

2017 Lincoln University of Missouri and University of Missouri Combined Research and Extension Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

University of Missouri Research and Extension

Food, agricultural, human health and nutrition, youth development and community 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, healthy communities and human health and wellbeing. 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, human health and nutrition and community research investments in the US have led to dramatic increases in output and enhanced agricultural productivity, community viability and human wellbeing. 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 and unhealthy lifestyles 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, community and human health issues.

The portfolio of research and extension programs reflects the national priority areas set forth by NIFA. The planned programs represent a spectrum of research and educational efforts focused on solving current problems. The MU AES research and MU Extension plan of work integrates efforts from basic to translational research with education programs from stakeholders, individual, family and community needs.

Lincoln University Cooperative Extension and Research

Incorporation of an integrated/organic agricultural production system resulting in high dollar products that are produced in an environmentally friendly manner is an ideal method for examining various agricultural practices at the rural/urban interface. This integrated system would be as self-contained as possible and would provide a location for numerous extension, research and community activities. Other potential areas that will be evaluated include: impact of farming practices on human health, human and family interaction, the environment, student experiential learning, energy use, and labor requirements.

Busby Farm will be a focal point for this highly integrated research and extension unit at Lincoln University. Busby Farm has been granted Organic Certification for the 2014 growing season. Results from the research conducted at the farm will be delivered to limited resource producers and families throughout the state of Missouri. This farm will complement our extension family and youth development programs in Jefferson City, Kansas City, St. Louis, Southwest Missouri, and the Bootheel. Families and/or youth can be brought to campus for summer camps. Youth will be exposed to agricultural practices at Busby and will be provided the opportunity for hands-on experience. This will be a unique farm opportunity in Missouri and it is being developed with input from private individuals, area high school students, numerous agricultural organizations, and the University of Missouri.

Individual research projects will continue at Carver and Freeman farms. These projects will allow investigators to examine specific issues of concern that cannot be readily incorporated into the integrated farming system. Projects that will be supported for continuing studies in cooperative research will include animal science, plant science, human nutrition, and environmental science.

The primary emphasis in small ruminant animal science research is on goat and hair sheep production systems. The programs are in areas of footrot resistance and parasite resistance selection, grazing performance, and reproductive efficiency. There are four small ruminant animal research projects being supported by Evans Allen grants at Lincoln University. These studies are highly integrated between research, extension and education at LU as well as with the University of Missouri (Columbia).

The University of Missouri has no plans for expanding extension efforts into goat production and the above projects will allow Missouri residents to receive assistance without duplication of effort by the land-grant universities.

Aquaculture continues to grow significantly at Lincoln University with the construction of a new indoor research facility and production scale culture ponds. Research-based information is being made available to the aquaculture stakeholders in Missouri through Lincoln University Cooperative Extension. Horticulture is a profitable enterprise on many small farm operations, and sustainable hydroponic technologies adaptable to small scale limited resource growers is integral to plant science research and outreach programs.

The Native Plant program is highly integrated with the Extension Small Farm Program. Studies continue to examine profitable and value added products and the marketing of new crops and other plants with particular interest in the needs of underserved farmers with limited resources. This program will improve urban and rural environments to increase native pollinators that benefit vegetable and fruit production.

The Integrated Pest Management (IPM) program was established to develop and promote affordable and environmentally compatible alternative strategies to combat pests of vegetables and small fruits. Emphasis will provide mid-and small-scale commercial producers, including under-represented, low-income farmers, with information on effective and environmentally friendly IPM tactics.

A systematic study of our environment requires investigation of intersections of many disciplines. Studies in environmental science will focus on minimizing detrimental impacts of agriculture on soil, water and air quality. Two recently approved projects will explore ecological links between bioindicators of environmental health and sustainable watershed management.

Basic, as well as applied, studies will continue in this area examining the causes and impacts of obesity in minority populations. Of particular focus in this area are the causes and prevention of obesity, in both youth and adults. A recently approved project will focus on the effects of dietary Omega-3 Fatty acids on the biomarkers of cardiovascular disease in obese individuals. A new study will examine the effects of fatty acids on biomarkers of cardiovascular disease in obese individuals.

Detection and identification of bacteria and food pathogens is an essential step in food safety inspection. One project in the area of food safety will develop a novel 3-dimensional (3-D) interdigitated microelectrode array (IDE) based impedance biosensor. This biosensor will be capable of rapid detection and selectively identifying *E. coli* O157:H7. Research is also being carried out to develop new methods to reduce contamination of fresh and fresh-cut produce by human pathogens.

Studies are being undertaken to develop alternative fuel sources that are feasible, economical,

efficient, and environmentally friendly. Microalgae studies are designed to evaluate the mass cultivation of microalgal biomass as an alternative fuel source.

Bioenergy is an important source in the future supply of energy in the US. In this study, two integrated systems, for the production of biogas, biooil and biochar, are compared. The results of this study will provide the basic scientific knowledge for comparing and optimizing different technologies for the production of bioenergy and biochar. Efforts are also being made to generate bioenergy from agriculture waste including animal manures.

Extension efforts to improve the educational and economic opportunities for under-represented populations in Kansas City, St. Louis, Jefferson City, Southwest Missouri, and the Bootheel will continue.

Programs of this type include: 1) Family and 4-H Youth Development, 2) Community Development, 3) Minority Health and Aging, 4) Expanded Food and Nutrition, 5) Urban Gardening, and 6) Childhood Obesity.

A recently approved project will conduct a study of Rural Entrepreneurship for economic development in Southeast Missouri Counties. The findings of this project should help in the development of policies and programs to help alleviate poverty in rural communities.

The Abstinence Education Program, funded by a grant from the Missouri Department of Health and Senior Services, will continue to provide education on teenage pregnancies, out of wedlock births and support decisions by adolescents to abstain from sexual activity. The target audience for this program is youth ages 14 through 17, in St. Louis County and City, Jackson County, Kansas City as well as Scott, New Madrid, Mississippi, and Pemiscot Counties in Southeast Missouri.

