

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Energy and Natural Resources

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	15%			
112	Watershed Protection and Management	10%			
121	Management of Range Resources	10%			
123	Management and Sustainability of Forest Resources	15%			
135	Aquatic and Terrestrial Wildlife	10%			
136	Conservation of Biological Diversity	10%			
605	Natural Resource and Environmental Economics	10%			
723	Hazards to Human Health and Safety	10%			
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%			
	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	3.4	0.0	0.0	0.0
Actual Paid	1.3	0.0	0.0	0.0
Actual Volunteer	0.5	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
22577	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
37676	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

MSU Extension agents and specialists work one-on-one with producers, landowners and consumers to identify and address unique problems and solutions related to energy and natural resources. They conduct workshops, trainings, group discussions, field tours, demonstrations and site visits that address specific topics such as forest stewardship and water quality. MSU Extension partners with local and state associations and organizations that are concerned about natural resource issues. MSU Extension organized the Montana State University president's annual bus tour, this time going through the eastern part of the state and spending three days learning about Montana's energy and natural resources industries.

2. Brief description of the target audience

- Private forest land owners and public land managers
- Farmers/Ranchers/Ag Producers
- Small acreage Landowners
- Professional loggers/foresters/rangeland managers
- Environmental scientists
- Community leaders
- State economists

3. How was eXtension used?

Specialists regularly answer questions submitted via eXtension's "Ask an Expert." Agents and specialists advertise programs and utilize evaluation tools and methods from eXtension. The Livestock and Poultry Environmental Learning Center (COP) is a major collaborator and partner in state and national outreach on issues related to sustainable livestock systems and related water quality, waste water, clean water act regulation and other similar issues.

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	8247	52871	367	8785

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	32	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Forestry: Number of private forest owners and managers who participate in and successfully complete meetings/workshops/clinics aimed at forest stewardship. Number of landowners and managers who have forest stewardship plans and actively implement them.

Year	Actual
2014	3515

Output #2

Output Measure

- Water Quality: Number of people attending Well Educated programs, who track water quality, regularly test their wells and receive information on how to help protect ground water resources. Number of people attending workshops and seminars to learn about watersheds and environmentally sustainable best practices.

Year	Actual
2014	3061

Output #3

Output Measure

- Energy Efficiency and Alternatives: Number of consumers, landowners and industry professionals utilizing resources created and/or consolidated by MSU Extension's E3A program. Number of people successfully completing E3A trainings.

Year	Actual
2014	11

Output #4

Output Measure

- Natural Resource Development: Number of workshops and resources provided to assist landowners with leasing of mineral and water rights and other legal issues related to development. Number of collaborations with industry, agriculture and community leaders in eastern Montana.

Year	Actual
2014	200

Output #5

Output Measure

- Rangeland health. Provide invasive plant education.

Year	Actual
2014	1600

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Forestry: Increased number of private forest owners who have and implement forest stewardship plans that allow them to continue to provide economic, environmental and social benefits to Montanans. Increased number of people who gain knowledge about forestry management and sustainability issues and contribute to forest health through personal responsibility.
2	Water Quality: Increased number of homeowners regularly testing their wells and managing them for safe consumption and environmental soundness. Increased number of Montanans who utilize online Extension and other resources related to watershed protection, drinking water safety and other water quality topics.
3	Energy Efficiency and Alternatives: Increased number of consumers accessing and utilizing E3A resources and training to improve efficiency, reduce environmental impacts and lower costs.
4	Natural Resource Development: Increased number of collaborations with partners in eastern Montana as a result of the Bakken Oil Field and related issues. Increase in the number of landowners who are educated and able to make sound decisions about their water and mineral rights.
5	Rangeland Health. Increase the knowledge and practices of landowners and managers related to invasive plants.

Outcome #1

1. Outcome Measures

Forestry: Increased number of private forest owners who have and implement forest stewardship plans that allow them to continue to provide economic, environmental and social benefits to Montanans. Increased number of people who gain knowledge about forestry management and sustainability issues and contribute to forest health through personal responsibility.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	3484

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Montana's wood products industry contributes \$500 million to Montana's economy annually. Private family lands (20% of forested acreage) supply 35-50% of the harvested wood. Federal lands make up 65% of Montana's forested acreage and state lands, less than 5%. To maintain forested landscapes for wood products, water quality, wildlife habitat and recreation, MSU Extension offers educational and training events for all landowners and managers. Extreme cold events, summer heat and severe winds present challenges for soil conservation; livestock well-being; farm and ranch heating and cooling costs; and range health across Montana. Windbreaks, shelterbelts and community trees are an important asset.

What has been done

Four week-long and five one-day workshops on Forest Stewardship were provided. More than five new publications with topics ranging from tree pruning to biomass markets were created and disbursed and a 28 page Montana Family Forest News magazine was mailed to 6,000+. Four one-day workshops on management, field operations and GPS mapping were provided for the Montana Logging Association. Two workshops were provided for local business owners. Nine half day workshops on windbreak establishment and renovation were offered across central and eastern Montana. Nine workshops were provided for school and early childhood program teachers. The annual week-long Montana Natural Resources Youth Camp was held for teens. Produced 240 Forestry Minutes for radio with listenership of 25,000.

