2011 University of Missouri Research Plan of Work

Status: Accepted

Date Accepted: 06/01/2010

I. Plan Overview

1. Brief Summary about Plan Of Work

Food and agricultural research provides the foundation in knowledge needed to address priority areas in plant and animal production, food, sustainable energy, natural resources, and the natural and human environments that support agricultural activity. Advances in understanding have been made possible by significant innovation in the technologies needed to measure and analyze natural processes that regulate plant and animal functions. This knowledge has been used in translational research to focus on current problems.

Agricultural research investments in the US have led to dramatic increases in output and enhanced productivity. As the world population and the demand for food and energy continues to increase, research scientists are called upon to develop new and innovative solutions to meet growing food demand with fixed or declining natural resources. In today's world, fighting hunger in vulnerable populations goes beyond humanitarian concerns and represents a means of improving our own national security. In addition, research into the social, economic and environmental implications of agricultural activity, from production through consumption, is needed in combination with the physical sciences to fully address agricultural issues.

The portfolio of research programs in the Missouri Agricultural Experiment Station reflect the five national priority areas set forth by NIFA. In addition to these national priority areas, an additional program "Natural Resources and Quality of Life" was added since activity in this program was not well categorized under any of the five high-priority areas. The planned programs represent a spectrum of research efforts focused on solving current problems. The Missouri AES research plan of work integrates efforts from basic to translational research. The companion Missouri Extension plan of work identifies stakeholders and needs which are then communicated through program integration.

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

Year	Extension		Research	
	1862	1890	1862	1890
2011	0.0	0.0	71.0	0.0
2012	0.0	0.0	71.0	0.0
2013	0.0	0.0	71.0	0.0
2014	0.0	0.0	71.0	0.0
2015	0.0	0.0	71.0	0.0

II. Merit Review Process

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

- Other (see below)

2. Brief Explanation

We will use annual faculty reporting instruments, including individual report of accomplishments and the NIFA progress reports to evaluate the program progress.

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?

The MO AES research planned program will provide the background research and discovery needed to:

supply extension programs with sound science for applied programs

add to the body of scientific knowledge through peer reviewed dissemination of results

prepare graduate students to work in areas of strategic importance

develop applied solutions for state and regional issues.

2. How will the planned programs address the needs of under-served and under-represented populations of the

MU Extension will seek input from traditional and non-traditional stakeholder groups by invitation and survey processes. Results of stakeholder input will influence research priorities. Applied research will be directed towards felt needs identified in the stakeholder input process. Linkage between extension and research is strengthened because many faulty have both extension and research responsibilities.

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

By the nature of research results, outcomes and impacts for the research planned programs will be described in qualitative causal affects, rather than quantitative measurements. Standard quantitative measures used to access research progress, such as peer reviewed publications, will be used to measure program outputs.

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

Improved efficiency will be gained by facilitating program evaluation by arranging knowledge areas into functional groups.

IV. Stakeholder Input

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

- Other (see MU Extension Plan of Work)

Brief explanation.

MU Extension seeks input from traditional and non-traditional stakeholder groups by invitation and survey processes. MU Extension personnel share results of the stakeholder input process with AES researchers. Many faculty appointments include both research and extension responsibilities, further strengthening the linkages between extension and research.

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

Brief explanation.

The following committees meet regularly to get stakeholder input:
Farms and Centers Advisory Committee

Research Center Advisory Committee

Ag commodity group advisory boards

Vice Chancellor's Leadership Council, College of Agriculture, Food and Natural Resources

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

- Other (see MU Extension Plan of Work)

Brief explanation.

MU Extension will seek input from traditional and non-traditional stakeholder groups by invitation and survey processes.

3. A statement of how the input will be considered

- Other (see MU Extension Plan of Work)

Brief explanation.

Stakeholder input is addressed in the MU Extension Plan of Work. Stakeholder input is considered in setting priorities, identifying emerging issues, developing budgets and hiring staff, and redirecting programs.

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

2. Brief summary about Planned Program

The Missouri AES research portfolio combines basic and applied research to further the disciplines of plant and animal biology and to provide information for delivery by extension programs. Plant and animal research increases the agricultural production capacity by improving yield, thereby enhancing the ability to meet growing global food demand.

