

2017 Montana State University Combined Research and Extension Plan of Work

Status: Pending Acceptance

Date Submitted: 03/31/2016

I. Plan Overview

1. Brief Summary about Plan Of Work

The Montana Agricultural Experiment Station (MAES) and Montana State University Extension are pleased to present this joint Plan of Work for 2017-2021.

MAES's mission is to "generate and disseminate superior knowledge and technological solutions to increase the competitiveness of communities capturing value from Montana's agricultural and natural resources, preserve environmental quality, and improve the quality of life for all our citizens."

MSU Extension's mission is to "improve the lives of Montana citizens by providing unbiased research-based education and information that integrates learning, discovery and engagement to strengthen the social, economic and environmental well-being of individuals, families, and communities."

For more than 100 years, MAES and Extension professionals have worked closely together and collaborated with the people of Montana to address problems with practical solutions and to proactively look forward to a better quality of living and improved future. This is an effective and harmonious partnership that will continue in the next five years and beyond.

Montana is home to eight land-grant institutions, the most of any state in the nation. Of the eight, only Montana State University, which includes MAES through the Hatch Act and Extension through the Smith-Lever Act, is part of the original Morrill Act of 1862. The other seven are tribal colleges that received land-grant designation through the Elementary and Secondary Education Reauthorization Act of 1994. These institutions and their tribal affiliations are; Anaiih Nakoda College (Gros Ventre and Assiniboine), Blackfeet Community College (Blackfeet), Chief Dull Knife College (Northern Cheyenne), Fort Peck Community College (Sioux and Assiniboine), Little Big Horn College (Crow), Salish Kootenai College (Bitterroot Salish and Pend d'Oreilles) and Stone Child College (Chippewa-Cree). Having eight land-grants is a growing point of pride for Montana as there are increasing numbers of partnerships that create comprehensive connections among them and elevate all citizens through the tripartite mission of research, education and outreach.

The 1994 tribal colleges serve primarily American Indian populations located in remote, under-served communities that otherwise lack access to higher education. They are critically important to the people they serve and include culturally relevant curriculum and programs that strengthen community pride and enhance cultural and historical identity. In addition to adopting the land-grant mission in 1994, five of the reservations also partner with MSU Extension, through the Federally Recognized Tribes Extension Program (FRTEP). The Blackfeet, Flathead, Fort Belknap, Fort Peck and Northern Cheyenne reservations all have Extension agents who live and work in the community and perform duties much like county agents.

Each of the seven 1994 institutions is found on a unique Montana reservation. These are: Blackfeet, Crow, Flathead, Fort Belknap, Fort Peck, Northern Cheyenne, and Rocky Boy. The seven reservations collectively span nine percent of Montana's land and include 12 federally-recognized sovereign tribal

nations. These are; Assiniboine, Blackfeet, Chippewa, Cree, Crow, Gros Ventres, Kootenai, Little Shell, Northern Cheyenne, Pend D'Orielle, Salish, Sioux. The reservations are sovereign and tribal governments establish services for their citizens. There are also many Indian people who live off-reservation in communities across Montana.

The Montana constitution, created in 1972, includes, in Article X, section 1(2), this language, "The state recognizes the distinct and unique cultural heritage of the American Indians and is committed in its educational goals to the preservation of their cultural identity." In 1999, the Montana Legislature passed the "Indian Education for All" law as a way of being more intentional about fulfilling this constitutional obligation (§ Mont. Code Annotated 20-1-501). Every public agency, and all educational personnel are called to work cooperatively with Montana tribes when providing instruction and implementing educational goals, and to include information specific to the cultural heritage and contemporary contributions of American Indians.

The MSU College of Agriculture (COA), MAES and Extension cooperatively design and implement programs that best align with Montana's sovereign Indian Nations. Because this demographic is largely underserved and underrepresented, programs and goals are targeted to generate strong and beneficial interactions regarding Montana reservation struggles, priorities and needs. MAES and Extension work with tribal councils and colleges across the Rocky Mountain region, and agents and educators provide a variety of academic programs and opportunities within tribal communities. Cooperative efforts provide resources and training in livestock management, childhood obesity, food preservation and safety, pasture restoration, environmental stewardship, sustainable agricultural practices, resource and risk management, pesticide certification and more. American Indians and other minorities are regularly invited and participate in MAES and Extension programming not located on reservations or targeted toward tribal needs. Cultural sensitivity and inclusiveness is a priority for all COA, MAES and Extension programming.

COA, MAES and Extension look forward to deepening trust and productive relationships with our 1994 land-grant counterparts. In the years ahead, Montana intends to become a state model of positive relationships that speak to the research and programming potential when 1862 and 1994 institutions are synergistic and collaborative in nature.

Determining research, teaching, outreach and engagement priorities and how to distribute limited resources has always been conducted in close relationship with stakeholders. Extension and MAES work cooperatively with individuals, families, businesses, state and federal agencies, tribal leadership and non-profit organizations through focus groups, community meetings and one-on-one visits held regularly throughout the state to identify the greatest needs that can be addressed. MAES and Extension laboratories include formal classrooms, farms and ranches, town hall buildings, greenhouses, fields and forests.

There are seven agricultural research centers and two USDA-Agricultural Research Services facilities located across Montana. MSU Extension has 92 agents and 32 specialists living and working in more than 60 offices and communities statewide, including the five FRTEP agents mentioned above.

The COA provides further strength to the combined efforts with modern facilities, world-class faculty and growing undergraduate and graduate enrollment. Being part of the fabric of Montana's communities and counties allows MAES, Extension and COA to fully engage with communities through multi-disciplinary, collaborative efforts that address both long-term concerns and emerging needs.

Agriculture continues to be Montana's primary economic industry and is part of the heritage and culture of the state. In 2015, approximately 27,800 agricultural operations and 59,700,000 acres are operated, covering more than 66 percent of Montana lands. Montana's top five commodities are wheat, cattle/calves, barley and pulse crops (beans, peas, lentils, etc.) and hay. Additionally, Montana ranks

second in the U.S. in acres devoted to agricultural enterprises, with crop and livestock cash receipts that exceed \$3 billion annually. According to 2015 Montana Agricultural Statistics, published by the Montana Department of Agriculture and the US Department of Agriculture, the total value of agricultural sector production was \$4.2 billion in 2012. USDA statistics show that Montana planted 5.8 million acres of wheat in 2015, with 2.2 million acres of spring and winter wheat varieties developed by MAES. MSU wheat varieties accounted for approximately \$500 million of \$1.2 billion wheat sold by Montana farmers in 2015. Some wheat varieties developed by MSU are sold by private companies. Montana exports 20 percent of agricultural products as foreign exports and 75 percent of its wheat to Asian markets.

Montana also plays a key geographic role as the site of the headwaters for the Missouri, Yellowstone and Columbia Rivers with a growing tourism industry. It has also experienced significant growth recently as a result of Bakken Oilfield development. While Montana remains committed to agriculture, it is also keenly tied to tourism and the recreational activities centered on waterways and scenic outdoors, and on the responsible use of abundant natural resources.

The continental divide runs north to south through the state and the rugged mountains often impact weather patterns resulting in very different conditions between the eastern and western parts of Montana. The average frost free zones vary from 30 days to 125 days depending on location and altitude. Weather plays a key role in crop selection and production in Montana. Researchers are also concerned about areas where diminished water resources place constraints on crop growth, and the impact of rising timberlines on range and croplands.

Knowing that changes in the climate will impact agriculture, faculty at the COA, MAES and Extension are exploring new varieties of crops and continuing to introduce new varieties of barley and wheat. Investigators expect barley, one of the most durable cereal crops, to perform exceedingly well in a drier, warmer climate. They are also exploring the vegetation and microbes growing in the thermal pools of the Yellowstone ecosystem. By studying the mechanisms of growth to native plants in geothermal-modified soils they gain a better understanding of limitations and opportunities increasing temperatures may present in agricultural production. The changing climate has significantly impacted Montana insects, which in turn impact the ecosystem. Researchers are studying the biology, distribution and systematics of insects.

COA, MAES and Extension are committed to helping reduce food-borne illness and assisting producers in providing a safer food supply. Consumers are demanding healthier, safer food, free from harmful chemicals and pesticides, and the global market is driving industry changes with constraints on grain and animal products.

Maintaining profitable enterprises while sustaining ecological systems has become a complicated balancing act that often becomes politically influenced. MAES, Extension and the COA are highly regarded for delivering non-biased, science-based solutions in these and other highly politicized areas.

In addition to helping constituents maintain profitable enterprises, COA, MAES and Extension actively work to support and encourage new agricultural and other small businesses. Sustainable agriculture is not just about soil pH or a commodity price--it takes a farmer, too. The average age of farmers across the United States is increasing (e.g., <http://harvestpublicmedia.org/changinglands>). Census data (1992-2012) show that even as the total number of farmers increased 23 percent to 28,000 across Montana, the three largest demographic shifts occurred for farmers 35-44 years of age (-12%), farmers 55-64 years of age (+10%), or farmers older than 65 years of age (+9%). Over the same timeframe, the youngest farmer cohort (<35 years of age) dropped five percent. Through education and outreach, faculty work to reverse these trends and encourage agricultural entrepreneurship.

COA, MAES and Extension faculty conduct research, integrated with teaching and outreach, to enhance economically viable and sustainable agricultural systems relevant to agriculture and producers in

Montana with globally transferable solutions. The research focuses on issues and concerns relevant to fields traditionally outside agricultural parameters, but which involve similar advanced knowledge acquisition such as cancer research and energy development. They focus on interdisciplinary studies with far reaching impacts in science, technology, energy consumption, food security, safety and hunger.

Through collaborative research projects and cooperation with rural, urban, and scientific communities, MAES and Extension faculty continue learning as they focus on diversity and efficiency in agricultural and allied industry operations that bolster Montana's economy. The tripartite approach between MAES, Extension and the COA demonstrates a commitment to leading the way toward being better stewards of our natural resources, and creating and maintaining effective programs that seek to develop intellectual and human capital across generations.

In addition to an agricultural focus, Extension offers extensive resources for youth and family development; healthy living, nutrition and food safety; housing and built environments; and community development.

In this 2017-2021 Plan of Work, MAES and Extension have organized a framework surrounding eight program areas to which valuable resources (personnel and financial) will be expended. These areas were determined based on interactions with stakeholders and represent priorities of Montana's public and NIFA.

1.) ANIMAL SCIENCES: Animal health research is of primary importance not only to Montana's beef producers, but for the larger global safety of Montana's food and product exports. Animal Sciences encompasses research priorities in animal health in direct correlation with humans, livestock, or food products. Primary research veins reflective of these areas are: vaccinations, nutrient utilization, reproductive performance, animal physiology, zoonotic diseases, external parasites, animal diseases, genetic improvement of animals and management of range resources. Producing the highest quality animals and obtaining the highest profit potential are essential for Montana. In this concentration, new and improved food processes will be featured as well as market economics, marketing and distribution practices. Promoting and maintaining animal health has led to advances in genetics, reproductive science and improved animal performance. Scientists will continue investigating vaccines for rotavirus, strangles, respiratory diseases, and mastitis. Researchers are using feed studies with barley, camelina meal, and supplements to evaluate varying rations for calves and cows, and to continue producing superior feeder stock to markets outside of Montana. Global economic changes, unstable fertilizer prices, drought and fire, weeds and pests, expanding export markets, market volatility and cultural changes all contribute to a challenging path for producers to remain profitable and sustainable in the industry. MSU Research, Extension and COA are partners with producers to address issues and meet the needs of Montana's agricultural industry.

2.) PLANT AND SOIL SCIENCES: The broader impact of the Plant and Soil Sciences field is a larger and higher quality food supply for the world, as well as the improved ability of Montana farmers to compete in a global marketplace and strengthen export markets for U.S. wheat. Research objectives in Plant Sciences speak to the plant science, genomics and pathology that have a direct impact on increasing yield potential, improving winter hardiness, enhancing disease resistance, and improving dual-purpose end-use quality grains. MSU's intensive genomic research helps Montana producers stay competitive and provides improved cultivars adapted to Montana's climatic conditions and cropping systems. Continued productivity of breeding programs improves the understanding of the genetics from key traits and allows the development of new selection tools. Additionally, the science of growing and maintaining plants for food, enjoyment and improvement of the human environment continues to be of primary significance to COA, MAES, and Extension efforts. MSU faculty and researchers continue to garner national notoriety in their horticulture research in biology, chemistry, plant materials and physiology, plant pathology, plant reproduction and arboriculture. Horticulture's general application through research has led to improved varieties of plants that benefit the state's agricultural producers. COA, MAES faculty and Extension agents

conduct and lead programs in cereal quality, genetics, cropping systems, molecular and conventional approaches to plant improvement, plant breeding, molecular genetics, biochemistry and agronomy. Much of the current research conducted in campus labs and in fields across the state is centered on disease resistance through genetics, bacterial diseases and the biochemistry and molecular genetics of plant diseases. Many research projects are problem-oriented and pertain to major plant pathological issues in the state. MSU Extension's horticulture programs, publications and links provide expert yard, garden and urban integrated pest management resources for individuals and businesses throughout Montana.

3.) FARM AND RANCH AND BUSINESS MANAGEMENT: COA, MAES and Extension personnel support Montanans in managing their farms, ranches and similar enterprises as businesses. Best practices, contracts, estate planning, marketing, taxation, accounting, operational planning, budgeting, agricultural policy and commodity support programs, risk management and decision support software for agriculture are all covered through extensive research and educational programming specifically designed to support Montana's number one industry, agriculture.

4.) ENERGY AND NATURAL RESOURCES: According to the Montana Department of Commerce, Montana has more potential for energy development from existing and untapped diversified sources than any other state in the nation. From coal deposits, oil, wind farms and geothermal energy potential, energy and natural resources have played a vital role in Montana's history and continue to be a priority for Extension and MAES. In addition, forests cover large areas and contribute to the economic base of the state while also serving as a critical natural resource for wildlife, recreation, tourism and cultural purposes. Management and stewardship is required to maximize potential outputs, as well as public safety, and a sustainable future. Water quality affects all entities and requires intentional management strategies. Rangeland ecology and management of invasive species is also fundamentally important. Extension and MAES provide unbiased, science-based research, education and outreach related to preserving and supporting the best use and management of these resources.