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

Year	Extension		Research	
	1862	1890	1862	1890
2017	266.0	36.5	66.0	44.5
2018	266.0	36.5	66.0	44.5
2019	266.0	36.5	66.0	44.5
2020	266.0	36.5	66.0	44.5
2021	266.0	36.5	65.0	44.5

II. Merit Review Process

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

- Combined External and Internal University Panel
- Combined External and Internal University External Non-University Panel
- Expert Peer Review

2. Brief Explanation

University of Missouri Research and Extension

In addition to annually reviewing the stakeholder input from all 114 counties, regional and state research and extension faculty surveyed current literature and national databases to identify state-wide demographics national and state trends, and discipline specific research related to program effectiveness. Based on this review, state-wide priority research and extension program needs will be identified and programs in response to those priorities will be developed by faculty. The program priorities with clearly defined outcomes will then be reviewed by the appropriate state program leader and research dean to assure the programs are both relevant and of high quality.

State-wide program priorities will be utilized by state and regional faculty as they develop local programming in response to counties identified needs. The resulting proposed county program plan will be taken to the county council for their acceptance. Once approved, the programming will be delivered and the impact evaluated.

Program quality and relevance will be maintained by establishing this ongoing merit review process of stakeholder needs identification; research and extension program response by faculty; stakeholder feedback; and outcome assessment.

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

Lincoln University Cooperative Extension and Research

Research proposals submitted by investigators, for Evans-Allen funding, are reviewed within each program area, then submitted to the Associate Research Director. The Associate Director evaluates them on feasibility and adherence to the Plan-of-work and how well they complement the extension programs. Proposals are then submitted to scientists to evaluate their scientific merit and then returned to the Associate Director. The names of reviewers are removed and the Associate Director returns the comments to the investigator(s) for their response. If the response is satisfactory and/or if satisfactory modifications are made to the proposal it is then submitted by the Director to NIFA. Programs within extension and research will be evaluated for overall direction, progress, and cohesiveness by a panel of program leaders, directors, and non-university stakeholders. Family, youth and community programs will also solicit input from stakeholders located near the satellite offices maintained by Lincoln University in St. Louis, Kansas City, Southwest Missouri, and the Bootheel region.

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?

University of Missouri Research and Extension

Sound program development theory based on the program logic model will be used in each step of the program development process.

The MU planned research 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

MU Extension planned programs will apply university research to address the critical

issues of strategic importance through a continuous cycle of needs assessment engaging our stakeholders to identify and prioritize critical issues; situational analysis using national databases; programming development and implementation to address critical issues; evaluation and reporting program outcomes and impact to stakeholders.

Input of our stakeholders have and will continue to be used to identify priority programs and influence research priorities.

We will continue to gather input from our regional and state research and extension faculty to identify critical issues of strategic importance and to make sure we have identified national and state-wide trends. Our involvement in multi-state initiatives, particularly the North Central region, also informs us as to critical issues of strategic importance.

Lincoln University Cooperative Extension and Research

Numerous joint activities with the University of Missouri Extension (UME) include: coordination of agricultural research and extension needs as determined by stakeholder input as described in detail in a memorandum of understanding between the two universities. Lincoln University will expand efforts in aquaculture, small ruminants, horticulture (vegetable production) and small farms program. Nanotechnology capabilities to assist in programs such as animal science and environmental science are being developed.

Research, extension and teaching personnel that are implementing these programs at LU interact with UME field staff for assistance with activities and disseminating information throughout the state. Information obtained at LU is disseminated electronically through an annual report. Community development, 4-H and Youth development components of our programs utilize the infrastructure provided by the University of Missouri Extension (UME) for assistance.

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

University of Missouri Research and Extension

MU Extension will seek input from traditional and non-traditional stakeholder groups by invitation and survey processes. National databases will also be used in the needs assessment process. Extension faculty members will include goals to address the needs of un-served or under-served audiences in their individual performance expectations. As a result, planned programs at all levels will address the identified needs of under-represented populations of the state. Faculty will implement the programming, evaluate program outcomes, and report back to these populations and the cycle will begin again. Extension has also created a strategic plan for diversity with one component related to programs and services. Action steps and performance indicators have been established to evaluate our progress. We have also diversified our delivery methods with such tools as web and two-way interactive video to reach under-served audiences.

Linkage between extension and research is strengthened because many faculty have both extension and research responsibilities.

Lincoln University Cooperative Extension and Research

Collaborative efforts with 4-H, Youth and community development allow Lincoln University to provide UME greater access to minority and underserved populations in regions such as the Bootheel, St. Louis, Kansas City, and Southwest Missouri. Lincoln University also benefits through the infrastructure support that UME provides. Split appointments between

Research and Extension personnel provides Lincoln University staff and researchers the opportunity to better serve all underserved areas in Missouri.

One of the targets of the goat program will be with minority limited resource populations in the state since one of the main products from Hispanics in the southern portions of Missouri is goats. Collaboration with UME and Missouri State University will enhance our ability to target these populations.

3. How will the planned programs describe the expected outcomes and impacts? University of Missouri Research and Extension

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.

Each extension program is developed using a program logic model that clearly describes the expected outcomes and impacts. Logic models are reviewed annually and updated as needed. Extension faculty will report against these measurable outcomes and impacts based on information collected from appropriate evaluation tools. This information will be shared with our stakeholders at county council meetings, in program impact reports, in annual reports and by posting our Plan-of-work on our extension website.

Lincoln University Cooperative Extension and Research

The primary outcomes anticipated by efforts at Lincoln University are to improve the quality of life and/or assist under-represented and under-served individuals in living with a sustainable income in an environment of their choosing. This environment could be in urban regions, at the rural/urban interface, or in isolated rural areas.