Understanding the basic functions of plant biology and biochemistry is critical to advancing agricultural science as it relates to plant production and protection. Traditional areas of crop management and breeding are now augmented by basic research that enhances our understanding of plant function at the environmental, whole plant, cellular and gene levels. Research in these areas provides new information about physiological relationships within the plant that ultimately are translated into crop management technologies. Research areas include basic plant biology and genomics, pests and diseases affecting plants, abiotic stresses, plant production management and integrated pest management.

Animal research will encompass both basic and translational research, extending beyond the traditional areas of agriculture to include such disciplines as molecular and cellular biology, immunology, and molecular genetics. The research effort will be diverse and include areas such as reproductive physiology, metabolic processes, whole animal function and innovative animal husbandry practices, all designed to improve production capabilities.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms			8%	
202	Plant Genetic Resources			3%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			7%	
205	Plant Management Systems			7%	
206	Basic Plant Biology			9%	
211	Insects, Mites, and Other Arthropods Affecting Plants			3%	
212	Pathogens and Nematodes Affecting Plants			8%	
216	Integrated Pest Management Systems			3%	
301	Reproductive Performance of Animals			10%	
302	Nutrient Utilization in Animals			5%	
303	Genetic Improvement of Animals			3%	
304	Animal Genome			5%	
305	Animal Physiological Processes			4%	
306	Environmental Stress in Animals			3%	
307	Animal Management Systems			2%	
311	Animal Diseases			5%	
404	Instrumentation and Control Systems			3%	
601	Economics of Agricultural Production and Farm Management			5%	
602	Business Management, Finance, and Taxation			2%	
610	Domestic Policy Analysis			5%	
	Total			100%	

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

1. Situation and priorities

Utilizing both plants and animals in the production of food, Missouri has the climate, natural resources, human resources and infrastructure to play a significant role in global food production.

In plant production, weather, pests, plant genetic background and environmental impacts are four primary factors that influence production capacity and profitability. AES scientists at MU conduct basic and applied research in these areas to improve plant production systems.

Basic research leads to crop improvement by enhancing the understanding of plant genetics and function. With model system research, investigators use well understood plants, such as Arabidopsis, to increase knowledge of plant function in important processes including resistance to diseases and interactions with the environment. Genetic modification of plants with genes to synthesize natural products (biopesticides) or to exhibit resistance to pesticides can lead to decreased

dependence on pesticides and thereby reduce negative environmental impacts (eg on water quality). Ultimately, knowledge gained through basic research gives rise to applied or translational research that improves performance in plant production systems.

Research in areas such as integrated crop management and plant breeding is transferred by means of extension programs such as the Missouri Crop Management Systems program that uses multiple delivery methods to reach a broad range of learners. The Forage Production and Management extension program is used to educate forage producers on best practices in systems such as management-intensive grazing and pasture-based dairying.

In animal production, sales of livestock, poultry and their products account for over 50% of the total agricultural cash income. One in six jobs in Missouri involves livestock production, processing, transportation or sales. Animal products serve human needs by supplying approximately 3/4 of the protein, 1/3 of the energy and a substantial amount of essential vitamins and minerals in the American diet as well as fiber to be used in the production of clothing.. A thriving and efficient animal agriculture is essential to aid in meeting challenge of providing food and fiber for the ever expanding human population.

The research effort will focus on both basic and translational approaches. Research in animal reproduction, forage utilization, ruminant nutrition and swine nutrition/production will be transferred to end users through the following extension programs: Show-Me Select Heifer Program, Forage Production Management, Pasture Based Dairy, and Mo-Pork (Increasing pork production in Missouri).

2. Scope of the Program

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

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

1. Assumptions made for the Program

Programs will include interdisciplinary work - across disciplines, divisions and colleges with extension personnel so that research results can translated into practical applications.

MU has a rich history and culture of collaborative work. In the plant sciences, researchers from the Division of Plant Sciences, Division of Natural Resources, Division of Biochemistry and the Division of Biological Sciences work together to advance questions related to plant biology. Researchers in crop production and protection have worked closely with the extension faculty in crop and forage programs.