5.) PEST AND DISEASE MANAGEMENT: An increase in public concern about food safety, quality, cost, biodiversity, and the sustainability of natural resources such as soil, air, and water quality is pushing scientists to rely less on pesticides and look for more environmentally-friendly options. The program area of integrated pest and disease management explores new and improved methods to identify and control insects, weeds and diseases challenging Montana farmers. Studying biological controls as low-impact pest control options promotes sustainable practices. Producers and researchers continue to evaluate new integrated pest management (IPM) methodologies so they can maintain a competitive position in U.S. and world markets while helping alleviate global hunger. Research areas will continue to privilege: insects, mites and other arthropods; pathogens and nematodes; weeds and biological control of pests; and overall integrated pest management systems. Faculty scientists will continue quality in-depth training programs for continuing education on integrated pest management and discover, evaluate or change new IPM priorities and projects. Additional outcomes may include new products registered, the passing rate percentage for pesticide application licenses and the number of new broad-ranging stewardship practices implemented. In Montana and throughout the U.S., maintaining profitable agricultural enterprises while sustaining ecological systems has become a difficult balancing act that often results in changes in agricultural practices and environmental policies. The importance of integrated pest management remains a consistently critical field as invasive plant and pest species continue to threaten Montana's agricultural economy as well as the global safety of the state's food exports.

6.) HEALTHY LIVING, NUTRITION AND FOOD SAFETY: Chronic diseases are Montana's leading cause of death; illness and disability account for approximately 70 percent of healthcare costs. In Montana, heart disease is the leading cause of death while other diseases including diabetes, stroke, osteoporosis and hypertension, significantly impact quality of life. Research shows that healthy food choices, physical activity and early detection of symptoms can prevent or delay these diseases saving millions in health care costs while improving life quality and ability to remain independent. Utilizing its network across the state

and trusting the relationships with agents in local communities, MSU Extension works with the Montana Department of Health and Human Services and other agencies to provide educational programming in every county.

7.) YOUTH AND FAMILY DEVELOPMENT: Positive youth development occurs through providing opportunities, choices, relationships, and the support necessary for youth to fully participate. Youth development takes place in families, peer groups, schools, neighborhoods and communities. Across the state, families are concerned with helping youth build skills and confidence to become competent, contributing and caring citizens. MSU Extension provides the support and framework for Montana's largest youth development organization, Montana 4-H.

MSU Extension and MAES recognize that families do not come in one size or shape and offer resources and training to help them navigate diverse trials and tribulations. Montanans desire resources that help them become better caregivers for the elderly and/or for disabled friends and family; and to support family members, often grandchildren, who encounter challenges. They are concerned about their own aging process and value resources to maintain a high quality of life, help manage their personal finances, contribute to the health of their communities and prepare for the distribution of their estates. They often look to MSU Extension for solutions and resources.

8.) COMMUNITY DEVELOPMENT: Montana's large size and small population spread over a wide range of landscapes creates unique challenges and opportunities for communities. MSU Extension agents live and work in the communities they serve and provide a historical, trusted link connecting leaders and interest groups with a focus on efforts toward community vitality. MSU Extension and MAES use proven economic and community development strategies to improve the conditions impacting business, family life and the health of a community as a whole.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2017	174.0	null	268.0	null
2018	174.0	null	268.0	null
2019	174.0	null	268.0	null
2020	174.0	0.0	268.0	0.0
2021	174.0	0.0	268.0	0.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Internal University Panel

- External University Panel
- External Non-University Panel
- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review
- Other (Dept. Head External to PI's Dept.)

2. Brief Explanation

The 2017 Plan of Work has been reviewed by faculty and professionals working within MSU Extension and MAES/COA. Program leaders in each area have been included in reviewing this plan.

Department heads within COA/MAES review HATCH Projects at the department level. A committee of peers then reviews the project and passes it to the director for final approval. The peer review committee, selected by the director after consultations with COA department heads, includes the principal investigator's (PI) department head, MAES administrator, one department peer reviewer and two additional faculty external to the PI's department. Researchers present seminars to the review committee and interested stakeholders, including faculty, staff, students, and constituents. The director requires researchers to propose new projects for a three-year period, while researchers with favorably reviewed ongoing projects continue for five years. Because there are not any Montana Agricultural Experiment funds allocated outside of the COA, expert reviews occur with Montana State University faculty external to the COA, as a requirement of the review process. Reviewers provide written recommendations on the following: relevance of importance of the project; relationship of the project to previous research; objectives; approach and methods; scientific and technical quality; resources; environmental, economic, and/or social impacts. The MAES administrator and department head share the responses with the PI. If the projects do not meet the expectation, the director will not approve them and will defer them until the researcher meets the key elements satisfactorily. Local advisory committees to the research centers, as well as the Montana Extension Advisory Council, provide seasonal, annual and long-term guidance.

While the review is not complicated, it provides valuable feedback for program considerations and is subject to changing and adapting in regard to program priorities.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

Montana is active in planning and delivering programs in collaboration with other states in the region and nationally. The state is situated among rural states that share similar issues, so partnering on program development and delivery is logical and practical.

The stakeholder input process used by MSU Extension, COA and MAES involves continual communication by professional faculty in Montana counties and those neighboring states and regions. It is not unusual to find clientele from "across the borders" using the closest county office or Experiment Station for a resource or information that may not be available in

their own state.

Additionally, COA, MAES and Extension professionals from around the country form collaborations to address common and shared concerns. They work to stay abreast of emerging issues and develop educational and outreach efforts that connect those who may be impacted.

Extension, MAES and COA obtain stakeholder input on priorities and programs. Stakeholder committees include the Sustainable Agriculture Focus Group, Montana Association of Counties (MACo), MAES State Advisory Council, Montana Extension Advisory Council (MEAC), Ag Coalition, 4-H Foundation Board of Directors, Montana Extension Association of Family and Consumer Science (MEAFCS), Montana Association of Community Development Extension Professionals (MACDEP), and other state and local groups. COA, MAES and Extension professionals often collaborate with the Natural Resource Conservation Service (NRCS) to provide training and expertise.

The Ag Coalition consists of representation from the Agricultural Business Association, Farm Bureau Federation, Montana Stockgrowers, Montana Grain Growers, Montana Farmers Union, Montana Water Users, Montana Wool Growers, Seed Growers and the Seed Trade.

Meetings for all of these groups are advertised via news releases, newsletters, individual letters and announcements at group meetings. Extension agents use county profile information to ensure those invited to the sessions reflect the diversity of the area.

MAES and Extension respond to stakeholder inputs by considering their proposals at research and outreach planning meetings with scientists, advisory groups and administrators. Administrators and faculty also solicit stakeholder input during the strategic planning process and as programs are developed, implemented and sometimes redesigned.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

Montana has a small population with a growing number of under-served and under-represented populations. Collaborative research, education and outreach efforts usually address American Indian issues. Montana is home to eight land-grant institutions, the most of any state in the nation. As such, Montana is uniquely situated to address agricultural and community challenges for the states' Native American demographic. The land-grant tradition encourages partnerships and efforts to expand and improve relationships between land-grants are ongoing.

The Montana Constitution and the Indian Education for All Act (§ Mont. Code Annotated 20-1-501) require recognition of the distinct and unique cultural heritage of American Indians, and commitment through its educational goals to the preservation of American Indian cultural heritage. All public educational agencies and personnel are expected to work cooperatively with Montana tribes when providing instruction or implementing an educational goal, and to include information specific to the cultural heritage and contemporary contributions of American Indians.

COA, MAES and Extension cooperatively design and implement programs that best align with Montana's sovereign Indian Nations. Because this demographic is largely under-served and underrepresented, programs and goals are targeted to generate beneficial interactions

regarding respective Montana reservation struggles, priorities and needs. Extension works closely with Reservation Agents to identify key problems, that, if they align with our expertise and resources, will result in research and outreach that address key issues and problems.

Additionally, because of the boom and bust nature of oil and economic development in the Bakken Oilfield, eastern Montana had a dramatic increase in population that is now seeing significant decline. The potential of this population to be under-served is increasing as well. While the demographics and census data are challenging to track, it is clear the diversity of the area's people has grown. The need for service programs to accommodate the drastic growth is a pressing challenge. This includes areas in public health, land-use planning, community services, business support and youth resources.

A multi-state collaboration often shares techniques that have been effective in reaching under-served or under-represented audiences. These "best practices" are proven techniques that work. Armed with these ideas and practices, planned programs can be tailored to particular audiences. Examples of the programs currently reaching an under-served or under-represented audience are the Supplemental Nutrition Assistance Program Education (SNAP-Ed) and Expanded Food and Nutrition Education Program (EFNEP). On reservations, Junior Ag Loans are one of many examples of providing resources.

3. How will the planned programs describe the expected outcomes and impacts?

COA, MAES and Extension research, education and outreach must demonstrate actual or potential economic impact to Montana's economy, and ultimately solve local and state problems. Each institution uses the "logic model" approach as the primary planning tool, with outcomes and impacts identified at the beginning of the planning process. Working alongside each other as multi-state entities and joint collaborators on planned programs and deliverables, each institution begins their work with the collaborative end goal in mind.

Training on using effective evaluation tools to determine outcomes is a continuing process. The "how" to collect the "what" is established during the planning process. Other states commonly share successful evaluation techniques and/or replicate studies that describe the impact of program efforts and provide valuable insight.

COA, MAES and Extension have recently updated institutional strategic plans, and each incorporate measurement of the impact of engagement in the community as a priority. As new tools and processes are developed, increased training for personnel will occur. Specialists are expected to provide evaluation processes/tools and impact statements to be used with programs offered on a statewide basis.

4. How will the planned programs result in improved program effectiveness and/or

The process of problem identification includes meeting with agricultural and natural resource organizations, public health and human services organizations, community leaders, youth development professionals and others; securing funding for research and outreach operations, and reporting to county, state and federal officials. This process assists in modifications that lead to improved program effectiveness in delivering results which, in many cases, enhance efficiency through new or alternative practices and or improve the lives of people. Research and outreach programs take the inherent initial risk and stakeholders ultimately weigh in on program effectiveness through adoption of new technologies and approaches. Montana stakeholders provide the impetus for continued and growing financial support through MAES, COA and Extension planned programs.

Past experience has shown that by working closely with stakeholders throughout the planning and implementation of programs, problems are solved quickly, and redundant and/or inefficient use of resources and time are eliminated. Having strong relationships allows MSU professionals and stakeholders to share honest and immediate feedback and leads to more comprehensive and efficient programs.

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (Educational outreach programs)

Brief explanation.

MAES, COA and Extension continually seek and obtain stakeholder input on program priorities. People who attend Extension or MAES programs or are referrals from other agencies are asked to indicate which issues are important to them, their families and communities. Radio, newsletters, newspapers and electronic distribution lists are used to inform clientele about the opportunity to make requests for assistance. Informational booths are set up at agricultural trade shows, home and garden shows and health fairs allowing for discussions with people who often are not regular clientele of Extension. These conversations reveal concerns/issues that might not be heard otherwise. When common issues surface through these methods, they are considered in the program planning process.

Stakeholder committees include the sustainable agriculture focus group, MAES State Advisory Council, Ag Coalition, MEAC, Montana Association of Counties (MACo), county commissioners, health and human services groups, 4-H Foundation, disaster planning and recovery and other state and local groups. Faculty routinely participate with these groups and NRCS to provide training and expertise. The Ag Coalition meets periodically with the dean and director to review program priorities, new initiatives, fundraising efforts, and legislative activities.

Extension agents also use county profile information to ensure those invited to the sessions reflect the diversity of the area. MAES, COA and Extension respond to stakeholder input by considering their proposals at planning meetings with scientists, advisory groups, and administrators. Administrators and faculty solicit stakeholder input during the strategic planning process as programs are developed, implemented, and sometimes redesigned.

2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys
- Other

Brief explanation.

MAES's seven agricultural research centers have local advisory groups that meet multiple times per year. A MAES State Advisory Council meets three times per year to discuss program focus and direction, Montana legislative priorities, and productivity/impact regarding research and program priorities. These meetings are open to the public. Administrators and faculty in the COA, MAES and Extension serve on agricultural association committees that annually direct and fund research and outreach activities. These committees use a variety of collection methods, but the most common are face-to-face meetings, telephone, and some video teleconferencing.

For Extension, membership on county advisory groups is generally achieved by sending an invitation to traditional stakeholder groups requesting the name of an individual who can represent their views and provide input for Extension programming. A similar invitation is sent to non-traditional groups, with personal contact made to explain the role of the representative. During programs targeted at certain audiences such as SNAP-Ed and EFNEP, attendees are asked directly for input or may be asked to serve on a specific advisory committee for the program area.

Membership on the Montana Extension Advisory Council (MEAC) is based on geographic representation, areas of interest and some previous relationship with Extension. Recruitment from specific sectors such as health care, government agencies and community development are also targeted. County Extension agents, state specialists, Extension program leaders and regional department heads are asked to make recommendations for membership to MEAC. Those who are selected serve a 3-year term and meet biannually.

2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups

- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public
- Other

Brief explanation.

Through direct participation with stakeholder groups, broad participation in committees, and directed meetings, MAES, COA and Extension listen to and consider defined problems or questions that research, outreach and education programs can address. Each institution also targets selective meetings with non-traditional groups on a regular basis.

The most common method of gathering stakeholder input is from conversations with the regular clientele of MSU Extension and MAES. Often this occurs in intentional program planning sessions to which these people are invited, requested to attend or are required to be present by their role or position. Examples of groups that fall into this category are county/reservation councils, 4-H councils, livestock associations, weed boards, human resource coalitions, local and state agricultural organizations, Ag Research Center advisory committees and special interest groups. Some of these groups have offices or directing boards that are asked for specific input.