Results

MSU Extension Forestry redesigned its web page generating 2848 users and 12,381 page views

over 4250 sessions. Users downloaded 1,882 PDF files, 186 Word documents and 43 Power Point presentations. You-Tube videos were viewed 396 times over 7,144 minutes or 119 hours. Nine mini-college presentations were viewed over an additional 501 minutes. 122 forest landowners completed more than 80 forest management plans for 12,281 acres with additional plans for another 4,000 acres still pending. Extensive education and outreach throughout 2014 resulted in long-term change in condition outcomes in Lewistown. A new Tree Board was established and a city ordinance passed to better manage boulevard trees. \$52,500 was raised through grants and donations. Twenty-seven fruit trees and 15 berry bushes were planted in public orchards, 26,000 tree seedlings were distributed to private landowners and 50 trees were planted in parks and other public areas. This illustrates how MSU Extension and local communities can partner to develop healthy urban forests.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

Water Quality: Increased number of homeowners regularly testing their wells and managing them for safe consumption and environmental soundness. Increased number of Montanans who utilize online Extension and other resources related to watershed protection, drinking water safety and other water quality topics.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	3061

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Montana has 60,000 miles of perennial streams which provide irrigation, drinking water and recreation. Approximately 45 percent of those streams are listed as impaired. Non-point sources

of pollution cause most of the impairment which is an issue everyone plays a role in. To improve management, the general public must understand that their actions have an impact and make decisions that mitigate damage. Nitrate concentrations in groundwater are on the rise in many areas of Montana and in the Judith River watershed, 15 to 25 percent of shallow wells exceed EPA drinking water standards. Private well owners with high nitrates are drinking contaminated water, buying bottled water or using reverse osmosis (\$1500/per unit) and farmers are losing millions of dollars in nitrogen loss.

What has been done

MSU Extension Water Quality (MSUEWQ) works with county partners and agencies to engage citizens in data collection to understand surface and groundwater issues. MSUEWQ works with eight watershed groups on surface water monitoring programs and more than 31 counties on groundwater testing through the Well Educated Program. In 2014 MSUEWQ began work with MSU Facilities Services to understand impacts on Mandeville Creek flowing through campus, piloting methods to be applied in other municipal watersheds. MSUEWQ is working with researchers from MSU and Utah State University to engage farmers of Judith Basin and Fergus counties in a participatory research project to better understand sources of nitrate in groundwater and farming practices effective at reducing leaching.

Results

The Madison Stream Team (MST) created by MSUEWQ and the local conservation district in 2010 has become a critical civic engagement partner for MT Dept. of Environmental Quality as they make plans for the watershed. MST is working toward piloting public monitoring methods initiated by MSUEWQ on Mandeville Creek through MSU Campus. In the Judith River watershed, research in the past two years has documented advantages of replacing fallow with pea. In this area, soil mineralization processes tend to produce as much available nitrate in the soil as added fertilizer. Since no fertilizer is added and no crops are using the available nitrogen, all the nitrate level growth in fallow fields comes from decomposing organic matter and nitrate conversion. Peas use soil nitrate before fixing their own from the atmosphere. When enough rainfall occurs to saturate soils, leaching occurs, moving nitrate from soil into groundwater. Fallow soils have higher moisture and nitrate levels and therefore the strongest potential for leaching. Project leaders are now working to broadly educate and inform locals about these findings, and to determine perceptions that might affect adoption of best practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Energy Efficiency and Alternatives: Increased number of consumers accessing and utilizing E3A resources and training to improve efficiency, reduce environmental impacts and lower costs.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	11

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

E3: Economy, Energy and the Environment is a coordinated federal and local technical assistance program that focuses on sustainability by providing custom, hands-on assessments of production processes. Montana is leading the nation by piloting the E3 framework with agricultural producers.

What has been done

Ten MSU Extension agents, who already have trusted relationships in their counties, are trained to complete assessments that identify opportunities and provide recommendations to reduce energy consumption, increase productivity, minimize carbon footprint and drive innovation. An E3 Assessment assists producers with maximizing energy savings and ensures eligibility for state/federal funding programs to help implement the recommendations. This program is early in its development so impacts aren't yet available.

Results

A website has been created for E3A, as well as for E3 in Montana Agriculture: www.E3A4U.info or www.e3.peakstoprairies.org. The goal is to ensure that by participating in E3, Montana's agricultural producers are in the best position possible to maximize available financial opportunities to implement E3 recommendations. This means that upon completion of the assessment, the producer will be eligible for USDA grant and loan opportunities, as well as other programs from E3 federal partners.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #4

1. Outcome Measures

Natural Resource Development: Increased number of collaborations with partners in eastern Montana as a result of the Bakken Oil Field and related issues. Increase in the number of landowners who are educated and able to make sound decisions about their water and mineral rights.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the Montana Department of Commerce, Montana has more potential for energy development from existing and untapped diversified sources than any other state. From coal and oil deposits, to wind farms and geothermal energy, potential energy resources play a vital role in Montana's future, just as natural resources have been a significant part of Montana's past. Montana State University strives to prepare a workforce that can meet these needs, as well as invested leaders who are committed to quality-of-life issues in changing communities.