2. Ultimate goal(s) of this Program

Conduct basic and applied research in plant and animal agriculture in order to increase the ability to meet growing world food demand. Continue utilizing basic research discoveries to improve plant and animal yield and develop production practices that will enhance production capacity.

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
2011	0.0	0.0	45.0	0.0
2012	0.0	0.0	45.0	0.0
2013	0.0	0.0	45.0	0.0
2014	0.0	0.0	45.0	0.0

Year	Extension		Research	
	1862	1890	1862	1890
2015	0.0	0.0	45.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Basic and translational research will be conducted and the results disseminated via scientific publications, scientific meetings, web publications, workshops, conferences, etc.

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

Extension

Direct Methods	Indirect Methods
● Other 1 (see MU Extension Plan of Work)	● Other 1 (see MU Extension Plan of Work)

3. Description of targeted audience

Researchers, scientists, extension specialists, field operation managers, agricultural producers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

2011:4 **2012:**4 **2013:**4 **2014:**4 **2015:**4

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	300	0	0

Year	Research Target	Extension Target	Total
2012	300	0	0
2013	300	0	0
2014	300	0	0
2015	300	0	0

V(H). State Defined Outputs

1. Output Target

- Number of peer reviewed journal articles

2011:200 **2012:**200 **2013:**200 **2014:**200 **2015:**200

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

2011:90 **2012:**90 **2013:**90 **2014:**90 **2015:**90

- Number of invited papers and invited presentations

2011:190 **2012:**190 **2013:**190 **2014:**190 **2015:**190

- Number of graduate degrees awarded

2011:35 **2012:**35 **2013:**35 **2014:**35 **2015:**35

V(I). State Defined Outcome

O. No.	Outcome Name
1	Research efforts will result in enhanced understanding of basic aspects of plant physiology and biochemistry. This knowledge will facilitate the development of better cropping management systems and improved plant varieties that have stronger disease or drought resistance, or value added traits.
2	The research efforts will result in new knowledge that will improve our understanding of animal physiology, genetics, reproduction, nutrition, growth, and animal well being. This knowledge will be translated to better animal production practices and improved animal production efficiency. In addition, students will be trained for positions in animal production, industry, government, and research/teaching.

Outcome # 1

1. Outcome Target

Research efforts will result in enhanced understanding of basic aspects of plant physiology and biochemistry. This knowledge will facilitate the development of better cropping management systems and improved plant varieties that have stronger disease or drought resistance, or value added traits.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

The research efforts will result in new knowledge that will improve our understanding of animal physiology, genetics, reproduction, nutrition, growth, and animal well being. This knowledge will be translated to better animal production practices and improved animal production efficiency. In addition, students will be trained for positions in animal production, industry, government, and research/teaching.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 304 - Animal Genome
- 305 - Animal Physiological Processes
- 306 - Environmental Stress in Animals
- 307 - Animal Management Systems
- 311 - Animal Diseases

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Competing Public priorities

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

Individual faculty are reviewed by the Division Director. Faculty submitted their research goals and accomplishments. Besides evaluating individual progress, the Division Director reviewed research progress and accomplishments in the context of the planned program. Results show continued progress in both basic and applied research.

Points of evaluation included the following:

Research focus ... Was it relevant and consistent with the objectives of the planned program?

Successful scholarship... Were research results conveyed through peer reviewed publications?

Successful grantsmanship... Was the research quality high enough to successfully compete for external grant funds?

2. Data Collection Methods

Description

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

2. Brief summary about Planned Program

The Missouri AES research portfolio includes research in atmospheric science directed towards increasing the understanding of the synoptic and planetary-scale atmospheric processes. Scientists develop models for long range forecasting and climate change. New and improved forecasting tools will provide agricultural scientists and producers with better information for developing crop varieties and adapting crop production strategies for future changes in climate.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
132	Weather and Climate			100%	
	Total			100%	

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

1. Situation and priorities

Of all crop production variables, weather and climate has the single greatest impact on production possibilities and yield. Agricultural producers have always been challenged to contend with uncontrollable variations in weather, such as precipitation quantity and patterns during the growing season. Agriculture research has led to improvements in plant varieties, irrigation systems and adaptive management practices to ameliorate the negative impacts of undesirable growing conditions. Scientists in these fields need information about long term weather and climate in order to develop plants and production systems to meet future demands. For example, drought tolerance and maturity length represent plant variety attributes that are manipulated to match climatic conditions. Improved forecasts of future climate conditions will provide the information needed to direct plant and management improvement strategies.