County and state advisory committees are also used to gather input. Advisory groups are generally comprised of a cross section of the leadership and citizens in the county. Efforts are made to involve under-served and under-represented clientele by contacting agencies and organizations that work with this audience regularly. They are asked for input and/or for names of people who could provide input. Local Extension agents follow up with personal conversations to explain the goals of the organization and process. Two annual MEAC meetings serve as another venue for gathering valuable stakeholder input.

At the state level, one of the most valuable sources of input is the Montana Association of Counties (MACo). Extension makes presentations during MACo's Annual Meeting, followed by an open session for mutual dialogue. These types of discussions also happen during the newly elected county commissioner's orientation and have proven very beneficial. Extension administration, through regional department heads (RDH's), also gathers stakeholder input from county commissioners during regular and systematic visits at the county level.

Surveys are used to gather information at either the local or state level. They may be hard copy, or electronic formats. Additionally, Montana's open meeting law requires inviting the public, and the organizer must publish an agenda. § Mont. Code Annotated 2-3-101.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities
- Other (Create a basis for additional resources)

Brief explanation.

As a land-grant institution, Montana State University has a solid foundation of past and future program initiatives that promote stakeholder input and strong interactive dialogue through which the COA, Extension and MAES administrators, faculty, scientists and staff set the tone for this collaborative environment. In a joint manner, MAES and Extension serve as the primary conduit for connection and delivery of education and new knowledge throughout Montana.

Information gathered through the stakeholder input process is used to determine program needs and direction. In some cases, educational teams made up of county Extension agents, specialists, clientele and researchers are formed to develop and implement programs.

The statewide Montana Extension Advisory Council (MEAC) meets twice a year. MAES Advisory Committees and the Ag Coalition Committee meet several times throughout the year to offer input and feedback. The Director of Extension and the Vice President and Dean of MAES and COA meet at least monthly and also provide system-wide updates and discussion about program priorities and funding.

Montana stakeholders indicate they are concerned about similar issues receiving attention across the nation. Many worry about job security and accessing health care in their communities. Agriculture producers are concerned about a positive profit margin and combating detrimental pests. Rural families wonder if local schools will remain open, or conversely if overcrowding and transiency will continue to cause issues. Farming and ranching communities wonder if they can afford vaccines and healthcare for their families and their livestock.

In those areas where education and research can help address the issue, Montanans look to Extension and MAES as a resource for education and information so they can make choices and decisions that are best for their families, businesses and communities. Budgets and staffing decisions are influenced, and aligned accordingly, from the input provided by the aforementioned groups.

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Animal Sciences
2	Plant and Soil Sciences
3	Farm, Ranch and Business Management
4	Integrated Pest Management
5	Energy and Natural Resources
6	Youth and Family Development
7	Healthy Living, Nutrition and Food Safety
8	Community Development

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Animal Sciences

2. Brief summary about Planned Program

Animal science research is of primary importance, not only for Montana's livestock producers, but for the larger global market dependent upon Montana's food and product exports. Animal Sciences encompasses research priorities in animal health that are in direct correlation with humans, livestock, or food products. Research goals surround pre- and post-harvest and production for any species of livestock related to food products, animal health systems, agribusiness and livestock management, animal product exports, and the general well-being of humans who work closely with livestock.

Primary research fields encompass, but are not limited to; vaccinations, nutrient utilization, reproductive performance, animal physiology, zoonotic diseases, external parasites, animal diseases, genetic improvement of animals, integrated livestock and cropping systems, targeted sheep grazing strategies, increased competitiveness in the lamb and wool markets, and management of resources. Producing the highest quality animals, on healthy lands while obtaining the highest profit potential is essential for Montana.

Promoting and maintaining animal health has led to advances in genetics, reproductive science and improved animal performance. By understanding immune systems and parasite development in livestock, and developing novel genes and new biochemical routes of activity for drugs and vaccines, ranchers can better manage economically important diseases like coccidiosis, shipping fever, brucellosis, Blue Tongue and Cache Valley Virus. Scientists will continue researching vaccines for rotavirus, strangles, respiratory diseases, and mastitis. Livestock reproductive systems, intestinal systems and neo-natal calf health will continue to be studied. Faculty scientists are using feed studies with barley, camelina meal, and supplements to evaluate varying rations for calves and cows, and to continue producing superior feeder stock to markets outside of Montana.

Montana has developed an integrated network to track livestock from Montana ranches to feedlots and packing plants in other states. Tracking provides both source and process verification for easy track-back in preparation for potential disease outbreaks. Extension's visible presence statewide enables almost immediate communication when timely transportation of information is necessary.

MSU Extension specialists and agents are active in bringing the latest knowledge and techniques from the researchers to the producers, and the latest concerns and successes from the producer to the researchers as all parties contribute to the overall success of the industry.

Global economic changes, unpredictable fertilizer prices, drought and fire, weeds and pests, expanding export markets, market volatility and cultural changes all contribute to a challenging path for producers to remain profitable and sustainable in the industry. MSU Research, Extension and COA are partners with producers to address issues and meet the needs of Montana's agricultural sector.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	5%		5%	
302	Nutrient Utilization in Animals	5%		5%	
303	Genetic Improvement of Animals	0%		11%	
305	Animal Physiological Processes	0%		10%	
306	Environmental Stress in Animals	5%		5%	
307	Animal Management Systems	5%		8%	
308	Improved Animal Products (Before Harvest)	5%		5%	
311	Animal Diseases	15%		15%	
312	External Parasites and Pests of Animals	0%		2%	
315	Animal Welfare/Well-Being and Protection	15%		7%	
603	Market Economics	5%		2%	
604	Marketing and Distribution Practices	5%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		5%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		5%	
902	Administration of Projects and Programs	0%		5%	
903	Communication, Education, and Information Delivery	35%		5%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Livestock products represented 37 percent of the \$4.7 billion agriculture market in 2014 with the majority being cattle and calves (more than \$1.2 million). Volatile cattle and feed markets, as well as rising input costs and persistent drought conditions provide challenges to sustainable beef cattle production. Livestock producers seek MSU Extension and MAES for the latest scientific-based information on how to adapt and remain profitable.

Montana is among the top 10 producers of beef cattle and sheep in the nation and excels in wool production. The sheep industry has similar challenges with additional complications related to wool harvesting and marketing. The sheep and lamb inventory was down six percent from January 2013 to January 2014. The value of wool production was up four percent from a year earlier. Producers received

\$2.20/pound compared to \$2.10/pound in 2013.

Losses due to environmental stress, disease, and mortality create the need for an improved understanding of the factors affecting Montana livestock. Promoting and maintaining animal health (cattle and sheep) has led to advances in genetics, performance, and reproduction technology.

Studying infectious diseases is important to Montana researchers because of the economic losses for producers and global food safety concerns. COA's Department of Microbiology and Immunology focuses a great deal of research on animal health, and particularly infectious cattle diseases. The department consistently ranks in the top tier of MSU academic departments in research expenditures. Much of the research reflected in these areas garners additional competitive grant funding because of the critical need. The Departments of Microbiology and Immunology and Animal and Range Sciences have several joint research projects developing and testing new drugs, vaccines, and diagnostic tools for fighting infectious diseases of livestock, humans, and wildlife, as well as zoonotic diseases prevalent throughout the state and region.

To address the needs of stakeholders and those who rely on COA, MAES and Extension animal science and animal health recommendations, the following priorities have been established:

- Develop and distribute knowledge about effective livestock disease control methods
- Improve beef production practices and evaluate genetics to improve herds
- Identify and mitigate the transmission of diseases between livestock, wildlife, and/or humans
- Improved traceability of livestock
- Increase wool and lamb competitiveness
- Implement targeted grazing strategies
- Evaluate, monitor and enhance nutritional impact of grazing on sheep and cattle
- Determine how factors such as herd size and supplement intake influence growth and development of cattle grazing native rangelands
 - Address methods to improve and document ranch biosecurity and bio-containment protocols

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- The Agriculture (livestock) industry will continue to be a high priority for Montana and remain its highest-grossing industry.
- Livestock production challenges, including rising input costs, volatile markets, and natural disasters will continue.
- Industry organizations, livestock associations, companies, and other agencies will continue to provide insight and input into priorities and activities.
- Full-time staff and part-time assistants will be available to maintain appropriate progress.

- Funding and technical support will be maintained from partnering institutions and cooperators.
- Montana's private agricultural producers will continue to seek knowledge and support from MSU COA and MSU Extension.

2. Ultimate goal(s) of this Program

- Discover novel vaccines for prevention of livestock diseases
- Maintain status as a leading university in animal production and animal health research
- Research correlating health and systems in rangelands, feed and livestock
- Provide genomic research to help Montana producers stay competitive
- Provide improved animal production management recommendations to Montana producers
- Produce safe, nutritious livestock products in sufficient quantity to meet U.S. and world demand
- Increase profitability
- Increase knowledge and use of environmentally sustainable practices as they relate to livestock health.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	3.0	0.0	71.6	0.0
2018	3.0	0.0	71.6	0.0
2019	3.0	0.0	71.6	0.0
2020	3.0	0.0	0.0	0.0
2021	3.0	0.0	71.6	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Meet one-on-one with producers, landowners and consumers to identify and address individual problems and solutions
- Encourage email and phone conversations with members of the public
- Offer classes, workshops, group discussions, demonstrations, field tours/trials, webinars
- Share information at farmer's markets, county fairs and other community events
- Attend and present information at professional conferences, county meetings and state conventions
- Prepare and distribute public service announcements, newsletters, MONTGuides, Television (Montana PBS Montana Ag Live), eXtension, listservs, blogs, radio and other media
- Create readily available and easily accessible databases for producers and researchers
- Prepare research articles, fact sheets and news releases for scientists and statewide media
- Host strategic planning meetings with state agricultural groups
- Develop systems that ensure food safety and agricultural security

- Integrate best practices for beef quality assurance in programs

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input checked="" type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2

3. Description of targeted audience

- Livestock producers
- Commodity Associations
- Land managers/owners (small and large)
- Weed Control Professionals
- State Agencies
- County Weed Boards
- Colleagues and related stakeholders
- Animal health businesses
- Legislators, county commissioners and other elected officials
- Rodeo team and related partners
- Tribal land managers
- Rural large-animal veterinarians

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research citations
- Number of publications on infectious disease and vaccines research
- Number of presentations on infectious disease research
- Number of undergraduate and graduate students trained in animal science and biotechnology
- Number of producers attending beef cattle workshops and clinics
- Number of Native American Youth receiving Junior Ag Loans

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Extension and MAES Beef Cattle Programs -Increase the number of producers using Extension and MAES information to successfully manage animal health and well-being issues. -Increase the number of producers who successfully utilize Extension and MAES programs to improve profitability. -Increase the number of producers who successfully utilize Extension and MAES to improve environmentally sustainable practices.
2	Extension and MAES Sheep Programs -Improve profitability of producers in the sheep and wool market through increased participation in and knowledge gained from seminars, classes and other educational opportunities; and expanding wool pools, wool delivery and marketing.
3	Identification of critical infection and disease resistance
4	Number of improvements in vaccines developed
5	Identification of genetic correlations and other factors influencing residual feed intake and feed efficiency; and education of producers and industry leaders with the latest scientific information
6	Conduct basic and applied infectious disease research -Increase the quality of meat, milk and fiber products -Reduce non-predator deaths in calves

Outcome # 1

1. Outcome Target

Extension and MAES Beef Cattle Programs

- Increase the number of producers using Extension and MAES information to successfully manage animal health and well-being issues.
- Increase the number of producers who successfully utilize Extension and MAES programs to improve profitability.
- Increase the number of producers who successfully utilize Extension and MAES to improve environmentally sustainable practices.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 312 - External Parasites and Pests of Animals
- 315 - Animal Welfare/Well-Being and Protection
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 902 - Administration of Projects and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Extension and MAES Sheep Programs

-Improve profitability of producers in the sheep and wool market through increased participation in and knowledge gained from seminars, classes and other educational opportunities; and expanding wool pools, wool delivery and marketing.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 312 - External Parasites and Pests of Animals
- 315 - Animal Welfare/Well-Being and Protection
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 902 - Administration of Projects and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Identification of critical infection and disease resistance

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 312 - External Parasites and Pests of Animals
- 315 - Animal Welfare/Well-Being and Protection
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 902 - Administration of Projects and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Number of improvements in vaccines developed

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals

- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 312 - External Parasites and Pests of Animals
- 315 - Animal Welfare/Well-Being and Protection
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 902 - Administration of Projects and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Identification of genetic correlations and other factors influencing residual feed intake and feed efficiency; and education of producers and industry leaders with the latest scientific information

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 312 - External Parasites and Pests of Animals

- 315 - Animal Welfare/Well-Being and Protection
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 902 - Administration of Projects and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 6

1. Outcome Target

Conduct basic and applied infectious disease research
-Increase the quality of meat, milk and fiber products
-Reduce non-predator deaths in calves

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 312 - External Parasites and Pests of Animals
- 315 - Animal Welfare/Well-Being and Protection
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 902 - Administration of Projects and Programs

- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other (high cost of fuel, fertilizer)

Description

The weather will always be a factor for livestock production and animal health. The national economy and various health-related issues play a role in the industry as more people become interested in growing their own food, or concerned about how their food is grown. The generational shift in livestock production agriculture, as the population changes, is also a factor. Extension and MAES play a stabilizing role in the industry providing proactive solutions, and unbiased, science-based information.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Evaluation studies will be conducted annually through the issuance of surveys, published peer review materials and secured peer reviewed grant proposals. In most cases where Extension/MAES provide training, participant evaluations and pre- and post- tests will be utilized, as well.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Plant and Soil Sciences

2. Brief summary about Planned Program

COA, MAES and Extension projects in Plant and Soil Sciences will continue to focus on ensuring producers and stakeholders remain competitive in national and world markets for 2017-2021, as well as to try to help producers meet the challenge of increasing the nation's food and fiber supply. The broader impact of the Plant & Soil Sciences program is a larger and higher-quality food supply for the world, the improved ability of Montana farmers to compete in a global marketplace, and a strengthening of export markets for U.S. wheat and other cash crops.