4. How will the planned programs result in improved program effectiveness and/or University of Missouri Research and Extension

The planned programs will result in improved program effectiveness by refining and expanding our use of the program logic model emphasizing the use of a variety of evaluation tools designed to measure both output and outcomes. This input will continue to be gathered over the course of the plan of work cycle in order to determine program effectiveness from the perspective of a variety of stakeholders. The planned programs will result in more efficiency by the use of technology; particularly distance education, websites, and use of web-based software designed for both audio and web. The design of our organizational structure, in using regional faculty to serve multiple counties, also allows us to be more efficient in our program delivery particularly when utilizing technology such as websites, web-based audio or interactive video. We will also continue to maximize our use of volunteers in many of our programs and expand our use of multi-state programming when appropriate.

Lincoln University Cooperative Extension and Research

These programs will result in greater integration of activities within LU and between LU and other Universities within Missouri. The MOU between Lincoln and UME will also assist in sharing knowledge and activities to a greater degree and will allow LU to be more efficient and concentrate efforts on limited research programs for meeting the needs of clientele throughout the state.

IV. Stakeholder Input

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

- 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
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals

Brief explanation.

University of Missouri Research and Extension

MU Extension and research faculty and staff seek input from traditional and non-traditional stakeholder groups in a variety of ways to assist us in determining the critical issues of strategic importance. Our goals in developing the methodologies for the stakeholder input process were to: diversify the audiences in order to gain a better perspective on the reach and effectiveness of our programs; to diversify the gathering process so that we could utilize the feedback for both program prioritization and also to gain knowledge as to preferred delivery methods as well as general awareness of our programs; and finally, to gather some program specific information and diversity needs information in a more substantive way in order to gain a better understanding of the issues underlying the needs to allow for us to be more effective in our programming response.

The stakeholder input process is shared with AES researchers. Many faculty appointments include both research and extension responsibilities, further strengthening the linkages between extension and research.

Lincoln University Cooperative Extension and Research

The listed actions do not occur in each program. Most programs do not use all the methods listed above to seek stakeholder input. All programs, however, use at least two of the above actions, and multiple programs use four of the above methods.

In general, stakeholders are invited to events and provided with information using mail lists, newsletters, association publications, presentations at stakeholder meetings, workshops and personal interactions. News releases inform and invite the general public. Efforts are evaluated and the results are used to modify and/or redirect formats as needed.

Each major program has advisory committees. The committees' members are surveyed for input once a year.

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
- Needs Assessments
- Use Surveys

Brief explanation.

University of Missouri Research and Extension

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

Resources

- County Extension Councils Annual Program Review Process
- Regional and State Extension Council program review process
- County Extension Council program advisory committees
- County Soil and Water Conservation District Boards

Lincoln University Cooperative Extension and Research

Targeted tools include a needs analysis, and surveys. Surveys are conducted at Lincoln University for selected programs. The University of Missouri Extension also shares their statewide survey results database.

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 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

Brief explanation.

University of Missouri Research and Extension

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

Lincoln University Cooperative Extension and Research

Some of the non-traditional and traditional groups include vegetable producer organizations, aquaculture organizations, organic farmers, as well as with sheep and goat association members. Also included are students, teachers, engineers, other scientists, and community leaders.

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

Brief explanation.

University of Missouri Research and Extension

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.

Lincoln University Cooperative Extension and Research

Advisory groups, with individuals targeted from specific populations of stakeholders, will receive an invitation once each year to hear research/extension activities and they will be asked to make recommendations for the coming years' priorities.

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Sustainable Food Production/Security and Environment/Natural Resource Management
2	Personal, Family and Community Wellbeing
3	Global Food Security and Hunger
4	Community and Leadership Development
5	Family and Youth Development
6	Climate Change
7	Food Safety
8	Sustainable Energy
9	Childhood Obesity

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Sustainable Food Production/Security and Environment/Natural Resource Management

2. Brief summary about Planned Program

The University of Missouri "Sustainable Food Production/Security and Environment/Natural Resource Management" program is focused on; (a) generating the basic and applied research knowledge base in the life/agricultural sciences, (b) which is critical to the development and delivery of research based extension programs that impact opportunities in Missouri's agriculture and natural resource sectors. These research based educational programs will focus on maximizing productivity and profitability of Missouri agriculture to compete in a global food market, while protecting and preserving the state's natural resources. These research and extension programs are focused on plant and animal productivity, natural resources; environmental quality including water quantity/quality and sustainable energy systems. These integrated programs will transfer the new knowledge to producers, and agribusiness will help optimize productivity while ensuring financial and environmental sustainability and improving the quality for Missouri farm families and communities.

3. Program existence : Mature (More than 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
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	4%	0%
111	Conservation and Efficient Use of Water	3%	0%	2%	0%
112	Watershed Protection and Management	10%	0%	2%	0%
123	Management and Sustainability of Forest Resources	2%	0%	6%	0%
135	Aquatic and Terrestrial Wildlife	0%	0%	10%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	12%	0%
205	Plant Management Systems	15%	0%	8%	0%
206	Basic Plant Biology	0%	0%	8%	0%
216	Integrated Pest Management Systems	15%	0%	2%	0%
301	Reproductive Performance of Animals	8%	0%	12%	0%
302	Nutrient Utilization in Animals	10%	0%	7%	0%
303	Genetic Improvement of Animals	0%	0%	10%	0%
307	Animal Management Systems	15%	0%	2%	0%
402	Engineering Systems and Equipment	5%	0%	4%	0%
502	New and Improved Food Products	0%	0%	3%	0%
601	Economics of Agricultural Production and Farm Management	15%	0%	0%	0%
605	Natural Resource and Environmental Economics	2%	0%	8%	0%
	Total	100%	0%	100%	0%

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

Missouri is fortunate to have diverse natural and human resources, along with a sophisticated business base, from which to build a truly progressive 21st century agriculture and economy. The wide range of climate and topography and the availability of irrigation water in the state result in considerable variability in crops produced. Soybeans and corn are by far the dominant crops in Missouri, being particularly important in the northern half of the state and in the southeast (Bootheel). The Bootheel is the most intensively cropped area with its high percentage of tillable, level land, long growing season and plentiful irrigation water. Forages are in high demand to meet the needs of the equine, beef and dairy sectors. Missouri is the number three cow-calf producing state in the nation. Cow-calf production fits in with crop production on many farms across the state. Swine production is also widespread, but especially

concentrated in north-central and west-central Missouri. Broilers and turkeys are dominant in the southwestern counties. 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.

