department of Livestock

**3. How was eXtension used?**

COA and MAES researchers worked closely with county extension agents and outreach coordinators to disseminate timely and accurate information regarding the evaluation and procurement of food safety.

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

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2000	4000	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	45	0

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

**Output Target**

**Output #1**

**Output Measure**

- Number of research citations

Year	Actual
2013	45

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

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

O. No.	OUTCOME NAME
1	Identify critical infection and resistance processes
2	Number of ranches per year adopting enterprise management of animal health issues
3	Number of improvements to vaccines developed
4	Number of activities per year that prevent disease outbreaks or manage diseases of Montana livestock
5	Meetings that maintain or enhance Montana's presence in the production of quality meat products
6	Number of producers that participate in livestock tracking programs

## **Outcome #1**

### **1. Outcome Measures**

Identify critical infection and resistance processes

### **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)**

Identifying critical infection and resistance processes is immensely important to Montana's food producers. Providing detection, treatment and resistance for a variety of illnesses and diseases ensures that Montana's food exports are safe and meet standards for the global market, while assuring producers and patrons of a healthy and economically viable food source. Infection and resistance studies also provide a deeper understanding of human illness and their correlation and behavior with that of animal diseases.

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

Identified virulence factors and protective antigens among the cell surface proteins of horse pathogen *Streptococcus*, and identified new virulence factors among 13 uncharacterized cell wall proteins. Determined whether virulence factors identified in the primary objective are protective antigens, and the study expects to identify new projective antigens that can be included in a vaccine formulation for the development of an effective and safe strangles subunit vaccine.

#### **Results**

2013 research objectives included cloning DNA fragments on three target genes for inactivation of the target genes, successfully obtaining *Streptococcus equi* mutants for two of the three target genes, and have generated mutants for 12 of 13 target genes. The project compared virulence of four mutants with the parent strain using a mouse model of intranasal *S. equi* infection, and one of the mutant was significantly attenuated in virulence. Studying animal losses allows a deeper and active understanding of food safety.

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

<b>KA Code</b>	<b>Knowledge Area</b>
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303	Genetic Improvement of Animals
305	Animal Physiological Processes
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection
903	Communication, Education, and Information Delivery

## **Outcome #2**

### **1. Outcome Measures**

Number of ranches per year adopting enterprise management of animal health issues

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

- 1862 Research

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

Change in Condition Outcome Measure

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

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

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

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

Consumers are increasingly demanding more information about their food products. Producers are therefore working to track their livestock from conception to consumption. Producers are focusing on genetics, disease identification and prevention, and better feed management systems. MSU studies help ensure Montana producers raise safe beef while improving the quality.

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

MSU investigators education and research programs allowed producers to document best management practices for raising and marketing calves. The program provides quality assurance certification, implements and documents bio-security plans on ranches, and provides informational outreach. Sheep and wool producers continued using targeted grazing to increase the competitiveness of Montana lamb and wool in the world market.

#### **Results**

During legislative testimony producers repeatedly shared the impact COA/MAES research had on their operations and how new technologies were saving money and increasing agricultural product quality.

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

<b>KA Code</b>	<b>Knowledge Area</b>
121	Management of Range Resources
301	Reproductive Performance of Animals
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection

### **Outcome #3**

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

Number of improvements to vaccines developed

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

- 1862 Research

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

Change in Condition Outcome Measure

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

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

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

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

Animal losses due to environmental stresses, disease, and death create the need for an improved understanding of factors affecting Montana livestock. Infectious disease continues to cause considerable losses to livestock producers by reducing production and by reduced sales because of food safety concerns. Disease outbreaks are closely monitored in Montana to ensure quality and disease-free animals are shipped to other states.

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

Research was conducted on the bovine gamma/delta T cells using functional, biochemical and molecular approaches, which clarified the general understanding of the bovine immune system and how it is similar and dissimilar to the immune system in rodents and humans. This information facilitates the development of new approaches to treat infectious diseases of cattle.

##### **Results**

The direct impact of this work is a general understanding of animal immune systems and their responsive health to new improvements to vaccine development. This discovery and research affects the fields of food animal production and food safety. Several producers expressed appreciation for the alert and pro-active action taken by MSU and the state livestock department.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection
903	Communication, Education, and Information Delivery

#### Outcome #4

##### 1. Outcome Measures

Number of activities per year that prevent disease outbreaks or manage diseases of Montana livestock

##### 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)**

Animal losses due to environmental stresses, disease, and death create the need for an improved understanding of factors affecting Montana livestock. Infectious disease continues to cause considerable losses to livestock producers by reducing production and by reduced sales because of food safety concerns. Disease outbreaks are closely monitored in Montana to ensure quality and disease-free animals are shipped to other states.