2. Scope of the Program

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

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

1. Assumptions made for the Program

While there is debate as to what extent human activity has contributed to climate change, there is widespread agreement that significant changes are taking place. Being able to better predict the likely rate and outcome of these changes will provide the information necessary for scientists and producers to adapt agricultural production to changes in climate.

2. Ultimate goal(s) of this Program

The goal of the program is to advance the fundamental understanding of weather and climate and improve models of long range forecasting.

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
2011	0.0	0.0	2.0	0.0
2012	0.0	0.0	2.0	0.0
2013	0.0	0.0	2.0	0.0
2014	0.0	0.0	2.0	0.0
2015	0.0	0.0	2.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Models of long range forecasting and climate change will be developed and results disseminated via scientific publications, scientific meetings, websites, workshops, conferences, etc.

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

Extension

Direct Methods	Indirect Methods
● Other 1 (see MU Extension Plan of Work)	● Other 1 (see MU Extension Plan of Work)

3. Description of targeted audience

Researchers, atmoshperic scientists, agricultural scientists, agricultural producers, extension specialists

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

2011:1 **2012:**0 **2013:**0 **2014:**0 **2015:**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	12	0	0
2012	12	0	0
2013	12	0	0
2014	12	0	0
2015	12	0	0

V(H). State Defined Outputs

1. Output Target

- Number of peer reviewed journal articles

2011:9 **2012:**9 **2013:**9 **2014:**9 **2015:**9

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

2011:2 **2012:**2 **2013:**2 **2014:**2 **2015:**2

- Number of invited papers and invited presentations

2011:3 **2012:**3 **2013:**3 **2014:**3 **2015:**3

- Number of graduate degrees awarded

2011:7 **2012:**7 **2013:**7 **2014:**7 **2015:**7

V(I). State Defined Outcome

O. No.	Outcome Name
1	Increased understanding of the synoptic and planetary-scale atmospheric processes and improved models of long range forecasting and climate change.

Outcome # 1

1. Outcome Target

Increased understanding of the synoptic and planetary-scale atmospheric processes and improved models of long range forecasting and climate change.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 132 - Weather and Climate

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

We will use annual faculty reporting instruments, including individual report of accomplishments and the NIFA progress reports to evaluate the program progress.

2. Data Collection Methods

Description

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

2. Brief summary about Planned Program

Scientists across disciplines in the Missouri AES conduct research to improve the viability of using biomass as a renewable source of energy. Research includes enhancing the yield on existing biofuel crops, as well as finding new plants for use in biomass production. To improve the cost competitiveness of bioenergy, investigators develop improved methods for producing biomass from crops and forests.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
122	Management and Control of Forest and Range Fires			5%	
123	Management and Sustainability of Forest Resources			41%	
124	Urban Forestry			5%	
125	Agroforestry			31%	
131	Alternative Uses of Land			6%	
511	New and Improved Non-Food Products and Processes			12%	
	Total			100%	

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

1. Situation and priorities

In light of the contemporary geopolitical environment, the perennial political desire for energy independence has risen to a pressing national goal. In order to meet this goal, the US will need a combination of energy sources, including coal, natural gas, nuclear, wind, solar, and renewable biofuels. The agricultural sector is charged with developing biologically based renewable sources of fuel. While the technical feasibility of biofuels such as ethanol have been demonstrated, the challenge is to make bioenergy cost competitive with other fuel sources, as will as environmentally sustainable. Cross disciplinary work will be required to develop biofuels and the methods to produce the underlying biomass economically.

2. Scope of the Program

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

- Multistate Integrated Research and Extension

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

1. Assumptions made for the Program

The desire to move towards energy independence will continue or strengthen. Biomass production will be one component in the US's energy portfolio.

2. Ultimate goal(s) of this Program

Improve the cost effectiveness of existing biobased energy production and develop new biofuel alternatives.