What has been done

During June of 2014, MSU Extension coordinated a three-day bus tour through eastern Montana on behalf of Montana State University's president, Waded Cruzado. Participants on the Follow the Energy Tour included all of MSU's vice presidents, deans and senior leadership, a state senator and some alumni. They visited the Northern Cheyenne and Crow reservations (very different perspectives on energy development), as well as Baker, Glendive, Sidney, Miles City and all towns in between. Agents in each county shared their unique stories along the way. The group visited Denbury Resources, Nabors Well Servicing Yard, the Southern Ag Research Center and the CHS Refinery.

Results

Exact results are difficult to quantify, but the impact of having this influential group take an extended leave from campus to spend three days on a bus traveling 1000 miles to small towns, community gatherings, private businesses and cultural places including the Little Big Horn Battlefield was significant. They learned about housing and infrastructure challenges and strategies in anticipation of a potential boom from the Keystone pipeline. They heard passionate testimony about social issues in the Bakken from a panel of experts from schools, churches, and community organizations in Sidney. They heard directly from a dozen Extension field faculty as they discussed the impacts of energy development on agriculture and education and about their needs and the opportunities that might be available for partnering in their communities. It was a comprehensive overview that may lead to solid collaborations, but gave senior MSU leadership a comprehensive view of Extension and the issues in the eastern part of Montana.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #5

1. Outcome Measures

Rangeland Health. Increase the knowledge and practices of landowners and managers related to invasive plants.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1600

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Invasive plants have become established on portions of range and wild lands throughout Montana. Many of these plants are listed as state and county noxious weeds, suggesting they have been deemed problematic by stakeholders, including the state Department of Agriculture, county weed districts, private producers and public land managers. The ecological impact of invasive plants includes altered structure, organization and function of rangeland plant

communities. Economically, weeds impact rangeland more than all other pests combined, including billions of dollars spent on control and reduction in livestock; and wildlife habitat. Knowledge of weed biology and ecology can be used to implement sound integrated management methods that mediate these impacts.

What has been done

One specialist conducted 34 presentations all across Montana, held a three-day weed management workshop, answered over 200 phone calls and emails, appeared on Montana Ag Live five times, distributed monthly weed posts, produced a Montana grass identification app for mobile devices and created two Extension publications. These efforts helped inform Extension agents and other professionals in all areas of the state. One-on-one interventions and local interactions occurred in all counties to connect the most current information with landowners and managers, potentially impacting the 70 percent of Montana's land that is designated as rangeland.

Results

Stakeholders who use Extension resources have an improved understanding of the biology, ecology and management of invasive plants on Montana range and wild lands and are better managers of their property, thus limiting ecological damage and decreasing monetary costs due to loss of forage and habitat. One project underway is investigating ways to refine re-vegetation of weed-infested rangeland through integrated management of two rangeland weeds: downy brome (cheatgrass) and tall buttercup. Through this project, Extension screened target and non-target effects of a grass seed pathogen that may be used to manage downy brome, and have determined that non-target effects can be mitigated with a fungicide treatment. The project has refined best practices for the application of the herbicide imazapic for controlling downy brome and increased knowledge of how soil moisture influences tall buttercup seedling success. These and related projects have resulted in two published journal articles, one thesis/dissertation, 10 conference papers and presentations at seven professional meetings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

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 Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Natural resources are greatly impacted by factors beyond human control, leaving those who depend on these resources challenged to develop flexible management plans that ensure resiliency, viability and profitability.

Accelerated growth in eastern Montana presents many challenges and opportunities which are and will continue to be affected by national and state government policies, funding for energy development issues, taxation policies and more. These rapid changes result in a great need for Extension to provide science-based resources and facilitate community and leadership development to mitigate political and social impacts.

Other external factors include the retirement of the housing specialist and director of the Montana Weatherization Center.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program was successful in meeting goals including:

- Increased awareness and knowledge of landowners, service providers and managers on core and emerging natural resource topics.
- Increased awareness by volunteers about their impact on local watersheds.
- Increased knowledge of homeowners who test and manage their wells

MSU Extension moved to an entirely new planning and reporting system during 2014. The system, along with extensive training, is improving planning, evaluation and reporting methods, though the transition has been a challenge.

Key Items of Evaluation

- The community of Lewistown raised \$52,500 for urban forestry projects. They planted 27 fruit trees, 15 berry bushes, and 50 trees in parks and boulevards and distributed 26,000 tree seedlings to private landowners.
- Research in the Judith River Basin is leading to better practices for limiting nitrate leaching that is causing millions of dollars in loss of nitrogen for farmers, and economic costs for residents who have to buy safe drinking water or reverse osmosis systems.

- A website has been created and results will be posted that show impacts of the E3: Economy, Energy and the Environment program.
- Research is underway to determine the best ways to refine re-vegetation of weed-infested rangeland through integrated management of downy brome (cheatgrass) and tall buttercup.