Missouri's Sustainable Food Production/Security and Environment/Natural Resource Management program will focus on:

- Developing food and other agricultural products for value-added and new uses: Research and extension efforts on the development and use of technology and value-added marketing alternatives will help increase the market value of the state's food, fuel and fiber products.
- Developing human resources: development of a sustainable workforce, improve the quality of life for Missouri farm families, including socioeconomic status, self-esteem, health and leadership abilities for all Missourians.
- Managing, sustaining water conservation and using Missouri's production and natural resources: Food, energy and fiber generation depends on the efficient and sustained use of soil, energy, water and air. Missouri's extension education programs and research efforts will focus on new and innovative practices that will sustain and grow the economic viability of rural Missouri's agricultural sector.
- Assessing social and economic changes: The program will examine how present and future research, education and public policy in agriculture and natural resources affect the Missouri agricultural industry and their communities.
- Enhancing environmental quality: Education programming and research activities will focus on improving the management, conservation and quality of Missouri natural resources - air, water and land - not only for the agricultural industry but for all Missourians.

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

- We will ensure alignment between University of Missouri research and extension efforts throughout this program of work.
- We will retain current faculty positions, although the focus of some will change.
- We see the continued major role of agriculture in the state.
- We see the protection of Missouri's natural resources and environment as extremely important.
- We will have financial support from state, university and federal programs that support base programs - although base funding levels will likely decrease.
- We will be increasingly dependent on grants, contracts, fees, gifts and endowments to support education, research and extension efforts.
- We will develop performance measures (both outputs and outcomes) that quantify the broader impacts of our research and educational programs.

2. Ultimate goal(s) of this Program

The University of Missouri "Sustainable Food Production/Security and Environment/Natural Resource Management" program is strategically focused on addressing the 21st Century challenges and opportunities impacting Missouri agriculture and agribusiness. The ultimate goal is to improve Missouri's quality of life, enhance the economic viability of Missouri enterprise, and at the same time protect the environment and the state's natural resources for all Missourians.

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	95.0	0.0	65.0	0.0
2018	95.0	0.0	65.0	0.0
2019	95.0	0.0	65.0	0.0
2020	95.0	0.0	65.0	0.0
2021	95.0	0.0	65.0	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.

Plant and animal scientists will conduct basic and applied research necessary to develop crop varieties and production strategies that can maintain high productivity in the face of increased climate variability and change.

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.

On-farm research and demonstrations used to evaluate production and economic efficiencies.

Campus-based and region-based faculty members, in partnership with commodity groups, conservation partners, general public, and private industry, will:

- Conduct focused management schools for crop, livestock and natural resources; artificial insemination courses; livestock facilities management short courses; Beef and Pork Quality Assurance Programs; Computer models/PDA record keeping programs; education about niche production markets and specialization opportunities; farm visits; on-farm research trials; educational workshops; meetings; and consultations.
- Conduct workshops and seminars, host field days, assist with planning sessions, establish watershed committees, use mass media (printed, radio, television coverage), to increase awareness and knowledge of Missourians to implement practice and programs that will preserve, protect and sustain the state's natural resource base.
- Develop curriculum-based natural resource management programs, including assessment and evaluation tools, marketing strategies and promotional materials.
- Conduct training workshops for local natural resource teams (University of Missouri Extension, Missouri Department of Conservation, and USDANRCS) and potential local partners (e.g., Missouri Tree

Farm, Conservation Federation of Missouri, Quail Unlimited, Wild Turkey Federation, Ducks Unlimited, Isaac Walton League, and Walnut Council).

- Produce up-to-date, science-based information and deliver through guide sheets, newsletters, and websites.

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"> • Education Class • Group Discussion • One-on-One Intervention • Demonstrations 	<ul style="list-style-type: none"> • Public Service Announcement • Newsletters • TV Media Programs • eXtension web sites • Web sites other than eXtension

3. Description of targeted audience

Missouri farmers, landowners, and agribusinesses are the primary target audience for this work. This will include all traditional and non-traditional farmers regardless of scale, land managers, bankers, agricultural consultants and agribusiness professionals who provide products and services to farmers. The program's research and education efforts will also provide research based information for state and local policy makers, federal partners, and state agencies as they make decisions regarding Missouri natural resources and environmental issues.

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 peer reviewed journal articles.
- Number of other peer reviewed publications book chapters, proceedings, abstracts, etc.
- Number of invited papers and invited presentations.
- Number of graduate degrees awarded.
- Number of in-service training session(s) for regional Extension specialists on an annual basis.
- Number of new or revised guide sheets annually for regional Extension specialists to use in producer meetings.
- Number of groups and individuals assisted to develop and implement forest, wildlife, and watershed plans.
- 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	Missouri's crop and livestock producers and its agribusiness sector will improve their knowledge resulting in increased productivity, economic viability, regulatory compliance and profitability through the adoption of research based integrated management practices/systems and information provided by CAFNR and MU Extension.
2	Missouri farmers, business, communities and homeowners will increase their knowledge and skills and adopt new research based best management practices that will improve and protect the state's water, environment and natural resources.
3	Basic and applied 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 into improved animal production practices that will be disseminated through the integrated livestock extension program.