In Montana, climate change research - as it directly impacts plant and soil science research - is becoming increasingly necessitated as major environmental changes continue to accelerate. COA/MAES and Extension faculty scientists at MSU will continue actively recruiting competitive grant dollars and personnel to bolster current and forecasted research faculty lines, undergraduate and graduate students, programs and labs, to support the next five years of sound plant and soil scientific research as the nation develops a responsive adaptation to global climate change.

Research objectives in this program capture research fields that have a direct impact on increasing yield, improving winter hardiness, enhancing disease resistance, and improving dual-purpose end-use quality grains. These research veins include, but are not limited to: plant genetics and plant genomics (wheat breeding programs), nutrient management, cropping systems, pest management, soil reclamation, soil health, carbon sequestration, cover crops, land-use management techniques and water resource conservation.

Montana crop production income from cash receipts was nearly \$2.3 billion dollars to the Montana agricultural sector in 2014. MAES and MSU wheat varieties accounted for \$500 million of the state's wheat crop, totaling more than 2.2 million acres of planted wheat developed by MSU.

Research in Plant and Soil Sciences has led to improved varieties of plants that benefit the state's agricultural producers in disease resistance and other market-named quality characteristics. Much of the current research is conducted in campus labs, and seven of MSU's AES research centers, as well as private producers' fields across the state. Most notably, research accomplishments are reflected in MSU COA's Wheat Breeding Programs for spring and winter wheat lines whose qualities regularly contribute to adding millions of dollars to Montana's cash crop industry (for desired qualities) in the last five years.

Many research projects continue to be problem-oriented and pertain to major plant pathological and soil challenges in the state. MSU Extension's horticulture programs, publications and links provide expert yard, garden and urban landscaping and integrated pest management support for individuals and businesses throughout Montana. The ability of specialists and researchers to collaborate to find solutions and proactively address concerns, and for Extension to deliver that information to farmers and ranchers, is critical to the ongoing success of Montana producers.

COA, MAES and Extension projects in Plant and Soil Sciences will continue to focus on ensuring producers and stakeholders remain competitive in national and world markets for 2017-2021, as well as to try to help producers meet the challenge of increasing the nation's food and fiber supply. The broader impact of the Plant & Soil Sciences program is a larger and higher-quality food supply for the world, the

improved ability of Montana farmers to compete in a global marketplace, and a strengthening of export markets for U.S. wheat and other cash crops.

Many research projects continue to be problem-oriented and pertain to major plant pathological and soil challenges in the state. MSU Extension's horticulture programs, publications and links provide expert yard, garden and urban landscaping and integrated pest management support for individuals and businesses throughout Montana. The ability of specialists and researchers to collaborate to find solutions and proactively address concerns, and for Extension to deliver that information to farmers and ranchers, is critical to the ongoing success of Montana agriculture.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

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	10%		6%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		4%	
111	Conservation and Efficient Use of Water	5%		5%	
112	Watershed Protection and Management	10%		5%	
132	Weather and Climate	5%		5%	
141	Air Resource Protection and Management	3%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
202	Plant Genetic Resources	0%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
204	Plant Product Quality and Utility (Preharvest)	10%		10%	
205	Plant Management Systems	10%		5%	
206	Basic Plant Biology	0%		5%	
502	New and Improved Food Products	0%		9%	
503	Quality Maintenance in Storing and Marketing Food Products	2%		2%	
601	Economics of Agricultural Production and Farm Management	13%		7%	
607	Consumer Economics	10%		3%	
701	Nutrient Composition of Food	2%		5%	
901	Program and Project Design, and Statistics	0%		1%	
903	Communication, Education, and Information Delivery	15%		5%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

In 2013, the value of crop production totaled \$2.5 billion of the nearly \$5 billion agriculture export industry for Montana. Wheat alone totaled 36.7% of the state's cash receipts. As the third leading producer of wheat products in the United States, Montana continues researching new and better varieties of wheat cultivars and has made significant advances in both the spring and winter wheat breeding programs. Solid stems, high yields and good end-use quality are primary selection targets. A goal over the next few years

is to cross-breed with diverse lines from other programs to increase genetic diversity. Researchers will continue developing new cultivars of small grains that are marketed globally. Montana is also the nation's leader in pulse crops.

In Montana and throughout the U.S., maintaining profitable agricultural enterprises while sustaining ecological systems has become a difficult balancing act. Agriculture is the largest user of freshwater in Montana with 1.7 million acres under irrigation using approximately nine million acre-feet of water annually. Education and research activities have precipitated a general trend toward more efficient irrigation and healthy soil systems, and for more drought tolerant crops. Researchers are investigating high yielding crop varieties resistant to insects and diseases that will perform well in Montana. The agricultural community and allied industries depend on new cultivars to remain competitive in the world marketplace. Primary breeding objectives include increasing yield potential, improving winter hardiness, enhancing wheat stem sawfly resistance and improving dual purpose quality grains. MSU's intensive genomic research will help Montana producers stay competitive and provide improved cultivars adapted to Montana's climactic conditions and cropping systems. Researchers continued to advance malting barley lines and improved feed, hay, and food barley varieties. Researchers are also exploring the feasibility of growing a variety of crops including pulse crops (peas, lentils, chickpeas and soybeans) herbs, mustard, safflower, sunflower, canola, turf grass, and specialty grains. MSU research provides technology that improves plant production systems while adding value and enhancing food security for stakeholders. Initiatives will provide new insights into food safety and risk assessment.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- Corporate funding organizations, grain and livestock associations, companies and other agencies will continue to provide input into priorities and activities
 - Funding and technical support from partnering institutions will be maintained
 - Small acreage properties will continue to be purchased by first time farmers/ranchers with little knowledge about appropriate stewardship practices for the land
 - Montana's highest grossing industry, production agriculture in grain exports, will remain at the top of economic exports and market income
 - Spring, winter and durum wheat will continue to be Montana's highest-grossing crop
 - Barley, sugar beets, pulse crops and forages will continue as high-grossing crops for Montana
 - Montana producers will continue to rely on new wheat breeds from MSU COA's wheat breeding programs
 - Global consumer and food markets will remain in alignment with Montana's agriculture production
 - Climate, ground water, and future disease and pests will continue to present constant challenges to the cropping sector of Montana's agriculture industry
 - MSU COA and Extension will continue be the state's source of non-biased, cutting-edge scientific information.

2. Ultimate goal(s) of this Program

- Develop drought tolerant crops suitable for growing in warmer and drier climates
- Identify plant mechanisms that allow plants to grow in all of Montana's diverse climatological environments
 - Increase the profitability of producers
 - Increase the knowledge and use of environmentally sustainable cropping systems
 - Address the economic feasibility and environmental impact of biological control practices
 - Study effects of management practices on soil water holding capacity and more broadly, soil health as well as soil erosion and soil production rates
- Build soil literacy
- Investigate crop rotation systems, production methods, and water and soil management
- Implement biological control practices and explore a multitude of science-based options
- Optimize grower profitability and natural resource sustainability
- Improve rangeland management by developing controls for exotic noxious weed species
- Provide efficacious and cost effective soil-education programs for producers
- Increase yield potential for small grain production
- Maintain status as a leading university for wheat and barley genetics research and soil science
- Provide improved wheat and barley cultivars to Montana producers
- Provide improved soil management practices to Montana producers
- Support food risk assessment education and research

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	3.0	0.0	110.3	0.0
2018	3.0	0.0	110.3	0.0
2019	3.0	0.0	110.3	0.0
2020	3.0	0.0	0.0	0.0
2021	3.0	0.0	110.3	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Develop new crops and cultivars suitable to a warmer and drier climate
- Explore the ecological impact of climate change on Montana grazing areas
- Study the impact of a changing climate on insects
- Continue investigating crops and management systems that rely on less water consumption
- Meet one-on-one with producers, landowners and consumers to identify and address individual problems and solutions
 - Encourage email and phone conversations with members of the public

- Offer classes, workshops, group discussions, demonstrations, field tours/trials, webinars
- Share information at farmer's markets, county fairs and other community events
- Attend and present information at professional conferences, county meetings and state conventions
- Prepare and distribute public service announcements, newsletters, MONTGuides, Television (Montana PBS Montana Ag Live), eXtension, listservs, blogs, radio and other media
- Create readily available and easily accessible databases for producers and researchers
- Prepare research articles, fact sheets and news releases for scientists and statewide media
- Host strategic planning meetings with state agricultural groups and Extension advisory groups
- Develop systems that ensure food safety and agricultural security
- Support FIFRA Section 18c products labeling requests
- Release germplasm, new cultivars, and new genomics tools and techniques
- Develop value-added, agriculturally based end-use products
- Enhance partnerships among faculty across Montana institutions, producers, agricultural industry and other educational institutions
- Enhance agricultural production practices to enhance product quality
- Investigate and educate producers on crops and management systems that consume less water

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input checked="" type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2

3. Description of targeted audience

- Crop and livestock producers
- State agricultural advisory committees
- State and federal government agencies
- Commodity associations
- Weed control professionals and County Weed Boards
- Small acreage landowners
- Tribal councils and Native American producers
- Crop protection companies registration and research personnel
- Private and commercial pesticide applicators
- Domestic and foreign buyers of wheat
- Montana Wheat and Barley Committee, grain elevator operators

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research citations
- Number of producers participating in Field Days
- Number of people participating in range monitoring programs
- Number of requests to identify or record new weeds and pests
- Number of foreign trade teams
- Number of new wheat lines developed

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Crops: Increase in number of producers who implement nutrient cycling, weed control, variety selection and alternative crop possibilities. Increase in number of farm operators who implement best practices to increase profitability and enhance long-term sustainability
2	Number of new stress-tolerant crop recommendations or changes for Montana. Number of new or improved cultivar recommendations provided to Montana producers to maintain dominance in small grain markets
3	Number of new molecular techniques incorporated into breeding projects to improve outcomes
4	Increase average per bushel yield of Montana grains while maintaining product quality
5	Increase agricultural resilience to short-term weather fluctuations by improving soil health and minimizing soil erosion.

Outcome # 1

1. Outcome Target

Crops: Increase in number of producers who implement nutrient cycling, weed control, variety selection and alternative crop possibilities. Increase in number of farm operators who implement best practices to increase profitability and enhance long-term sustainability

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 132 - Weather and Climate
- 141 - Air Resource Protection and Management
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Number of new stress-tolerant crop recommendations or changes for Montana. Number of new or improved cultivar recommendations provided to Montana producers to maintain dominance in small grain markets

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 132 - Weather and Climate
- 141 - Air Resource Protection and Management
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Number of new molecular techniques incorporated into breeding projects to improve outcomes

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 132 - Weather and Climate
- 141 - Air Resource Protection and Management
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Increase average per bushel yield of Montana grains while maintaining product quality

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 132 - Weather and Climate
- 141 - Air Resource Protection and Management
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Increase agricultural resilience to short-term weather fluctuations by improving soil health and minimizing soil erosion.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 132 - Weather and Climate
- 141 - Air Resource Protection and Management
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 502 - New and Improved Food Products
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 607 - Consumer Economics
- 701 - Nutrient Composition of Food
- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other (High cost of fuel, fertilizer)

Description

Global economic changes, fertilizer prices, drought and fire, weeds and pests, expanding export markets, market volatility and cultural changes all contribute to a challenging path for producers to remain profitable and sustainable in the industry. Decreasing groundwater availability and drastic climate variations also present external factors to the program.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Evaluation studies will be conducted annually through the issuance and collection of surveys, published peer reviewed materials, and secured peer reviewed grants. Long-term studies will be conducted throughout the state at various test sites, labs and greenhouses. Additionally, information will be obtained from field days, conversations, direct input, and annual funding discussions with the Montana Wheat and Barley Committee. MSU works closely with the USDA NASS field office in the Montana Department of Agriculture for regular, updated agricultural statistics, which demonstrate a quantifiable evaluation of the impact on research priorities and accomplishments in the state's production agricultural industry particularly within the grain market.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Farm, Ranch and Business Management

2. Brief summary about Planned Program

Managing and operating a farm or ranch business requires a multifaceted skill set. The MSU College of Agriculture, Montana Agricultural Experiment Station (MAES) and Extension are committed to providing Montana's farming and ranching communities with the timely and unbiased, research-based knowledge required to successfully operate farming and ranching enterprises and related businesses. A chief priority of COA, MAES and Extension is to enhance the expertise of Montana's farmers, ranchers and agribusiness operators. Faculty in our Department of Agricultural Economics and Economics and Extension Economist Specialists are committed to ensuring the success of Montana's agricultural imports and exports in changing, global markets by recommending and watching markets and producing meaningful work as it relates to agricultural policy and legislation - both on a state and national level.

MSU COA, MAES and Extension regularly collaborate with agricultural business managers, allowing them to understand the specific challenges facing Montana producers. This engagement leads to development of research and outreach programming that build skills including critical analysis, logical problem solving, data and policy analysis and written and oral communications. Providing critical programming, responding to changing needs and being accessible to individuals and families is a priority.

Extension's Farm Management program provides educational materials on: farm and ranch management, financial and economic implications, agricultural policy and commodity programs, risk management, beginning farmer and rancher issues and decision support software for agriculture. COA, MAES and Extension also assist with analysis and research related to niche opportunities in businesses such as wineries and breweries, meat processing, beekeeping, sustainable foods, bioenergy systems and more.