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
2011	0.0	0.0	8.0	0.0
2012	0.0	0.0	8.0	0.0
2013	0.0	0.0	8.0	0.0
2014	0.0	0.0	8.0	0.0
2015	0.0	0.0	8.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Basic and translational research will be conducted and the results disseminated via scientific publications, scientific meetings, web publications, workshops, conferences, etc.

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

Extension

Direct Methods	Indirect Methods
● Other 1 (see MU Extension Plan of Work)	● Other 1 (see MU Extension Plan of Work)

3. Description of targeted audience

Researchers, scientists, extension specialists, agricultural producers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

2011:0 **2012:**0 **2013:**0 **2014:**0 **2015:**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	0	50	0
2012	0	50	0
2013	0	50	0
2014	0	50	0
2015	0	50	0

V(H). State Defined Outputs

1. Output Target

- Number of peer reviewed journal articles

  2011:30 **2012:**30 **2013:**30 **2014:**30 **2015:**30

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

  2011:15 **2012:**15 **2013:**15 **2014:**15 **2015:**15

- Number of invited papers and invited presentations

  2011:15 **2012:**15 **2013:**15 **2014:**15 **2015:**15

- Number of graduate degrees awarded

  2011:10 **2012:**10 **2013:**10 **2014:**10 **2015:**10

V(I). State Defined Outcome

O. No.	Outcome Name
1	Research across disciplines will be conducted to improve the viability of biomass as an energy source by improving biomass production efficiency, developing new crops and uses, and improving handling and delivery processes for bioenergy products.

Outcome # 1

1. Outcome Target

Research across disciplines will be conducted to improve the viability of biomass as an energy source by improving biomass production efficiency, developing new crops and uses, and improving handling and delivery processes for bioenergy products.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 122 - Management and Control of Forest and Range Fires
- 123 - Management and Sustainability of Forest Resources
- 124 - Urban Forestry
- 125 - Agroforestry
- 131 - Alternative Uses of Land
- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Competing Public priorities
- Competing Programmatic Challenges

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

We will use annual faculty reporting instruments, including individual report of accomplishments and the NIFA progress reports to evaluate the program progress.

2. Data Collection Methods

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity

2. Brief summary about Planned Program

Researchers in the Missouri AES develop new ways to turn raw agricultural products into nutritious food products that consumers want to eat. Nutritional attributes are combined with sensory analysis of taste, smell, appearance, etc. to develop foods that are both appetizing and nutritious. Both nutritive value and appeal are essential to fighting obesity.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products			52%	
702	Requirements and Function of Nutrients and Other Food Components			32%	
703	Nutrition Education and Behavior			16%	
	Total			100%	

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

1. Situation and priorities

Staggering statistics on the rate of childhood obesity in the US have pushed it to the forefront of health concerns. Beyond the immediate negative impacts on childhood well being, such as early onset of Type II diabetes, the consequences that will result as obese children age to adulthood will be devastating if the trend is not reversed. While insufficient exercise has played an important role, food consumption has been a major factor influencing the trend towards childhood obesity. Science is needed to develop and evaluate food products that will meet nutritional needs and provide sensory satisfaction. Such products will greatly enhance the effectiveness of nutrition education on adoption of healthier lifestyles.

2. Scope of the Program

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

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

1. Assumptions made for the Program

To be effective, strategies to reduce childhood obesity must be broad enough to address food nutrition and appeal for the population as a whole, not just children.

2. Ultimate goal(s) of this Program

Use science to evaluate and develop food products that are both apetizing and nutritious, thereby helping to reduce the obesity epidemic.

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
2011	0.0	0.0	2.0	0.0
2012	0.0	0.0	2.0	0.0
2013	0.0	0.0	2.0	0.0
2014	0.0	0.0	2.0	0.0
2015	0.0	0.0	2.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research will be conducted and the results disseminated via scientific publications, scientific meetings, web publications, workshops, conferences, etc.