Outcome # 1

1. Outcome Target

Missouri's crop and livestock producers and its agribusiness sector will improve their knowledge resulting in increased productivity, economic viability, regulatory compliance and profitability through the adoption of research based integrated management practices/systems and information provided by CAFNR and MU Extension.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 502 - New and Improved Food Products
- 102 - Soil, Plant, Water, Nutrient Relationships
- 206 - Basic Plant Biology
- 601 - Economics of Agricultural Production and Farm Management
- 402 - Engineering Systems and Equipment
- 216 - Integrated Pest Management Systems
- 205 - Plant Management Systems
- 201 - Plant Genome, Genetics, and Genetic Mechanisms

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Missouri farmers, business, communities and homeowners will increase their knowledge and skills and adopt new research based best management practices that will improve and protect the state's water, environment and natural resources.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 135 - Aquatic and Terrestrial Wildlife
- 123 - Management and Sustainability of Forest Resources
- 111 - Conservation and Efficient Use of Water
- 605 - Natural Resource and Environmental Economics
- 112 - Watershed Protection and Management
- 601 - Economics of Agricultural Production and Farm Management
- 402 - Engineering Systems and Equipment

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Basic and applied 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 into improved animal production practices that will be disseminated through the integrated livestock extension program.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems
- 303 - Genetic Improvement of Animals
- 601 - Economics of Agricultural Production and Farm Management
- 402 - Engineering Systems and Equipment

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.)

Description

- A downturn in the state's economy will impact agricultures' ability to produce and families the ability to access high quality, nutritious foods.
- Budget restrictions that limit the creation of new knowledge, or the curtailment of extension education programs, would impact outcomes.
- Public policy and Farm Bill changes regarding the support for agriculture programs, research, trade, commodity support, training, environmental regulations, and production practices may affect program outcomes.
- Natural, disease, or human-driven catastrophes will affect outcomes.
- Economic constraints may threaten potential new technologies that would increase food safety.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

We will conduct evaluations through the life of this program of work through listening sessions; advisory committees, councils; through formal and informal evaluations completed in conjunction with series teaching, workshops, field days, continuing education workshops and peer reviews of planned research and extension programs; and, from external peer panels during six-year reviews of unit and issue-based reviews of our research and extension programs.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Personal, Family and Community Wellbeing

2. Brief summary about Planned Program

University of Missouri Extension reviewed The Survey of Consumer Finances which shows a rise in families' median level of debt burden, financial stress and the incidence of late payments. The increases cut across all income and age groups with the highest levels of financial stress in households headed by people 65 or older and earning less than \$25,000 annually. Research based resource management programming arms consumers with the information they need to manage their money for current expenses, investments, retirement and estate planning.

University of Missouri Extension nutrition and health education programs build on a strong research base and targets adults and youth ages 3 through 18 and provides basic food, nutrition and healthy lifestyle information that promotes healthy food choices, physical activity and chronic disease prevention and management.

University of Missouri Extension 4-H youth development faculty and staff work with volunteers and professionals to plan, implement and evaluate progressive series of programs and experiences that connect young people with content of interest, caring adults and opportunities for mastery over an extended period of time. Program examples include 4-H clubs and after-school programs that integrate STEM skills.

Individual and family health, family fiscal security, and youth opportunities and development are impacted by healthy, vibrant communities. MU research and extension, fostering the long-term viability of communities, embraces a holistic focus in which we work collaboratively with communities to foster sustainable business, community and economic development, leadership development, community decision making, and inclusive communities. Community emergency management planning prepares communities for dramatic changes created by weather related disasters and develops the capability to assist communities and residents in all areas of emergency management. The program also actively participates in the Extension Disaster Education Network (EDEN).

3. Program existence : Mature (More than 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
602	Business Management, Finance, and Taxation	9%	0%	0%	0%
604	Marketing and Distribution Practices	1%	0%	0%	0%
607	Consumer Economics	1%	0%	0%	0%
608	Community Resource Planning and Development	4%	0%	0%	0%
610	Domestic Policy Analysis	1%	0%	0%	0%
703	Nutrition Education and Behavior	20%	0%	0%	0%
723	Hazards to Human Health and Safety	2%	0%	0%	0%
724	Healthy Lifestyle	5%	0%	0%	0%
801	Individual and Family Resource Management	2%	0%	0%	0%
802	Human Development and Family Well-Being	1%	0%	0%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%	0%	0%	0%
805	Community Institutions and Social Services	7%	0%	0%	0%
806	Youth Development	37%	0%	0%	0%
	Total	100%	0%	0%	0%

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

Increased rates of obesity, type 2 diabetes, decreased physical activity, and low consumption of fruits, vegetables and whole grains in Missouri adults and youth have led to Missouri being ranked as the most obese state in the nation as of spring 2013. Missouri also receives poor marks in preventing the outbreak of food borne illness. Federal reports show that roughly 5,000 people in the United States are killed and 325,000 hospitalized by food-borne illness each year.

The rise in families' median level of debt burden, financial stress (when debt payments take more than 40 percent of income) and the incidence of late payments, now cuts across all income and age groups with the highest levels of financial stress in households headed by people 65 and older and earning less than \$25,000 annually.

Creating family, youth and community wellbeing requires a systems approach. Communities are more racially and ethnically diverse, often with increased aging, changing economic opportunities, decreasing median family incomes, increased obesity/health risks and youth at risk. Some communities see an influx of retirees and others an exodus of youth; some are growing; others continue to experience decline. Local governments struggle with increasing pressures and demands that require a wide array of public engagement to sufficiently address increasingly complex issues. Community economic development

strategies require a new way of thinking that includes: a) sustainability that integrates social, environmental and economic aspects, creating opportunities for a new, green and equitable economy; b) local knowledge and skills (including cultural heritage, arts, and nature) as a critical source for entrepreneurial economic stability and growth; c) creating local and regional place-based systems and partnerships to support entrepreneurship and business retention; e) measures of success based on the quality of community, quality of jobs created and ability to provide decent living; and g) providing high-speed broadband to develop, sustain, and expand businesses. Fostering critical new leadership voices among youth, elderly, new immigrants and the low-income population occurs best through local efforts that can be more responsive to local needs and organized around a pressing issue or for a particular constituency. Creating resilient families, businesses and communities requires community emergency preparedness as Missouri experiences at least 10 significant natural weather events each year.