Additionally, COA, MAES and Extension provide content and programs related to government programs and regulations, operational planning and budgeting, contracts and estate planning. Each of these knowledge areas help to provide foresight and confidence in the management of crops, animals, marketing, finance and business organization for Montana's production agriculture industry.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

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	0%		5%	
104	Protect Soil from Harmful Effects of Natural Elements	0%		8%	
111	Conservation and Efficient Use of Water	0%		15%	
112	Watershed Protection and Management	0%		5%	
121	Management of Range Resources	0%		15%	
122	Management and Control of Forest and Range Fires	0%		5%	
132	Weather and Climate	5%		7%	
136	Conservation of Biological Diversity	5%		15%	
307	Animal Management Systems	5%		0%	
601	Economics of Agricultural Production and Farm Management	15%		0%	
602	Business Management, Finance, and Taxation	15%		5%	
609	Economic Theory and Methods	10%		6%	
610	Domestic Policy Analysis	10%		6%	
611	Foreign Policy and Programs	5%		3%	
903	Communication, Education, and Information Delivery	30%		5%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Agriculture remains a vital core industry in Montana. Adapting to changing global macroeconomic conditions, alongside local weather, pest, disease, and other agro-ecological events, presents a challenge for individuals, families and communities. COA, MAES and Extension are committed to providing tools for Montana's agricultural producers to meet and overcome these challenges.

MSU Extension fills a critical role in connecting the most current research with the producer. The ability of MSU Extension to collaborate with other research entities to find solutions and proactively address concerns, and to deliver that information to farmers and ranchers, is critical to the success of Montana agriculture.

Researchers and agents work to improve the lives of Montana citizens and the agricultural community by providing direct access to information and risk management strategies to cope with factors such as

variable weather conditions, changing regulatory policies and new technologies. Researchers and agents provide outreach and support that spans every aspect of the farming and ranching business. Existing research and experience reveal current approaches and programs are highly demanded and well used.

To address the needs of stakeholders, COA, MAES and Extension priorities remain influenced by criteria that respond directly to the public's needs. Priorities are also to address trends in economic and environmental conditions that may affect producers.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- As regulatory policies, environmental stressors, consumer preferences and other factors change, Montana producers will continue to benefit from current, non-biased, research-based information.
- Promoting and maintaining financial security for producers will continue to be a central goal and lead to further advances in market research, understanding tax and regulatory policy and business management best practices.
- The public will continue to demand accurate and detailed economic information as a foundation for private agricultural production enterprises.
- Funding through industry organizations, farm and ranch organizations, companies and other agencies will continue to provide resources to advance these priorities.
- Program development will proceed as planned without major interruptions.
- Outreach methods will continue to expand and garner public interest.

2. Ultimate goal(s) of this Program

- Maintain status as a leading university in farm and ranch economic research
- Provide research to the public in support of financial and business decision making
- Provide leadership in the latest agribusiness policy reform
- Create and maintain new outreach programs
- Provide improved production management recommendations to Montana producers

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	1.5	0.0	13.5	0.0

2018	1.5	0.0	13.5	0.0
2019	1.5	0.0	13.5	0.0
2020	1.5	0.0	13.5	0.0
2021	1.5	0.0	13.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

COA, MAES and Extension will work one-on-one and in groups with producers, landowners and consumers to identify and address individual and industry challenges and solutions. They will regularly answer specific questions through workshops, phone calls, email and personal consultations. Agents and specialists will also offer classes, workshops, group discussions, demonstrations, field tours/trials and more. Agents, specialists and volunteers disseminate knowledge at every available chance via community events and meetings. MSU Extension utilizes PSA's, newsletters, MontGuides, television, eXtension, listserves and other media. Additional priorities include:

- Publish peer reviewed articles contributing to the field
- Create and maintain outreach programs
- Provide improved information and research in relation to farm, ranch and agribusiness management
- Contribute to the understanding of financial and management decisions
- Provide informational training and programs related to the environment

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input checked="" type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input checked="" type="checkbox"/> Other 1 (MontGuides (Fact sheets)) <input type="checkbox"/> Other 2

3. Description of targeted audience

- Farmers/Ranchers/Ag producers
- Land Managers/Owners
- Livestock/Crop producers and related stakeholders
- Private forest land owners and public land managers
- Small acreage land owners
- Tribal farm and ranch managers

- Agribusiness owners and managers
- Agricultural educators

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of producers attending Extension and MAES presentations
- Number of peer-reviewed journal articles
- Number of non-credit instruction events

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Number of new or improved management recommendations provided to and adopted by Montana producers.
2	Increase in number of producers, small and large acreage landowners who are aware of current programs and information related to farm and ranch business management, and make timely management decisions as a result.
3	Increase in number of producers/farm and ranch managers who implement range monitoring activities which lead to improvement in resource management strategies.

Outcome # 1

1. Outcome Target

Number of new or improved management recommendations provided to and adopted by Montana producers.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 101 - Appraisal of Soil Resources
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 121 - Management of Range Resources
- 122 - Management and Control of Forest and Range Fires
- 132 - Weather and Climate
- 136 - Conservation of Biological Diversity
- 307 - Animal Management Systems
- 601 - Economics of Agricultural Production and Farm Management
- 602 - Business Management, Finance, and Taxation
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Increase in number of producers, small and large acreage landowners who are aware of current programs and information related to farm and ranch business management, and make timely management decisions as a result.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 101 - Appraisal of Soil Resources
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 121 - Management of Range Resources
- 122 - Management and Control of Forest and Range Fires
- 132 - Weather and Climate
- 136 - Conservation of Biological Diversity
- 307 - Animal Management Systems
- 601 - Economics of Agricultural Production and Farm Management
- 602 - Business Management, Finance, and Taxation
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Increase in number of producers/farm and ranch managers who implement range monitoring activities which lead to improvement in resource management strategies.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 101 - Appraisal of Soil Resources
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water

- 112 - Watershed Protection and Management
- 121 - Management of Range Resources
- 122 - Management and Control of Forest and Range Fires
- 132 - Weather and Climate
- 136 - Conservation of Biological Diversity
- 307 - Animal Management Systems
- 601 - Economics of Agricultural Production and Farm Management
- 602 - Business Management, Finance, and Taxation
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other

Description

External factors which may affect outcomes include: inadequate funding and technical support from partnering institutions and cooperators, lack of full time staff and part time assistants, changes in global macroeconomic trends and major interruptions in program development.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

COA, MAES and Extension have recently completed strategic plans that focus on the integration of learning, discovery and engagement throughout all programming areas. Measuring the impact of these efforts is a primary focus and work is currently underway to identify methods and means for

accomplishing this. Currently, COA, MAES and Extension presenters ask participants to complete pre- and post- surveys and/or other evaluation tools during programming. Further evaluation studies will be conducted through surveys and other methods along with published peer-reviewed materials and grant awards.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Integrated Pest Management

2. Brief summary about Planned Program

The importance of integrated pest management remains a consistently critical field as invasive pest species continue to threaten Montana's agricultural industry as well as the global safety of the state's food exports, and general health of the state's myriad natural resources essential to agriculture production. Pests will continue to represent a colossal economic threat to Montana producers in pre- and post-harvest production systems. Dwindling water resources, vulnerable natural resources and a changing climate have only exacerbated the demand for research funding and applied research as it relates to supporting and protecting Montana's agriculture industry. Producers, researchers and faculty will continue to evaluate new integrated pest management methodologies so they can maintain a competitive position in U.S. and world markets while helping alleviate global hunger.

The program area of integrated pest management explores new and improved methods to identify and control insects, weeds and diseases in large and small-scale cropping and agricultural production. An increase in public concern about food safety, quality, cost, biodiversity, and the sustainability of natural resources such as soil, air, and water quality is pushing scientists to rely less on pesticides and look for more environmentally-friendly options. Studying biological controls as low-impact pest control options promotes sustainable practices. In Montana and throughout the U.S., maintaining profitable agricultural enterprises while sustaining ecological systems has become a difficult balancing act that often results in changes in agricultural practices and environmental policies.

Research areas will continue to focus on: insects, mites and other arthropods, pathogens and nematodes, weeds, and biological control of pests affecting plants and overall integrated pest management systems. Faculty scientists will continue quality in-depth training programs for continuing education on integrated pest management and discover, evaluate, or change new integrated pest priorities and projects. Additional outcomes may include new products registered, pesticide application licenses increased and a number of new broad-ranging stewardship practices implemented. Research is also focused on stopping food-borne illness (pre-harvest for food and animal consumption). Diversified, innovative and integrated cropping systems have helped with disease and weed control while reducing dependence on chemical fertilizer.

Most land managers agree the spread of invasive plants and pests are the primary environmental threats to western wildlands and rangelands. Noxious weed invasion reduces the ecological integrity of land and water, alters ecosystems, impacts wildlife habitat and threatens the survival of native plants. MSU Extension manages the Private Pesticide Applicator Training Program for the Montana Department of Agriculture. Both Extension and COA/MAES actively participate in research projects on the subject and interact with producers, landowners and property managers to share the latest information.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		10%	
212	Diseases and Nematodes Affecting Plants	10%		10%	
213	Weeds Affecting Plants	15%		10%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	0%		10%	
215	Biological Control of Pests Affecting Plants	15%		10%	
216	Integrated Pest Management Systems	25%		16%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		10%	
601	Economics of Agricultural Production and Farm Management	5%		5%	
603	Market Economics	0%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	5%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		5%	
721	Insects and Other Pests Affecting Humans	0%		2%	
903	Communication, Education, and Information Delivery	25%		2%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Stem rust, wheat stem sawfly, orange wheat blossom midge, late blight, Russian olive, Fusarium head blight, cheatgrass, narrowleaf hawksbeard, and wheat curl mites are only a small portion of current diseases, insects and invasive plants currently threatening the health and safety of Montana's agriculture industry. Many additional plant diseases, invasive plants, and insects are not currently present, though they have the capability of spreading into Montana and the surrounding Northern Rockies region. The evolution of agricultural pests to survive control measures has led MSU COA and Extension to research and produce improvements in resistance efforts like agronomic traits and monitoring for fungicide resistance in an effort to meet the pressing need for pest and disease resistance tools. MSU Extension provides a free diagnostic service, housed within the Schutter Diagnostic Lab, for Montana producers facing disease and pests. Lab scientists provide identification and management options to accurately identify pests, confirm the pests' presence and the potential level of damage, and provide recommendations to clients. The lab's service activity is increasing on behalf of Montana's producers

requesting diagnostic and management support.

COA and Extension cooperate to offer pesticide application training and credentials to Montana producers. Pesticide applications are critical to avoid selecting for pesticide-resistance, avoid threatening pollinators, while managing pests. Diminishing pollinator populations can compromise yield and natural landscapes.

Research programs are faced with the public demand to optimize grower profitability and natural resource sustainability through the development, selection, and implementation of economically sound and environmentally acceptable pest management strategies. MSU researchers explore integrated, sustainable pest management systems and are addressing the economic feasibility and environmental impact of alternative controls, organic methods of crop production, and water management issues to help produce high quality crops and mitigate current and future pest problems.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- Current invasive plants, diseases and pests will continue threatening Montana agriculture
- Climate change will continue to affect and alter cropping system rotations
- Water resources will continue their vulnerability
- Pesticide and herbicide application information will continue to be publicly demanded
- The public will continue a demand for knowledge about biological control agents
- Crop diseases will be widespread

2. Ultimate goal(s) of this Program

- Continue providing pest and disease management information to agriculture and horticulture professionals of Montana and surrounding states
- Prioritize and coordinate pest management research, Extension and educational programs
- Respond to the informational needs of the public and private sectors on a regional basis
- Create and develop new strategies to meet current and new pest and disease challenges

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	3.0	0.0	62.0	0.0

2018	3.0	0.0	62.0	0.0
2019	3.0	0.0	62.0	0.0
2020	3.0	0.0	62.0	0.0
2021	3.0	0.0	62.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Meet one-on-one with producers, landowners and consumers to identify and address individual problems and solutions
 - Encourage email and phone conversations with members of the public
 - Offer classes, workshops, group discussions, demonstrations, field tours/trials, webinars
 - Share information at farmer's markets, county fairs and other community events
 - Attend and present information at professional conferences, county meetings and state conventions
 - Prepare and distribute public service announcements, newsletters, MONTGuides, Television (Montana PBS Montana Ag Live), eXtension, listservs, social media, radio and other media
 - Create readily available and easily accessible databases for producers and researchers
 - Prepare research articles, fact sheets and news releases for scientists and statewide media
 - Host strategic planning meetings with state agricultural groups
 - Develop systems that ensure food safety and agricultural security
 - Integrate best practices for pests and disease management in parallel programs

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input checked="" type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2

3. Description of targeted audience

- Agricultural producers in Montana facing current and future threats relating to invasive plants, plant diseases and pests.
 - University faculty scientists conducting research in integrated pest management
 - Extension outreach personnel and statewide agents
 - University economic development research programs

- Montana USDA state statistician and agricultural economics faculty
- Montana grain producers and associated committees, groups, and boards

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of samples processed by Schutter Diagnostic Laboratory.
- Number of certified and re-certified pesticide applicators.
- Number of volunteers helping to trap wheat stem sawflies and other pests

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Range: Increase in number of producers and small acreage landowners who are aware of the identification of pest infestations, and quickly identify new problems so they can make timely management decisions.
2	Weed and Pest Control: Increase in the number of applicators who are certified and employ safety precautions and risk management strategies while using pesticides in the most environmentally and economically effective manner. Increased number of county agents trained to identify pests, limiting number of samples that have to be sent to Schutter Diagnostic Lab. Timely follow up by agents or SDL staff and specialists to identify pests, disease and plants and follow-up with appropriate recommendations.
3	Develop, enhance and distribute pest management programs to increase knowledge and ability to manage pests and diseases affecting producers.
4	Develop seasonal management programs and applied pest and disease management research that leads to improved management practices.
5	Increase the number of producers/ranch managers who implement range monitoring activities which lead to improvement in resource management strategies.