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

Research centered on the use of forage nutrient analysis and the application of the analysis results as risk management for beef cattle producers, and understanding the quality of harvested forages is critical to building a cost-effective feeding plan.

###### **Results**

MSU researchers and Montana Department of Livestock researchers formed a taskforce to address this concern and develop strategies for vector mitigation. Through a series of conference calls, they developed recommendations and shared the information with Montana public.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
121	Management of Range Resources
305	Animal Physiological Processes
307	Animal Management Systems
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
903	Communication, Education, and Information Delivery

#### Outcome #5

##### 1. Outcome Measures

Meetings that maintain or enhance Montana's presence in the production of quality meat products

##### 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)**

Quality meat production is critical for producers, processors, and consumers. Educational programs geared toward specific audiences enhance food safety awareness and increases the quality of meat products produced and processed in Montana.

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

An MSU professor and beef cattle specialist administered the Steer of Merit program, providing feedback on youth beef cattle projects for youth, parents, beef cattle producers, and county agents. The state Steer of Merit Committee meets annually to set industry-reflective standards for the following fair season.

###### **Results**

Two professors redesigned a university course in the Animal and Range Sciences Department to include social and video media. They incorporated agriculture and range science advocacy training into the course, which has allowed a broad audience to have access to advocacy materials.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
121	Management of Range Resources
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
305	Animal Physiological Processes
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
315	Animal Welfare/Well-Being and Protection
503	Quality Maintenance in Storing and Marketing Food Products
902	Administration of Projects and Programs
903	Communication, Education, and Information Delivery

**Outcome #6**

**1. Outcome Measures**

Number of producers that participate in livestock tracking programs

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

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

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

**Issue (Who cares and Why)**

USDA has encouraged livestock tracking programs for producers as a national effort to mitigate transmission of disease and track animals if there is a disease outbreak.

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

MSU researchers evaluated electronic identification tags and are now emphasizing DNA tracking in the sheep and cattle industry. MSU hired two faculty members in 2012 to enhance DNA and genetics management and a rumen micro-biologist. At the Northern Agricultural Research Center researchers evaluated 276 replacement heifers and developing bulls through the GrowSafe System. Reproduction, longevity and RFI are evaluated and the data will be used for long-term tracking and monitoring of the livestock.

#### **Results**

Through the use of EID tags producers are receiving carcass information and sometimes even feedlot information, allowing them to identify production characteristics for their herd and for individual bloodlines beyond typical ranch production traits. This information allows producers to position their production for the future and identify specific markets that fit their product.

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

<b>KA Code</b>	<b>Knowledge Area</b>
315	Animal Welfare/Well-Being and Protection
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
903	Communication, Education, and Information Delivery

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

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

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Public Policy changes
- Government Regulations

##### **Brief Explanation**

MSU COA and MAES experienced significant faculty movement impacting this planned program, and several programs with remaining research goals have migrated with the principal investigators and their respective projects, outlined in the 2012 and 2013 Plan of Work.

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

##### **Evaluation Results**

Montana has 2.5 times more cattle than people providing the foundation for the number one industry in the State - agriculture. It is in this context that researchers design, implement, and conduct research projects within the COA/MAES. Research in the Animal Health Program is critical to the industry in Montana and producers and consumers alike who count on the investigators to promote a healthy industry through their consistent research. Highlights for 2013 were:

- Advancements in knowledge of Staphylococcus Aureus in humans and livestock
- Hired new faculty members, two of which are core users of new molecular tools
- Evaluated 256 animals through the GrowSafe system and added new equipment to MSU research center doubling the capacity of researchers to evaluate residual feed intake
  - Conducted webinars, workshops, and seminars to share up-to-date information on animal health and quality assurance reaching audiences in excess of 2,500

### **Key Items of Evaluation**

The Animal Bioscience Building combined with state-of-the-art laboratory equipment assisted in the successful recruitment and hiring of three new faculty members in the Animal and Range Sciences Department for the College of Agriculture. The new faculty include a beef geneticist, a range ecologist, and a rumen microbiologist. The College also purchased an Illumina MiSeq and is using it to help members of the Crow Indian Reservation identify sources of antibacterial resistant E. Coli. A collection of biting flies (mosquitos and midges) have been collected for disease collection specifically for the knowledge for livestock producers. A model product was produced used for estimating environmental concentrations of insecticides used for adult mosquito management. Educational aids and curricula were produced on adding value to beef cattle, these materials were presented 23 times to a total of 1,261 constituents in the North West region of the United States. Presentations for this program included state and agricultural extension agents, financial advisors, local business leaders and beef cattle and forage producers. Finally, data and research material was produced on a study regarding the commonality of S. aureus in the anterior nares of horses.