Connecting caring adults and youth means building systems in the county MU Extension 4-H youth development program that promotes long-term, meaningful and positive relationships between youth and adults. Learning experiences for youth will be targeted to help them increase their interest and engagement in science, develop positive attitudes towards science, develop science skills and abilities and for older youth to apply and make a contribution through science.

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

MU Extension faculty provide research information and educational programming to the general public, special target groups, youth from pre-school to high school, adults, older citizens, local leaders, and agency personnel. Evidence curricula targeting the general public, low-income families, high school students through teachers (NEFE's High School Financial Planning Program), elders (CSREES Financial Security in Later Life), and family agencies increase financial literacy and asset development as well as reducing individual debt. We offer programs to college students, young couples, women, unbanked consumers, divorcing families, consumers meeting financial education requirements for bankruptcy discharge, and those planning estate and retirement asset distribution strategies. Programs assist participants to successfully develop, maintain, and monitor quality, affordable, healthy and sustainable housing in their community.

Nutrition and health programs focus on the stages of change, underpinned by the Social Ecological Model which emphasizes experiential learning, e.g., food tasting, food preparation, physical activity, hand washing and positive body image.

Community decision-making involves a broad spectrum of community members in community deliberation, planning and implementation. Community decision-making is improved by use of information and analysis of alternatives, and implementation occurs when people have a voice in creating their own future. Everyone is a leader, and citizens from all walks of life need to accept responsibility for problem solving. Leadership can be learned. Successful, healthy, and sustainable communities generate and maintain a flexible, dispersed leadership and networks that seek to build inclusion and enhance the skills,

knowledge and ability of local people. Innovation contributes to the quality and economy of the community. A community culture that nurtures entrepreneurship is as critical as actual skill and knowledge development for entrepreneurs themselves. Development of an entrepreneurial support system and partnerships that support community entrepreneurship and appropriate policies is essential to creating viable community economies. Fostering entrepreneurship includes entrepreneurial practices within nonprofits, education, and government. Building on the basis of local resources is rooted in an asset-based approach. Resources include a wide array of local knowledge, culture, history and tradition, businesses, natural and man-made systems, organizations, and diversity of groups and residents.

When environments include sustained opportunities for young people to gain a sense of belonging, independence, mastery and generosity, youth can: master skills to make positive life choices; effectively contribute to decision-making and act responsibly; and positively influence their communities and beyond. On-going caring relationships are essential to positive youth development.

2. Ultimate goal(s) of this Program

The overall goal of this program is healthy, functioning youth, families and communities. Program participants will reduce the risk factors of nutrition-related diseases and complications of chronic diseases affected by poor diet quality and physical inactivity. They will also reduce environmental barriers to the adoption of healthy lifestyle practices. Program participants will also learn proper food handling skills which will reduce their risk of food-borne illness.

Consumers will be financially literate and capable of effectively functioning in the financial marketplace. Homeowners will learn skills in home maintenance, home inspection, energy and financial management. Renters and landlords will create better partnerships with each accepting and fulfilling their respective responsibilities. Programs will promote interagency cooperation addressing housing problems.

Adult volunteers and faculty create environments that connect youth with caring adults and opportunities for mastery in the sciences and meaningful leadership experiences over an extended period of time.

Citizens and decision-makers develop and use the skills, information and tools necessary to engage in public deliberation and problem solving on a wide variety of issues and challenges to create their desired future. Leaders, organizations, and communities demonstrate an increased capacity to engage the citizenry and address community issues effectively by mobilizing the community resources and assets for common purposes and efficacious local decision making and governance. Local organizations, businesses, and communities sustain engagement and collaborative learning with the university. Best practices of entrepreneurial community development are spread and adopted. Viable and sustainable regional and local communities link rural and metro areas and engage the multiple facets of diversity in the community to build its sustainability. Individuals and families, businesses, farms, organizations, and communities are prepared for and able to recover more easily from disaster.

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	171.0	0.0	0.0	0.0
2018	171.0	0.0	0.0	0.0
2019	171.0	0.0	0.0	0.0
2020	171.0	0.0	0.0	0.0

2021	171.0	0.0	0.0	0.0
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V(F). Planned Program (Activity)

1. Activity for the Program

Faculty will conduct workshops, multi-session programs and meetings, intensive courses, conferences; develop products, curriculum and resources; provide training and consultation; and work with and use various media to share state of the art knowledge and research.

We will engage with eXtension, partner with other organizations, leaders, agencies, and other states for training and delivery, and develop collaborative partnerships with local, state and national organizations for programming and funding (including the regional rural development center). Faculty will work collaboratively and across disciplines to develop and deliver programs that are based on research and best practice while engaging with the community for its development and to inform research and teaching on campus. We will provide internships for under grad and graduate students, class projects based in the community, research and evaluation opportunities that engage graduate students.

In addition, we will establish and assist COAD (Community Organizations Active in Disasters) and provide disaster educational materials and workshops to communities and organizations. We will support establishment and viability for 4-H clubs and programs, and local leadership development for youth and adults.

We will form planning committees/advisory panels, facilitate participatory visioning and planning workshops, moderate local dialogues about key issues, hold community meetings and conduct presentations, gather data and use decision support tools to analyze alternatives for the community, organizations, or interest groups with citizens and decision makers, work with communities to address a specific need or issue. We will also work with communities and regions to develop models of excellent entrepreneurial community practice, community economic development and regional economic development strategies. We will provide counseling and expertise, coaching, and training for businesses.