Outcome # 1

1. Outcome Target

Range: Increase in number of producers and small acreage landowners who are aware of the identification of pest infestations, and quickly identify new problems so they can make timely management decisions.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting
- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally
- 721 - Insects and Other Pests Affecting Humans
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Weed and Pest Control: Increase in the number of applicators who are certified and employ safety precautions and risk management strategies while using pesticides in the most environmentally and economically effective manner. Increased number of county agents trained to identify pests, limiting number of samples that have to be sent to Schutter Diagnostic Lab. Timely follow up by agents or SDL staff and specialists to identify pests, disease and plants and follow-up with appropriate recommendations.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting
- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally
- 721 - Insects and Other Pests Affecting Humans
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Develop, enhance and distribute pest management programs to increase knowledge and ability to manage pests and diseases affecting producers.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants
- 215 - Biological Control of Pests Affecting Plants

- 216 - Integrated Pest Management Systems
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting
- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally
- 721 - Insects and Other Pests Affecting Humans
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Develop seasonal management programs and applied pest and disease management research that leads to improved management practices.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting
- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally
- 721 - Insects and Other Pests Affecting Humans
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Increase the number of producers/ranch managers who implement range monitoring activities which lead to improvement in resource management strategies.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 214 - Vertebrates, Mollusks, and Other Pests Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting
- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally
- 721 - Insects and Other Pests Affecting Humans
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other

Description

Global economic changes, unpredictable fertilizer prices, drought and fire, weeds and pests, expanding export markets, market volatility and cultural changes all contribute to a challenging path for producers to remain profitable and sustainable in the industry. Decreasing groundwater availability and drastic climate variations also present external factors to the program.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Evaluation studies will be conducted annually through the issuance and collection of surveys, published peer-reviewed materials, and secured, peer-reviewed grants. Long-term studies will be conducted throughout the state at various test sites, labs and greenhouses. Additionally, information will be obtained from field days, conversations, direct input, and annual funding discussions with the Montana Wheat and Barley Committee.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Energy and Natural Resources

2. Brief summary about Planned Program

Montanans have always utilized abundant natural resources for earning a living, recreation, tourism and cultural purposes. Interest in preserving and protecting these resources is part of Montana's heritage. COA, MAES and Extension engage with landowners, managers and industries, utilizing science-based best practices to maintain, improve and sustain Montana's natural resources.

Extension natural resources programs touch the lives all Montanans. Forests and rangelands cover 26 and 65 million acres, respectively. Montana's primary watersheds and intact ecosystems are national treasures. Thoughtful management and stewardship is important for the economy, as well as for the safety of Montanans. Several decades of extreme weather events have created an increased need to prepare for and protect the public from unprecedented wildfire and flood events.

While much of Montana's rangeland is actively used as part of the livestock industry for grazing and forage, increasing acreages are being subdivided into small properties owned and managed by people wanting to live the modern American dream of wide open vistas, recreation, small business and hobby livestock ownership. Many of these new landowners have little or no background in pasture management, weed control, streamside management, wildlife habitat or soil conservation. COA, MAES and Extension play primary roles helping these citizens learn about and care for their properties.

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. COA, MAES and Extension share resources while seeking technological solutions to increase the value of Montana's current and potential resources, while also preserving environmental quality and quality of life.

Extension's Climate Science Working Group provides thoughtful leadership for programming efforts, training, resource development, grant opportunities, interdisciplinary programs, and communications related to potential impacts of climate change. The group is actively involved with, and receives funding from, the USDA's Northern Plains Regional Climate Hub.

The eastern part of Montana has seen tremendous change due to energy exploration in the Bakken Oil Field. There are significant environmental, economic, social and community development challenges directly related to the boom and bust nature of the business. Landowners need information about surface and mineral rights, rangeland rehabilitation, waste water drainage and treatment, and other topics. COA, MAES and Extension offer resources and collaborate with others to make informed, science-based decisions and establish priorities and strategies to minimize damage and maximize outcomes.

The political nature of topics in this program area make education and unbiased, scientific information especially critical. COA, MAES and Extension are trusted and dependable sources of this information for policymakers.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

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	5%		10%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		15%	
111	Conservation and Efficient Use of Water	10%		5%	
112	Watershed Protection and Management	5%		10%	
122	Management and Control of Forest and Range Fires	5%		0%	
123	Management and Sustainability of Forest Resources	10%		8%	
124	Urban Forestry	5%		2%	
131	Alternative Uses of Land	5%		5%	
132	Weather and Climate	10%		10%	
135	Aquatic and Terrestrial Wildlife	5%		3%	
136	Conservation of Biological Diversity	5%		10%	
141	Air Resource Protection and Management	5%		7%	
402	Engineering Systems and Equipment	5%		0%	
605	Natural Resource and Environmental Economics	5%		14%	
610	Domestic Policy Analysis	5%		1%	
903	Communication, Education, and Information Delivery	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Natural resources in Montana are at risk of being impacted by a changing climate. Science-based management and increased knowledge is necessary to keep pace as conditions evolve. Much of the state's forest and rangeland acreage is privately owned. Extension offers both private landowners and public land-managers extensive training opportunities and support in creating sound and lasting management strategies that will last into the future.

The eastern part of the state faces many unique challenges related to natural resource development. Concerns of water quality including arsenic and nitrates have been noted statewide. MSU Extension Water Quality programs help people keep their drinking water safe by offering education and water quality testing. Many farm operators and landowners are interested in learning about energy alternatives and methods for reducing energy costs. The MSU Extension E3A program offers resources and training in this

area. The Extension Weatherization Center provides resources to help homeowners and contractors increase energy efficiency and in some cases receive certifications.

Researchers with MSU COA/MAES are exploring carbon sequestration in rangelands and croplands. Research is centered on developing new crops and cultivars suitable to a warmer and drier climate, as well as exploring the ecological impact of climate change on wildlife habitats and livestock grazing areas. Montana scientists have taken advantage of close proximity to Yellowstone National Park to study flora growing in or near hot springs. Understanding the growth mechanisms of these native plants in geothermal-modified soils will help researchers understand the limitations and opportunities that increasing temperatures may present to agricultural production and even to cancer research.

MSU COA/MAES has expanded research in carbon sequestration in rangelands and croplands. Researchers are learning more about climate change and potential impacts to forest and rangeland ecosystems. Experts warn that a warmer climate will likely result in more disturbances such as wildfires, floods, droughts, insect infestations, and an increase in invasive plants.

Combined priorities remain to investigate how climate change may impact crop production, water systems, and rangeland and forest management. Researchers are developing models and projects to ensure crop and livestock producers and land managers have timely and accurate information. Researchers must continue developing alternative crop varieties and high yielding cultivars that can grow in warmer and drier climates. Extension plays a vital role in the delivery of new knowledge and best practices to producers and citizens.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- Environmental restrictions related to water, air and pesticides will continue to increase.
- Natural resources and environmental issues will continue to influence economic development and social and political decisions within Montana.
 - The Montana wood products infrastructure, including private forest owners, relies on MSU Extension to keep informed and trained to meet forest best practice requirements and water quality standards.
 - Extension natural resources and environmental programs provide scientific information to help the general public and decision-makers understand the complex interrelationships and consequences of natural resource and environmental management from a science-based, non-biased platform.
 - Corporate funding organizations, grain and livestock associations, companies, and other agencies will continue to provide input into priorities and activities.
 - Full-time staff and part-time assistants will be available to maintain appropriate progress.
 - Funding and technical support partnering institutions and cooperators will continue.
 - Program development will proceed as planned without major interruptions.
 - The Montana Weatherization Center will continue to offer training and resources for energy efficiency in agricultural endeavors as well as for families and communities.

2. Ultimate goal(s) of this Program

- Increase the awareness and knowledge of landowners, service providers and managers on core and emerging natural resources topics so they can create and follow stewardship plans with the best available information.
 - Monitor and examine potential ecological impacts associated with predicted climate changes on Montana forests, range, water and wildlife resources.
 - Study the impact of climate change on pests, plants and other natural resources.
 - Continually engage landowners and managers so they utilize best management practices to protect and improve their water resources.
 - Increase the number of homeowners who test and manage their wells, assuring safe drinking water.
 - Increase access of consumers to resources and educational opportunities regarding the latest science-based information on energy alternatives and techniques for efficiency.
 - Help consumers, industry, landowners and communities adapt to, and make research-based decisions regarding development issues related to the Bakken Oil Fields.
 - Work to develop improved land management strategies that utilize new technologies for increased fuel-use efficiency, soil conservation and productivity, and carbon sequestration.
 - Increase landowner and manager knowledge of sustainable livestock grazing practices on forests, rangelands and pastures.
 - Increase landowner and manager knowledge of invasive plant management on forests and rangelands.
 - Increase landowner and manager knowledge of best management practices to successfully integrate livestock grazing with fish and wildlife resources on forests and rangelands.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	4.5	0.0	22.9	0.0
2018	4.5	0.0	22.9	0.0
2019	4.5	0.0	22.9	0.0
2020	4.5	0.0	22.9	0.0
2021	4.5	0.0	22.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

COA, MAES and Extension will work one-on-one and in groups with landowners and consumers to identify and address individual and industry struggles and solutions. They will regularly answer specific questions through workshops, phone calls, email and personal consultations to address topics such as forest and

rangeland stewardship and water quality.

COA, MAES and Extension will partner with local and state associations and organizations that are concerned about natural resource issues. In particular, they will engage with leaders concerned about natural resources to find ways to provide meaningful education and research while collaborating to solve problems and create strategies for future growth and development. Agents and specialists will offer classes, workshops, group discussions, demonstrations, online resources and field tours/trials. Agents, specialists and volunteers will disseminate knowledge via community events and meetings, websites and social media. MSU Extension and MAES will utilize PSA's, newsletters, MONTGuides, television, eXtension, listservs, social media, and other sources to share information.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input checked="" type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input checked="" type="checkbox"/> Other 1 (MontGuides (Fact sheets)) <input type="checkbox"/> Other 2

3. Description of targeted audience

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

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research citations
 - Number of people attending forest stewardship programming
 - Number of people attending water quality programming, including workshops and seminars to learn about watersheds and environmentally sustainable best practices.
 - Number of participants attending training through the Weatherization Center
- Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Increased number of private forest owners who create 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.
2	Increased number of homeowners regularly testing 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 Extension resources and participating in training to improve efficiency, reduce environmental impacts and lower costs.
4	Natural Resource Development: Increased number of collaborations with partners in eastern Montana to explore benefits and challenges as a result of the Bakken Oil Field and related issues. Increase in the number of landowners who are educated and make sound decisions about water and mineral rights.
5	Bio-energy research: Continued examination of the potential for greater utilization of hazardous forest fuels as a source of alternative carbon neutral liquid fuel production.
6	Increased knowledge and use of best management practices for successfully integrating livestock grazing with fish and wildlife resources.
7	Increased knowledge and practice of sustainable livestock grazing practices on forests, rangeland and pastures.
8	Increased awareness about how communities can best address challenges and opportunities related to oil and gas development.

Outcome # 1

1. Outcome Target

Increased number of private forest owners who create 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.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Increased number of homeowners regularly testing 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. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

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

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

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

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management

- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Bio-energy research: Continued examination of the potential for greater utilization of hazardous forest fuels as a source of alternative carbon neutral liquid fuel production.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity

- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 6

1. Outcome Target

Increased knowledge and use of best management practices for successfully integrating livestock grazing with fish and wildlife resources.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 7

1. Outcome Target

Increased knowledge and practice of sustainable livestock grazing practices on forests, rangeland and pastures.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 8

1. Outcome Target

Increased awareness about how communities can best address challenges and opportunities related to oil and gas development.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 104 - Protect Soil from Harmful Effects of Natural Elements
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 131 - Alternative Uses of Land
- 132 - Weather and Climate
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 402 - Engineering Systems and Equipment
- 605 - Natural Resource and Environmental Economics
- 610 - Domestic Policy Analysis
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other

Description

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 and MAES to provide science-based resources and facilitate community and leadership development to mitigate political and social impacts. Other external factors include:

- Inadequate funding and technical support from partnering institutions and cooperators
- Inadequate moisture
- Lack of full-time staff and part time assistants
- Major interruptions in program development
- Reduced support from Montana crop and animal agricultural groups, conservation and wildlife groups, private industry, private donations and other agencies

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

MSU Extension and COA/MAES recently completed new strategic plans which focus on the integration of learning, discovery and engagement through all programming areas. Measurement of the impact of these efforts is a primary focus and work is currently underway to identify methods and means for accomplishing this.

Some programs in this area are connected to research projects that have specific targets established and strategies outlined for collecting data. Pre- and post- surveys are completed in forest, rangeland, pest management, water quality, E3A, and other training programs.

Evaluation studies will be conducted annually through surveys, published peer reviewed materials, and secured peer reviewed grants. Long-term studies will be conducted throughout the state at various test sites, labs and greenhouses.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Youth and Family Development

2. Brief summary about Planned Program

MSU Extension and MAES recognize that families come in a variety of configurations and offer resources and training to assist them in navigating all the various stages and changes that occur across generations. Montanans desire resources to support youth; and resources that help adults become better caregivers for the elderly and/or for disabled friends and family. Montanans seek assistance in supporting grandchildren and other family members. They are concerned about their own aging process and value resources to maintain a high quality of life, help manage their personal finances, contribute to the health of their communities and prepare for the distribution of their estates.

Families value parenting support to help raise their children to become competent, capable contributing members of society. The focus on child and youth development is ongoing and intentional. MSU Extension provides the support and framework for Montana's largest youth development organization, Montana 4-H. Positive child and youth development occurs through providing opportunities, choices, relationships, and the support necessary for youth to fully participate. Youth development takes place in families, peer groups, schools and in neighborhoods and communities.

