

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Climate Change

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
101	Appraisal of Soil Resources			10%	
102	Soil, Plant, Water, Nutrient Relationships			13%	
111	Conservation and Efficient Use of Water			10%	
121	Management of Range Resources			16%	
122	Management and Control of Forest and Range Fires			5%	
132	Weather and Climate			5%	
136	Conservation of Biological Diversity			12%	
201	Plant Genome, Genetics, and Genetic Mechanisms			12%	
216	Integrated Pest Management Systems			12%	
903	Communication, Education, and Information Delivery			5%	
	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	55.6	0.0
Actual Paid Professional	0.0	0.0	69.1	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	778006	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	3749252	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	2806312	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Develop new crops and cultivars suitable to a warmer and drier climate
- Explore the ecological impact of climate change on Montana wildlife habitats and grazing areas
- Study the impact of a changing climate on insects
- Develop and enhance pest management programs
- Continue investigating crops and management systems that rely on less water consumption
- Complete 10 year carbon sequestration research project

2. Brief description of the target audience

- Crop and livestock producers in Montana
- State agricultural advisory committees
- State of Montana, Montana Department of Agriculture, BLM, USFS, and other government entities
- Participants in extension and commodity group meetings, conferences, and field days

3. How was eXtension used?

Information generated from research resulted in a riparian rehabilitation guide for private and public land managers. Seven hundred copies were distributed to Cooperative Extension Agents and Conservation District Coordinators in Blaine, Hill, Phillips and Valley Counties. Distribution was followed with three workshops to introduce the guide and explain its use in rehabilitating degraded riparian areas. Completion of a second study has supplied foundational material for the revision of the USDA NRCS Technical Guide TR 1737-15 1998. Proposed revisions were submitted to the regional review team.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2500	5000	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	5	34	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of research citations

Year	Actual
2013	34

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of new drought tolerant crop recommendations (or changes) for Montana
2	Number of carbon sequestration technologies explored

Outcome #1

1. Outcome Measures

Number of new drought tolerant crop recommendations (or changes) for Montana

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)

Climate change models suggest earlier and more rapid spring runoff in the middle and northern latitudes of Asia, Europe and North American by 2035. This translates into fewer riparian ecological services and diminished late season flows. Because these reductions competition among irrigators, municipalities and wildlife conservation for the remaining water will escalate. Damn construction will meet considerable resistance because of further loss of riparian ecological services.

What has been done

Found a clearer picture of the potential for possible impact from heavily stocked shrub stands on phreatic groundwater recovery following thinning of adjacent conifer stands, and establish a treatment target level of sagebrush stands that enhances groundwater recovery without sacrificing wildlife habitat productivity. Drafted supportive information for future development of a proposal to describe the impact of climate change on wood plant dominated ecosystems in Idaho, Montana, Nevada, Oregon, Washington and Wyoming.

Results

Quantified the amount of dietary quality of forbs and grasses in the pre-treatment drainages in a measurement of amount of forage produced in 2013. Produced planned reduction of 32% of the existing shrub canopy in four of the treatment drainages. This information can serve as a landscape management goal for wildlife biologists writing habitat recovery plans for the Greater Sage Grouse in southwestern Montana.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Number of carbon sequestration technologies explored

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)

MSU researchers are interested in learning more about nutrient management and cycling in Montana soils and the potential of soils to sequester carbon in response to changes in cropping system practices. As no till cropping systems increase many growers no longer use intensive tillage practices to control weeds during fallow phases. The potential impacts of this research may become critical to Montana's agricultural community should trading of C credits become mandatory for carbon dioxide emitting industries in the United States.

What has been done

The ultimate goal is to characterize carbon cycle science through global surface flux observations and model syntheses and land-atmosphere interaction. Project includes exploring the variation of soil processes at the landscape scale, using natural and human induced gradients to study atmospheric deposition to soils, disturbance effects on soil function, and the contribution of weathering processes to surface water chemistry in small catchments.

Results

Great progress has been made in documenting the quantity of soil carbon, including Montana, through federal programs such as the Rapid Carbon Assessment program. Understanding of the process that dominate soil carbon turnover has been improved recently. Progress made on this project focused on understanding a process-based understanding of dominant controls over soil carbon turnover rates, and developing plans for a synergistic and hands-on learning opportunities for students and community stakeholders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
132	Weather and Climate
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

External factors which affected the outcomes included:

- A new faculty member added to the program within the last two years
- Inadequate funding and technical support from partnering institutions and cooperators
- Inadequate moisture (rainfall, irrigation, snowpack) for consistent crop production
- Lack of full-time staff and part time assistant
- Major interruptions in program development

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation studies were successful through the issuance and collection of surveys, published peer reviewed materials and securing peer reviewed grants. Notable evaluation results:

Researchers disseminated the results to the agricultural community at grower meetings, Certified Crop Adviser meetings, industry conferences, and MAES field days. They also shared the information with agricultural professionals at the American Society of Agronomy National meetings. The investigator developed a web site to keep growers, agricultural consultants, and other interested parties up-to-date on the progress of various studies.

Results of a long-term study on linking upland plant community structure and riparian processes resulted in a riparian rehabilitation guide for private and public land managers. Experts in the riparian processes distributed 700 of the guides in four Montana counties and hosted several workshops to explain how to rehabilitate degraded riparian

areas. A new website was developed and is used to forecast spring and winter wheat basis in various Montana locations and can be found at <http://wheatbasis.montana.edu>.

Key Items of Evaluation

- MSU COA researchers advanced crop options for a warmer and drier climate:
- Developed two new spring wheats varieties called "WB9879CLP" and "Silver" durum
 - A winter wheat, "SY Clearstone"
 - Increased planting of "Vida," a drought resistant variety of spring wheat which was the top choice for growers in 2011 and 2012
 - Researchers developed and shared new knowledge about carbon sequestration
 - Created a riparian rehabilitation guide
 - Furthered research helping forests and rangelands with emphasis on whitebark pine and sage