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"> ● Education Class ● Group Discussion ● One-on-One Intervention ● Demonstrations ● Other 1 (Simulations/Role Play) ● Other 2 (Retreats & Field Trips) 	<ul style="list-style-type: none"> ● Public Service Announcement ● Newsletters ● TV Media Programs ● eXtension web sites ● Web sites other than eXtension ● Other 1 (Social Media) ● Other 2 (Bulletins/Manuals/Displays)

3. Description of targeted audience

Programs are designed for families and individuals of all ages. From young children, teens, adults and older adults, we provide educational programs and technical assistance to individuals and in group settings, with special focus on underserved populations. Our faculty work closely with other agencies within their communities, the state, and extension faculty across the country.

Targeted audiences are all social groups in the community, including low-income and minorities, non-

English speaking, community leaders and organizations, local government, professionals working in community and economic development, local businesses and potential business owners, home builders, and agencies that assist in disaster. We place no limitation on gender, ethnic or religious diversity, lifestyle choice, etc. We also will make a concerted effort to reach military personnel, veterans and their families.

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 engaged in science learning experience.
- Number of adults engaged in leading science experiences for youth.
- Number of in-depth training programs conducted.
- Number of other conferences, courses, and workshops held.
- Percent of participants in workshops and training indicating they would recommend the program to others.

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 participants adopting research based practices as result of increasing their knowledge of family resource management, healthy food and nutrition practices, and healthy lifestyles.
2	No. of youth who pursue study in science career path as the result of participating in programming with direct access to the technological and research advances in agriculture, life sciences, human development, social sciences and engineering, young people in MU Extension's 4-H Youth Development programs that build problem-solving skills and increase their interest in STEM.
3	No. of persons reporting taking on new leadership roles as a result of their engagement in community development programs (decision making, emergency management, leadership development, organizational development and capacity building, community economic development, etc.).

Outcome # 1

1. Outcome Target

Number of participants adopting research based practices as result of increasing their knowledge of family resource management, healthy food and nutrition practices, and healthy lifestyles.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 607 - Consumer Economics
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 802 - Human Development and Family Well-Being
- 801 - Individual and Family Resource Management
- 602 - Business Management, Finance, and Taxation
- 703 - Nutrition Education and Behavior
- 724 - Healthy Lifestyle
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

No. of youth who pursue study in science career path as the result of participating in programming with direct access to the technological and research advances in agriculture, life sciences, human development, social sciences and engineering, young people in MU Extension's 4-H Youth Development programs that build problem-solving skills and increase their interest in STEM.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

No. of persons reporting taking on new leadership roles as a result of their engagement in community development programs (decision making, emergency management, leadership development, organizational development and capacity building, community economic development, etc.).

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 806 - Youth Development
- 805 - Community Institutions and Social Services
- 610 - Domestic Policy Analysis
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities

4. Associated Institute Type(s)

- 1862 Extension

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.)

Description

The contemporary arena in which community actions are pursued can seem overwhelmingly complex. Also affecting programming are the devolution of authority for action and service delivery; maintaining quality with fewer resources; expectations for shared power; increased diversity, challenges of collaboration, and reconciling local development with globalization. Competing public priorities force citizens to prioritize their time and energy and can lead to polarization and citizens feeling marginalized even when they offer their input. The decline in tax revenues for some communities and state programs has affected the ability to implement new projects and continue to support others at the same level. With term limits and tighter budgets at local and state levels and internal university pressures, our funding and program priorities may fluctuate. With the increasing number of weather-related disasters, our work fluctuates and some planned programs have to be delayed or cancelled. Finally the challenge of tracking and evaluating change in family, individuals and community contexts is complex, can be time

consuming, and relies on voluntary participation.

The ability to provide volunteer training and educational experiences for youth is dependent on having a well-educated and motivated local and state faculty to guide and support volunteers. Typically, we have vacancies and turn over that threatens the on-going delivery of quality programming.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Conduct post/pre-post evaluations at the conclusion of the training/course/workshop to determine learning and intent to apply learning. Conduct follow-up evaluation of application within three to twelve months for most offerings to determine application of learning. We will monitor changes and collect data based on attribution in communities and organizations over time for the indicators identified in the North Central Region.

General data collection for learning and application will follow similar protocols so that data can be aggregated by sub-regions of the state, the state and multi-state North Central region.

4-H campus and field faculty will use the Quality Matters 4-H observation tool on a subset of 4-H clubs annually. Once a baseline of quality is determined, 4-H faculty will use the National 4-H Common Measures for Universal or Life Skills and Science. Campus and field faculty will determine jointly specific events (e.g., camps, robotics build and competition), to evaluate youth outcomes for increased interest and engagement in science, develop positive attitudes towards science, develop science skills and abilities and for older youth to apply and make a contribution through science.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger

2. Brief summary about Planned Program

Animal Science

Lincoln University, Cooperative Research and Extension Animal Sciences Program (ASP) investigates production practices for economically important livestock species and risks to human and animal health. The species chosen are of value to farmers with limited resources. Stakeholder input is based on local livestock associations (North Central Regional Aquaculture Center, Missouri Aquaculture Association, and Missouri Sheep and Goat Producers), market trends and direct requests.

Livestock production addresses improving approaches to internal parasite control and disease prevention, preventing and treating footrot, and improving animal production management systems through enhancing reproductive efficiency, genetic advancement, and nutrition. The target audience, limited resource farmers and their families, will be informed of methods to employ, which will enhance the farming operation's profitability and sustainability through workshops and programs. Examples of workshops and programs include: shearing and fitting schools, pasture management, artificial insemination, and herd and flock health management.

The animal science program includes food-fish production research in the areas of: nutrition (bluegill and crappie), genetics (sunfishes), production dynamics (sunfishes), pest management, and fish health. In addition, new market strategies are presented to stakeholders to enhance their opportunities to increase their farm income.

The insect and pest management program will address factors related to insect-borne diseases of humans and animals. Understanding the environmental, ecological, and genetic factors related to insect vector disease transmission will enable development of more effective vector management strategies and lower rates of insect transmitted disease in humans and animals.