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

Extension

Direct Methods	Indirect Methods
● Other 1 (see MU Extension Plan of Work)	● Other 1 (see MU Extension Plan of Work)

3. Description of targeted audience

Food industry scientists, researchers, nutritional scientists, extension specialists

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	0	0	0	0
2012	0	0	0	0

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

2011:0 **2012:**0 **2013:**0 **2014:**0 **2015:**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	10	0	0
2012	10	0	0
2013	10	0	0
2014	10	0	0
2015	10	0	0

V(H). State Defined Outputs

1. Output Target

- Number of peer reviewed journal articles

  2011:3 **2012:**3 **2013:**3 **2014:**3 **2015:**3

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

  2011:6 **2012:**6 **2013:**6 **2014:**6 **2015:**6

- Number of invited papers and invited presentations

  2011:4 **2012:**4 **2013:**4 **2014:**4 **2015:**4

- Number of graduate degrees awarded

  2011:5 **2012:**5 **2013:**5 **2014:**5 **2015:**5

V(I). State Defined Outcome

O. No.	Outcome Name
1	Development of new foods and lifestyle strategies that will help in the fight against obesity.

Outcome # 1

1. Outcome Target

Development of new foods and lifestyle strategies that will help in the fight against obesity.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 502 - New and Improved Food Products
- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Public Policy changes
- Competing Public priorities

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

We will use annual faculty reporting instruments, including individual report of accomplishments and the NIFA progress reports to evaluate the program progress.

2. Data Collection Methods

Description

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

2. Brief summary about Planned Program

Researchers in the Missouri AES use scientific technology and handling processes, such as microbiological technology, to develop novel ways to improve food safety.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

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

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies			34%	
504	Home and Commercial Food Service			4%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			9%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			44%	
723	Hazards to Human Health and Safety			9%	
	Total			100%	

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

1. Situation and priorities

Even though the US has the world's safest food supply, here are an estimated 76 million cases of food borne illness annually. Recent occurrences of tainted food that have resulted in sickness and even death have brought food safety to the fore front of public concern.

2. Scope of the Program

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

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

1. Assumptions made for the Program

The public's interest in a safe food supply will continue or increase. Research will lead to the development of new technology and handling processes that will make food safer.

2. Ultimate goal(s) of this Program

Develop technologies and methods to insure the safe production and delivery of high-quality food to 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
2011	0.0	0.0	3.5	0.0
2012	0.0	0.0	3.5	0.0
2013	0.0	0.0	3.5	0.0
2014	0.0	0.0	3.5	0.0
2015	0.0	0.0	3.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Basic and applied research will be conducted and the results disseminated via scientific publications, extension publications, scientific meetings, web publications, workshops, conferences, etc.

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

Extension

Direct Methods	Indirect Methods
● Other 1 (see MU Extension Plan of Work)	● Other 1 (see MU Extension Plan of Work)

3. Description of targeted audience

Food industry scientists, researchers, scientists, extension specialists

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

2011:0 **2012:**0 **2013:**0 **2014:**0 **2015:**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	40	0	0
2012	40	0	0
2013	40	0	0
2014	40	0	0
2015	40	0	0

V(H). State Defined Outputs

1. Output Target

- Number of peer reviewed journal articles

  2011:15 **2012:**15 **2013:**15 **2014:**15 **2015:**15

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

  2011:22 **2012:**22 **2013:**22 **2014:**22 **2015:**22

- Number of invited papers and invited presentations

  2011:10 **2012:**10 **2013:**10 **2014:**10 **2015:**10

- Number of graduate degrees awarded

  2011:5 **2012:**5 **2013:**5 **2014:**5 **2015:**5

V(I). State Defined Outcome

O. No.	Outcome Name
1	Research will lead to the development of new technologies and processes to improve food safety.

Outcome # 1

1. Outcome Target

Research will lead to the development of new technologies and processes to improve food safety.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Description

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

We will use annual faculty reporting instruments, including individual report of accomplishments and the NIFA progress reports to evaluate the program progress.