Comprehensive programming and information on human development, family interaction, caring for aging loved ones and parenting is offered statewide. Specialists and agents also offer extensive programming in estate planning, personal finance and budget management, as well as information for families seeking affordable health insurance.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
307	Animal Management Systems	5%		0%	
602	Business Management, Finance, and Taxation	10%		0%	
801	Individual and Family Resource Management	15%		0%	
802	Human Development and Family Well-Being	15%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		0%	
806	Youth Development	50%		100%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

During stakeholder input processes, youth issues continue to surface as a priority of Montanans. The MSU Extension 4-H program provides opportunities for life skill and competency development focused on helping youth to become strong, contributing members of their families, communities, and world. Stakeholders recognize the 4-H program as an effective, proven venue for youth to explore topics related to citizenship, healthy living and science, as well as to learn about leadership, volunteerism and community service. Youth involved in 4-H learn how to lead, follow and be contributing members of a team and to apply their knowledge and skills in other environments. MSU Researchers also provide mentorship

and learning opportunities to youth through Ag Research Center activities and Field Days.

In the area of family development, the general population of Montana is aging. The fastest growing age group in the state is individuals over 85. Along with extended life expectancy comes a variety of chronic illnesses. Most elderly Montanans live on their own or with a spouse, yet they often require either direct or managed care. MSU Extension offers resources for caretakers to help address health-related issues.

From 1990-2000, there was a 53 percent increase in the number of grandparents in Montana responsible for caring for their grandchildren (9th nationally). The US Census (2010) reported 6,053 grandparents hold the primary responsibility for the basic needs of their grandchildren, while 11,098 grandparents lived in households with one or more grandchildren under the age of 18. Grandparents are faced with this responsibility for a variety of reasons: death of the parent, parental child abuse, neglect, abandonment, teen pregnancy, issues of divorcing parents, alcohol/drug problems, financial difficulties, illness and military deployment. The two-parent nuclear family structure no longer describes the majority of families. Parents and caregivers often need assistance. MSU Extension offers resources in this area to help in reducing the risk of abuse/neglect to children and/or the elderly, and strengthening the family unit.

Montanans are interested in the wise use and handling of their financial resources. Statistics reveal that 70 percent of Montanans die without a will. The state legislature continues to change the intestate succession (dying without a will law) and contract laws that impact beneficiaries of real and personal property. Montana farmers/ranchers/owners of closely held businesses continue to be interested in intergenerational transfers. Congress has made changes in the federal estate and gift tax laws and education is needed to provide families, including those living on reservations, with information about the impact of these laws. Montana State University economists conduct research and outreach to offer the most current scientific-based information to Montanans.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- There is a continuing need for youth to learn skills they can use over time to become contributing adults.
- The 4-H program has been providing opportunities for positive youth development and teaching life skills to young people for over a century and will continue in the future.
- Youth need safe places and positive relationships with caring adults.
- Families come in many configurations: single parent, grandparents raising grandchildren, blended families and traditional two-parent families.

- The number of people caring for aging family members is increasing.
- Families will continue to have concerns related to financial resources and having enough money to live comfortably in retirement years.
- Estate planning is a difficult topic that many people avoid but is needed.
- Education related to personal finances is needed.

2. Ultimate goal(s) of this Program

- Youth Competency Development: 4-H Youth programs will provide clubs, classes, training, camps and other activities which lead to the increased knowledge and aptitude of participants within specific competency areas like citizenship, healthy living, and science, engineering and technology (SET).
- Youth Life Skill Development: Opportunities provided through 4-H youth programs will lead to a demonstrated increase in specific life skills of participating youth.
- Leadership/Volunteer Development: Youth and adults completing training will demonstrate improved leadership skills and adoption of positive youth development practices.
- Military Partnerships: Partnerships with military and other organizations will be effective in providing resources for military families, as measured by increases in knowledge of how to access resources and increased ability to cope with deployments and other unique military-related situations.
- Parenting and Caregiving: Participants of parenting and caregiving classes will have increased knowledge and actively use skills learned through MSU Extension and Research programming.
- Personal Finances: Montanans will have access to classes, seminars, online training and printed resources to assist them in making personal finance decisions related to saving, estate planning and more.
- Reservations: Increased support for reservation goals and enhanced partnerships with Montana's 1994 Land Grant institutions including Aaniih Nakoda College, Blackfeet Community College, Chief Dull Knife College, Fort Peck Community College, Salish Kootenai College and Stone Child College. We will promote traditional culture and intergenerational pride through specifically-targeted, culturally-sensitive programming that fosters healthy, meaningful relationships among youth, families and elders.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	8.0	0.0	0.0	0.0
2018	8.0	0.0	0.0	0.0
2019	8.0	0.0	0.0	0.0
2020	8.0	0.0	0.0	0.0
2021	8.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Collaborate with Native American reservations and 1994 land-grant institutions to provide culturally appropriate programming and related materials to Native American families.

- Conduct workshops and clinics that provide active learning and skill development
- Conduct meetings that focus on facilitation and leadership skills
- Develop curriculum and supporting teaching tools for volunteers to use
- Provide training for youth and adult volunteers
- Partner with youth serving groups on state and local levels
- Provide/develop web-based education and information access
- Facilitate small support groups for caregivers
- Develop printed and online resources

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input checked="" type="checkbox"/> Other 1 (Field trips) <input checked="" type="checkbox"/> Other 2 (Camps) 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input checked="" type="checkbox"/> Other 1 (Facebook) <input checked="" type="checkbox"/> Other 2 (MontGuides)

3. Description of targeted audience

- Youth aged 5-19
- Children ages 0-5
- Parents of youth involved in 4-H
- Adult and youth volunteer leaders
- Professionals involved with youth development
- School administrators and teachers
- Military families
- Rural and urban Montana families, landowners and business owners
- Caregivers
- Healthcare providers and services
- Reservation populations

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of youth enrolled in organized 4-H clubs
- Number of youth participating in 4-H overnight camping programs
- Number of youth and adult volunteers offering support for the 4-H program
- Number of participants in classes and support groups for parents and caregivers.
- Number of participants in personal finance classes

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Youth competency development: Increased number of youth participating in 4-H projects and activities and demonstrating increased knowledge and ability in specific competency areas including but not limited to science, healthy living and citizenship.
2	Youth life skill development: Increased number of youth participating in 4-H activities and demonstrating increased knowledge and ability in specific life skill areas including but not limited to teamwork, communication skills and public speaking.
3	Leadership/Volunteer Development: Increased number of youth and adults who have received leadership training and demonstrate increased knowledge and ability as a result of the training.
4	Military Family Partnerships: Increased interaction with military families resulting in increased capacity of families to access resources and support.
5	Parenting/Caregiving: Increased number of parents and caregivers who access support and resources and increased knowledge and ability of participants as a result of those efforts.
6	Personal Finances: Increased number of participants in classes and trainings and increased knowledge and aptitude of those participants based on pre- and post- survey results. Increased number of ACA inquiries, referrals, resources developed and shared, workshops and enrollments.

Outcome # 1

1. Outcome Target

Youth competency development: Increased number of youth participating in 4-H projects and activities and demonstrating increased knowledge and ability in specific competency areas including but not limited to science, healthy living and citizenship.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 602 - Business Management, Finance, and Taxation
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Youth life skill development: Increased number of youth participating in 4-H activities and demonstrating increased knowledge and ability in specific life skill areas including but not limited to teamwork, communication skills and public speaking.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 602 - Business Management, Finance, and Taxation
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being

- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Leadership/Volunteer Development: Increased number of youth and adults who have received leadership training and demonstrate increased knowledge and ability as a result of the training.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 602 - Business Management, Finance, and Taxation
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Military Family Partnerships: Increased interaction with military families resulting in increased capacity of families to access resources and support.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 602 - Business Management, Finance, and Taxation
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Parenting/Caregiving: Increased number of parents and caregivers who access support and resources and increased knowledge and ability of participants as a result of those efforts.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 602 - Business Management, Finance, and Taxation
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 6

1. Outcome Target

Personal Finances: Increased number of participants in classes and trainings and increased knowledge and aptitude of those participants based on pre- and post- survey results. Increased number of ACA

inquiries, referrals, resources developed and shared, workshops and enrollments.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 602 - Business Management, Finance, and Taxation
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other

Description

Unexpected external factors can affect outcomes. For example, natural disasters can affect family finances as well as the physical and emotional health of the family structure. Economic changes impact families' ability to earn an income. Government benefits can impact healthcare revisions. Military deployments and benefits could be affected by budgeting and government decisions.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Montana 4-H will collect and compile data from participants involved in activities focused on life skill development. This is an ongoing effort that is improving with additional training and a new system for statewide reporting through Activity Insight.

In addition, 4-H members are required to keep a 4-H Record Book (journal), which describes their involvement from beginning to end. They record the things they learn from the activities in which they have participated. These records are a source of information about the knowledge youth have gained, what behaviors they have learned and what changes they have made over time.

Pre- and post- surveys are utilized in most leadership, finance, parenting, caregiving and other classes and opportunities including those for military families, parents and caregivers.

There is some loss of ability to measure impacts as Extension's direct involvement is minimized in caregiver programs due to the train-the-trainer approach. This is demonstrated by grandparents who are parenting grandchildren as they learn about resources and form support groups, they often continue to meet, share and learn without direct Extension involvement, clearly a desired outcome, however one that makes quantifying difficult.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Healthy Living, Nutrition and Food Safety

2. Brief summary about Planned Program

Chronic diseases are Montana's leading cause of death, while illness and disability account for approximately 70 percent of healthcare costs. In Montana, heart disease is the leading cause of death and along with other diseases including diabetes, stroke, osteoporosis and hypertension, significantly impact quality of life. Research shows that healthy food choices, physical activity and early detection of symptoms can prevent or delay these diseases, saving millions in health care costs while improving life quality and ability to remain independent. Utilizing its network across the state and the trusting relationships of agents in local communities, MSU Extension works with the Montana Department of Health and Human Services and other agencies to provide healthy lifestyle education programs in every county.

MSU Extension education, research and outreach addresses under-served populations - helping Montanans in rural areas, often designated as food deserts, and with limited access to medical services - establish and maintain healthy lifestyles. The Expanded Food and Nutrition Education Program (EFNEP) improves the health of limited resource youth and families with young children through practical lessons on basic nutrition and healthy lifestyles, food resource management, food safety and physical activity. The EFNEP youth program offers age-appropriate lessons and activities that engage Montana's youth in Title 1 schools found in Billings, Great Falls and Missoula. Supplemental Nutrition Assistance Program Education (SNAP-Ed) provides educational programs that increase the probability that participants will make healthy food choices with a limited budget and choose a physically-active lifestyle. Many unique local and county programs focus on nutrition and healthy living for all.

Programs delivered under this planned program category also focus on safe food. In this context, it involves food handling practices and protocols followed by food service managers/employees as well as food preservation techniques used in the home. Extension has long been recognized as one of the best sources of reliable information related to food safety, so it is appropriate to maintain a presence in this area.

It is important to note that the COA and MAES also conduct important research and teaching related to growing and raising safe, nutritious food. For the purpose of this report, projects that are focused on production agriculture and pre-harvest safety are found under Plant Sciences or Animal Sciences. Projects related to post-production food safety are included here.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
701	Nutrient Composition of Food	0%		3%	
702	Requirements and Function of Nutrients and Other Food Components	5%		50%	
703	Nutrition Education and Behavior	30%		15%	
704	Nutrition and Hunger in the Population	10%		15%	
721	Insects and Other Pests Affecting Humans	0%		5%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		5%	
724	Healthy Lifestyle	20%		0%	
801	Individual and Family Resource Management	10%		7%	
802	Human Development and Family Well-Being	20%		0%	
805	Community Institutions and Social Services	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Societal costs of poor health, sometimes the consequence of negative decision-making related to nutrition and physical activity, are on the rise. When considering obesity and attributable medical expenditures alone, costs are estimated today at \$125 billion annually in the U.S. Related health concerns such as diabetes and heart disease compound the problems. To address these issues, Extension provides programming to help youth and adults make well-informed decisions related to nutrition, physical activity and basic health testing procedures. Through changes in health-related attitudes and behaviors, rising obesity rates can be influenced in a positive direction.

Stretching the food dollar is a challenge for limited-resource families and impacts the health and well-being of youth and adults alike. Almost 20% of all Montana children live in poverty with an even higher percentage on reservations. In many cases, food deserts complicate the ability to access healthy, nutritious, affordable foods. Working low-income families often lack the time, knowledge and skill to prepare and serve tasty, low-cost and healthful meals. Studies also show that people who run out of food or miss meals because they cannot afford them are among the most obese.

Nutrition plays a critical role in the aging process. However, there is a high rate of malnutrition among older adults who experience additional environmental risk factors. Seventy-three percent of older adults report eating fewer than the recommended daily intake of fruits and vegetables. Sixteen percent report having been told by a doctor that they have diabetes.

Food safety is a growing concern for the food service industry, public and private agencies. One out of 65 Montanans experience an illness related to unsafe food handling practices. To combat this trend, many food service groups require food safety training, including Montana school systems that must comply with the mandatory USDA policy to implement a School Food Safety Plan, as well as Pow Wow workers. There are three major efforts underway: Basic Food safety training for food service employees, ServSafe Food Protection Manager Certification Courses and Hazard Analysis and Critical Control Point (HACCP) training for the Food Industry.

Montana has an abundance of nutritious seasonal, wild and homegrown foods appropriate for home preservation. Current trends toward local/sustainable foods have contributed to a renewed interest in home food preservation. It is critical that those who practice preserving and processing foods at home have access to the most reliable information available related to food safety and quality. A study done by CSREES-USDA in 2000 revealed a high percentage of home food processors are using practices that put them at risk for food borne illness and economic losses due to food spoilage. As a result of this study and more recent updates, there is a renewed need to provide programming for home food preservers.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- By employing a health-centered (rather than a weight-centered) approach to well-being, people can improve their health by developing lifestyle habits, rather than by trying to achieve a specific body size,

shape or weight. Past programming has resulted in impact data that indicates this as an acceptable and successful approach.