2. Data Collection Methods

Description

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Natural Resources and Quality of Life

2. Brief summary about Planned Program

The Natural Resources and Quality of Life program includes research into the natural and social environment in which people live. Together, these components determine the quality and sustainability of life for humans. For the natural environment, basic and applied research is directed towards understanding the use and sustainable management of natural resources. In the human environment, there is a need to understand how economic and sociological factors effect the well being of individuals, families and communities.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

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

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			6%	
102	Soil, Plant, Water, Nutrient Relationships			15%	
104	Protect Soil from Harmful Effects of Natural Elements			1%	
111	Conservation and Efficient Use of Water			5%	
112	Watershed Protection and Management			8%	
121	Management of Range Resources			1%	
133	Pollution Prevention and Mitigation			5%	
134	Outdoor Recreation			1%	
135	Aquatic and Terrestrial Wildlife			21%	
605	Natural Resource and Environmental Economics			6%	
608	Community Resource Planning and Development			7%	
801	Individual and Family Resource Management			7%	
802	Human Development and Family Well-Being			3%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities			11%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			1%	
805	Community Institutions, Health, and Social Services			2%	
	Total			100%	

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

1. Situation and priorities

Human populations continue to grow and place increasing demands on natural resources for economic and social betterment. To maintain a sustainable supply of natural resources for economic and social purposes, there is a need to understand the basic functioning of ecosystems and their constituent communities and species. There also is need to develop effective, efficient management strategies to ensure the health and sustainable use of those natural ecosystems and constituent parts. In the human environment, there is a need to understand factors at the family and community level that effect human development and quality of life.

2. Scope of the Program

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

- Multistate Integrated Research and Extension

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

1. Assumptions made for the Program

The conservation and sustainable use of natural resources will be a high priority for the State of Missouri and the nation.

Problems related to natural resource use can be positively addressed by the scientific method.

Understanding the forces and dynamics affecting the human environment will lead to improvements in the quality of life for families and communities.

2. Ultimate goal(s) of this Program

To protect the integrity of natural systems so as to ensure that natural resources are conserved and managed for sustainable use for the economic and social benefits of people. To provide information which will improve the quality of life at the family and community level.

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
2011	0.0	0.0	17.0	0.0
2012	0.0	0.0	17.0	0.0
2013	0.0	0.0	17.0	0.0
2014	0.0	0.0	17.0	0.0
2015	0.0	0.0	17.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Basic and applied research will be conducted to address underlying principles related to natural resources and to assist in the implementation of efficient, effective management actions to conserve natural resources and ensure the sustainable use of those resources. Research will also be conducted in human environmental science. Research findings will be disseminated via appropriate scientific publications, conferences, workshops, trainings, etc.

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

Extension

Direct Methods	Indirect Methods
● Other 1 (see MU Extension Plan of Work)	● Other 1 (see MU Extension Plan of Work)

3. Description of targeted audience

Researchers, scientists, extension specialists, conservation managers, policy makers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contact Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0
2015	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

2011:0 **2012:**0 **2013:**0 **2014:**0 **2015:**0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2011	85	0	0
2012	85	0	0
2013	85	0	0
2014	85	0	0
2015	85	0	0

V(H). State Defined Outputs

1. Output Target

- Number of peer reviewed journal articles

2011:60 **2012:**60 **2013:**60 **2014:**60 **2015:**60

- Number of other peer reviewed publications (book chapters, proceedings, abstracts, etc.)

2011:24 **2012:**24 **2013:**24 **2014:**24 **2015:**24

- Number of invited papers and invited presentations

2011:70 **2012:**70 **2013:**70 **2014:**70 **2015:**70

- Number of graduate degrees awarded

2011:15 **2012:**15 **2013:**15 **2014:**15 **2015:**15

V(I). State Defined Outcome

O. No.	Outcome Name
1	Research efforts will result in new knowlege that will lead to improved quality and sustainablity of natural and human environments.

Outcome # 1

1. Outcome Target

Research efforts will result in new knowlege that will lead to improved quality and sustainablity of natural and human environments.

2. Outcome Type : Change in Knowledge Outcome Measure

2011:0	**2012:**0	**2013:**0	**2014:**0	**2015:**0

3. Associated Knowledge Area(s)

- 101 - Appraisal of Soil Resources
- 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
- 121 - Management of Range Resources
- 133 - Pollution Prevention and Mitigation
- 134 - Outdoor Recreation
- 135 - Aquatic and Terrestrial Wildlife
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 804 - Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
- 805 - Community Institutions, Health, and Social Services

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

{NO DATA ENTERED}

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)

Description

We will use annual faculty reporting instruments, including individual report of accomplishments and the NIFA progress reports to evaluate the program progress.

2. Data Collection Methods

Description

{NO DATA ENTERED}