- Based on research, it is known that nutrition is an important component to successfully addressing chronic disease issues as well as achieving a healthy lifestyle.
- Future funding for nutrition education for limited-resource families is uncertain.
- Food preservation will continue to be of interest while the economy is slow and as the culture changes to support more locally-grown food priorities.
- Rural people are often isolated, having little access to healthcare or health care information, intervention or experience healthy food deserts.

2. Ultimate goal(s) of this Program

- Healthy Lifestyles: Classes and programs directed toward healthy living reach adult and youth audiences in Montana communities.
- Nutrition: Classes, programs, publications and other resources are offered in person and on-line throughout Montana and online to specifically address the nutrition needs of youth, adults and the elderly.
 - EFNEP/SNAP-ED: The NEP curriculum is broadly utilized to educate youth and adults about food safety, food resource management, and nutrition.
 - Food Safety: Classes, seminars, formal training and additional resources are readily available and used by Montanans resulting in a decrease of unsafe food handling practices.
 - Food Preservation: County agents provide specialized training and up-to-date resources and knowledge to consumers through classes with regular follow-up with direct responses to questions from individual consumers.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	4.0	0.0	6.3	0.0
2018	4.0	0.0	6.3	0.0
2019	4.0	0.0	6.3	0.0
2020	4.0	0.0	0.0	0.0
2021	4.0	0.0	6.3	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Conduct train the trainer workshops
- Conduct workshops, seminars, meetings
- Facilitate meetings, discussion groups, focus groups
- Develop local and state partnerships
- Develop MontGuides (fact sheets), publications, website materials, video based materials
- Conduct web based, interactive training/education opportunities

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input checked="" type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input checked="" type="checkbox"/> Other 1 (MontGuides (Fact Sheets)) <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input type="checkbox"/> Other 1 <input type="checkbox"/> Other 2

3. Description of targeted audience

- Low income adults
- Low income youth
- Adults that are FSP eligible
- Youth from FSP eligible households
- Teachers in the Montana School System
- Middle to older aged women, especially those living in rural areas
- Parents and youth living in rural areas
- Working people
- Elderly and shut-in people
- Reservation youth
- Food service managers and staff

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of participants in Strong Women, Arthritis Foundation and other exercise programs facilitated through MSU Extension
- Number of food safety and nutrition related MontGuides distributed by MSU Extension Publications
- Number of adult participants in EFNEP/SNAP-Ed
- Number of participants in all levels of ServSafe classes

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Healthy Lifestyles: Increased participation in healthy lifestyle programming and health monitoring that leads to healthy lifestyle choices.
2	Nutrition: Increased participation in nutrition classes, training and use of online and printed resources leading to measureable changes in nutrition habits.
3	SNAP-Ed: Increased participation by eligible SNAP recipients leading to increased knowledge and behavior change related to nutrition, food resource management, food safety and physical activity. EFNEP: Increased participation by eligible low-income families with young children, pregnant woman and teens, leading to increased knowledge and behavior change related to nutrition, food resource management, food safety and physical activity.
4	Food Safety: Increased participation in food safety classes, trainings and increased knowledge, utilization and certifications earned by participants.
5	Food Preservation: Increased participation in food preservation classes and increased knowledge and utilization of concepts learned by participants.

Outcome # 1

1. Outcome Target

Healthy Lifestyles: Increased participation in healthy lifestyle programming and health monitoring that leads to healthy lifestyle choices.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population
- 721 - Insects and Other Pests Affecting Humans
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 724 - Healthy Lifestyle
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Nutrition: Increased participation in nutrition classes, training and use of online and printed resources leading to measureable changes in nutrition habits.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components

- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population
- 721 - Insects and Other Pests Affecting Humans
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 724 - Healthy Lifestyle
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

SNAP-Ed: Increased participation by eligible SNAP recipients leading to increased knowledge and behavior change related to nutrition, food resource management, food safety and physical activity.
EFNEP: Increased participation by eligible low-income families with young children, pregnant woman and teens, leading to increased knowledge and behavior change related to nutrition, food resource management, food safety and physical activity.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population
- 721 - Insects and Other Pests Affecting Humans
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 724 - Healthy Lifestyle
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Food Safety: Increased participation in food safety classes, trainings and increased knowledge, utilization and certifications earned by participants.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population
- 721 - Insects and Other Pests Affecting Humans
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 724 - Healthy Lifestyle
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 5

1. Outcome Target

Food Preservation: Increased participation in food preservation classes and increased knowledge and utilization of concepts learned by participants.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 701 - Nutrient Composition of Food
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior
- 704 - Nutrition and Hunger in the Population
- 721 - Insects and Other Pests Affecting Humans
- 722 - Zoonotic Diseases and Parasites Affecting Humans
- 724 - Healthy Lifestyle
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other

Description

The national budget crisis and ongoing disagreement in the Congress could lead to funding and benefit changes that directly affect Montana's children, elderly, ill, veterans and rural people, many of whom live at or near the poverty level. Changes in harvests or hunting opportunities as a result of weather or policy changes could affect food security and availability.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Most programs use pre- and post- surveys to evaluate effectiveness.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Community Development

2. Brief summary about Planned Program

Montana's large size and small population spread over a range of landscapes creates unique challenges and opportunities for communities. MSU Extension agents live and work in the communities they serve and provide a historical, trusted link connecting leaders and interest groups with a focus on community vitality efforts.

The Montana Community Foundation estimates there will be a large transfer of wealth taking place over the next several years which could greatly impact the survival and success of many small towns. MSU Extension supports community development by helping establish community foundations and other organizations that focus on long-term strategic planning, fundraising, grant making, endowment building and community collaboration.

In addition, Extension provides leadership and government training, and often coordinates and/or participates in community partnerships and projects at the local, county and state level. The Local Government Center is the only source of training and support of its kind for municipal and county governments and for elected and appointed officials.

Extension plays a vital role in proactively planning for and managing disasters. Agents and specialists are able to quickly organize informational meetings, resources and follow-up. Several participate as statewide communication liaisons who are charged in an emergency with quickly identifying immediate needs and how to meet them. Extension agents often serve as integral members of preparation teams who plan extensively for response to community disasters/emergencies affecting the area.

MSU Extension works closely with tribal leaders to collaborate on research, education, outreach and engagement opportunities for American Indian children and families. Community gardens in a handful of communities have helped foster healthier communities through creation of farmers markets, trading posts and volunteering at the gardens.

MSU Extension, often through the Montana Master Gardener Program, works in communities on projects such as community gardens, city beautification, farmer's markets, as well in providing fresh fruits and vegetables for community organizations and families.

3. Program existence :

- New (One year or less)
- Intermediate (One to five years)
- Mature (More than five years)

4. Program duration :

- Short-Term(One year or less)
- Medium-Term (One to five years)
- Long-Term (More than five years)

5. Expending formula funds or state-matching funds :

- Yes
- No

6. Expending other than formula funds or state-matching funds :

- Yes
- No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	40%		0%	
704	Nutrition and Hunger in the Population	10%		0%	
723	Hazards to Human Health and Safety	10%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	20%		0%	
805	Community Institutions and Social Services	10%		0%	
902	Administration of Projects and Programs	10%		0%	
	Total	100%		0%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Communities face growing challenges related to the economy, changing climate, growth/declining/aging population, transfer of wealth and more. Because of being embedded within communities, local agents are often strong community leaders with historical and trusted links they can use to build collaborations and work toward a common good. One major focus of MSU Extension Community Development is to help build community resources through the development of foundations and endowments as well as long-term strategic planning.

Citizens throughout the state need to be aware of local/community emergency plans and services available if a disaster should occur. MSU Extension is frequently involved with communication before and during a disaster as well as contributing to extensive planning to ensure that individuals and communities are ready for disastrous situations.

Montana has more than 11,000 public employees who are responsible for more than \$1 billion in county and city funds. The MSU Extension Local Government Center (LGC) is the only entity of its kind offering training, technical assistance and research to those public employees. The LGC and Community Development programming provide training for volunteers and elected officials who may have no technical background or directly-related education for their role as a public servant.

Montana is home to seven Indian reservations and 12 tribes. FRTEP agents live and work on five of these. Health disparities and other challenges related to being underserved and in difficult to reach areas and with high rates of poverty are great. Extension Community Development is expanding efforts to address issues through proactive collaborations with the tribes.

Montana has many food deserts and a culture that thrives on self-reliance and neighborly behavior. Extension is involved in many projects related to the local food movement and bringing people together through gardening, as well as the beautification of communities through urban horticulture.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

- Evidence shows that communities which develop leadership skills in their citizens, set specific goals and strategically plan to accomplish a united vision are resilient and better able to adapt to stress and changing conditions.
 - Training for citizens serving on boards, councils and committees leads to better local governance.
 - Disasters including wildfire and drought will happen and being prepared limits negative impacts.

2. Ultimate goal(s) of this Program

- Community Resource Development: Partnerships with community groups lead to the development and success of community foundations and endowments supported by strong strategic planning and maintain wealth within communities.
 - Governance and Citizen Leadership: Increased training and support for locally elected and public officials and volunteers will significantly reduce liability and inefficiencies of local and county government.
 - Emergency/Disaster Planning and Management: An increased number of communities with clearly defined plans for managing disasters and citizen awareness of those plans and access to available resources.
 - Community Development with Tribal Populations: Targeted efforts to collaborate with

tribal communities will result in achieving carefully developed strategic goals.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	3.5	0.0	0.0	0.0
2018	3.5	0.0	0.0	0.0
2019	3.5	0.0	0.0	0.0
2020	3.5	0.0	0.0	0.0
2021	3.5	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Community meetings will be held to determine community values, attitudes and vision on which to develop strategies and action plans.
- Partnering with local economic development entities, agencies, businesses/industry and organizations to implement goals and plans of action.
- Planning for potential disasters that may occur in a community, e.g., EDEN.
- Training opportunities available for people serving on boards, councils and committees in both the public and private sectors.
- Culturally-sensitive meetings with tribal leaders focused on community development.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
<input checked="" type="checkbox"/> Education Class <input checked="" type="checkbox"/> Workshop <input checked="" type="checkbox"/> Group Discussion <input type="checkbox"/> One-on-One Intervention <input checked="" type="checkbox"/> Demonstrations <input checked="" type="checkbox"/> Other 1 (MontGuides (Fact Sheets)) <input type="checkbox"/> Other 2	<input checked="" type="checkbox"/> Public Service Announcement <input type="checkbox"/> Billboards <input checked="" type="checkbox"/> Newsletters <input type="checkbox"/> TV Media Programs <input checked="" type="checkbox"/> eXtension web sites <input checked="" type="checkbox"/> Web sites other than eXtension <input checked="" type="checkbox"/> Other 1 (Publications) <input type="checkbox"/> Other 2

3. Description of targeted audience

- Business and Community Leaders
- Local Development Entities
- Chamber of Commerce Members
- Tourism Leadership - local/state
- County and City Government
- County DES, Law Enforcement Emergency Response Coordinators
- Current community leadership/potential community leaders
- Landowners
- Adults/Youth serving on Boards
- Elected officials
- Tribal members and councils

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
 - Direct Adult Contacts
 - Indirect Adult Contacts
 - Direct Youth Contacts
 - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of participants in programs to support Community Foundations, endowments and other similar collaborations focused on community sustainability
- Governance and Citizen Leadership: Number of participants at trainings offered through Extension Community Development and the MSU Extension Local Government Center to elected and public officials and volunteers.
- Number of participants helping with community garden projects on Montana's reservations

Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Community Resource Development: Increased participation of community members toward supporting established community priorities with a resulting increase in the number of Community Foundations and endowments.
2	Citizen Leadership and Good Governance: Increased number of people serving on boards, councils and/or committees who are trained and prepared for the responsibilities/authorities of the entity.
3	Emergency/Disaster Planning and Management: Increased number of communities creating and updating clear disaster mitigation plans with effective and efficient leadership by Extension personnel.
4	Community Development with Tribal Populations: Increased number of collaborations with tribes to address specific community development priorities.

Outcome # 1

1. Outcome Target

Community Resource Development: Increased participation of community members toward supporting established community priorities with a resulting increase in the number of Community Foundations and endowments.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 704 - Nutrition and Hunger in the Population
- 723 - Hazards to Human Health and Safety
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions and Social Services
- 902 - Administration of Projects and Programs

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Citizen Leadership and Good Governance: Increased number of people serving on boards, councils and/or committees who are trained and prepared for the responsibilities/authorities of the entity.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 704 - Nutrition and Hunger in the Population
- 723 - Hazards to Human Health and Safety
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions and Social Services

- 902 - Administration of Projects and Programs

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Emergency/Disaster Planning and Management: Increased number of communities creating and updating clear disaster mitigation plans with effective and efficient leadership by Extension personnel.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 704 - Nutrition and Hunger in the Population
- 723 - Hazards to Human Health and Safety
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions and Social Services
- 902 - Administration of Projects and Programs

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Community Development with Tribal Populations: Increased number of collaborations with tribes to address specific community development priorities.

2. Outcome Type :

- Change in Knowledge Outcome Measure
- Change in Action Outcome Measure
- Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 704 - Nutrition and Hunger in the Population
- 723 - Hazards to Human Health and Safety
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions and Social Services
- 902 - Administration of Projects and Programs

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)
- Other

Description

Outcomes may be affected by significant natural or other emergency/disasters. In areas around the Bakken Oil Fields, community development is facing challenges that will be affected by legislation (state and federal), market trends and more. As federal funding becomes less secure, local communities will be required to set priorities and Extension will have a role in identifying and developing resources (financial and human) to be most effective.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

MSU Extension recently completed a new strategic plan which focuses on the integration of learning, discovery and engagement throughout all programming areas. Measurement of the impact of these efforts is a primary focus and work is currently under way to identify methods and means for accomplishing this. Currently pre- and post- surveys, one-on-one conversations and observations are the most common evaluation tool. In some cases the evaluation will be based on the actual number of new community foundations and the dollars raised or specific impacts within individual communities.