Outcomes are to improve production efficiency and increase opportunities with new strategies regarding livestock and fish production. These results are essential to enable sustainability of diversified production for small and limited resource farmers.

Plant Science

The Small Farm Research and Extension program has the objectives of supporting the 1890 Mission through research on crop production problems, aimed at improving the economic and social well-being of underserved rural and urban residents with limited resources.

The program also emphasizes a collaborative team effort in areas of small fruits and vegetable crops, including sustainable hydroponics technologies, as well as native plants and herbs and spices. It will continue to strive for reaching more limited resource farmers and ranchers and deliver appropriate research-based information and education that will eventually lead to overall well-being of their family.

The Native Plants Program (NPP) is becoming a much more prominent through collaboration with

various other agencies and entities. NPP is in partnership with the Center for Rural Affairs, located in Nebraska, to promote sustainable agriculture and organic practices. NPP has partnered with University of Missouri (Columbia) to conduct survey work in the Bootheel Region and has a cooperative agreement with the U.S. Forest Service to grow native plant seed and nursery stock for species of concern, rare, Ozark endemics and those important to pollinators.

The Integrated Pest Management (IPM) Program at Lincoln University, is involved in both research and extension services on sustainable/organic practices for small fruits and vegetables. Relevant research on insect pest and weed management is underway. Lincoln University and the University of Missouri will combine outreach efforts to synergize beneficial impacts on citizens of Missouri.

3. Program existence : Intermediate (One to 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
102	Soil, Plant, Water, Nutrient Relationships	0%	5%	0%	8%
111	Conservation and Efficient Use of Water	0%	5%	0%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	2%	0%	2%
204	Plant Product Quality and Utility (Preharvest)	0%	5%	0%	5%
205	Plant Management Systems	0%	5%	0%	7%
212	Diseases and Nematodes Affecting Plants	0%	2%	0%	2%
216	Integrated Pest Management Systems	0%	5%	0%	5%
301	Reproductive Performance of Animals	0%	5%	0%	5%
302	Nutrient Utilization in Animals	0%	5%	0%	5%
303	Genetic Improvement of Animals	0%	10%	0%	10%
307	Animal Management Systems	0%	15%	0%	15%
311	Animal Diseases	0%	6%	0%	6%
313	Internal Parasites in Animals	0%	5%	0%	5%
405	Drainage and Irrigation Systems and Facilities	0%	2%	0%	2%
503	Quality Maintenance in Storing and Marketing Food Products	0%	5%	0%	0%
601	Economics of Agricultural Production and Farm Management	0%	8%	0%	8%
604	Marketing and Distribution Practices	0%	5%	0%	5%
721	Insects and Other Pests Affecting Humans	0%	5%	0%	5%
	Total	0%	100%	0%	100%

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

1. Situation and priorities

Situation

Lincoln University's target audience is limited resource producers participating in agricultural enterprises on small acreages. Missouri has 101,600 small farms, (from National Agricultural Statistics Service, NASS) which accounts for almost 94% of the total number of farms in the state. The heads of households in the majority of small farm families are employed outside the home. These families need research based alternative options to sustain their way of life. The state's diverse climate, geology, and

geography provide unique opportunities and challenges to Missouri farmers. Missouri is the third largest cow-calf producer in the United States and improved efficiency of production is needed to maintain this status. Alternatives to cattle for small farm operators include sheep and goats, which are easy to handle and can browse and consume forbs, which are not preferred by cattle.

Missouri is the second largest aquaculture producing state in the North Central Region. It is an important industry to support since it is the leading agricultural contributor to the U.S. trade deficit. Fishery harvests are in decline, yet demand for fishery products is increasing. There is a need for increased seafood production and aquaculture can provide an alternative supply for seafood products. Sunfishes, native to Missouri, are highly regarded as food fishes and have been identified as potential aquaculture taxa for the North Central region. However, there are critical factors limiting their economic and sustainable production. Other potential species may become important and will offer the same type of research opportunities.

Managing pests has been consistently identified as the number one challenge faced by most medium- and small-scale producers. For example, in recent surveys, 43% of organic producers and 66% of Amish farmers indicated that pests (arthropods, diseases and weeds combined) are the most important factor limiting production. Another survey applied to Extension educators in the state during an In-Service Education workshop implemented by the Lincoln University Integrated Pest Management (IPM) Program in 2011 revealed the importance and need of IPM. Data clearly shows that farmers have a high need and a high desire to obtain information about IPM programs.

Priorities

Livestock:

1. Develop improved approaches to internal parasite control and disease prevention.
2. Develop improved animal production management systems through enhancing reproduction, genetics, nutrition, and pasture management.

Aquaculture:

1. Develop least-cost diets that meet the nutritional requirements for different life stages of sunfish species in food fish production.
2. Produce sunfish strains through selective breeding for optimum food-fish production.
3. Develop best method for optimum production of sunfish species in recirculating and pond Aquaculture systems.

4. Adopt, develop, or promote rapid disease identification technologies, treatments, and bio-security standards for sunfish in culture systems.

Plant Science:

1. Identify the needs and expectations of small farmers in Missouri. Continue to update the information gathered from the small farms survey conducted in 2001, and gather information periodically from several sources, including the USDA Agriculture Census data.
2. Keep the County-based Small Farm Program staff (Farm Outreach Workers) informed of the latest farming-related innovations and developments so that they can share the information with the collaborating farmers and ranchers.
3. Increase the capability for controlled environmental research at the University (high tunnel, hydroponics, etc.). Continue to conduct small-fruit and vegetable variety trials.
4. Promote production of value-added products, and assist small farmers and ranchers to explore and utilize new marketing techniques.
5. Foster the development and adoption on IPM, leading to increased protection and promotion of high value agricultural products, reduced pesticide use by farmers, and increased production of vegetables and

small fruits grown with reduced risk pesticides and with organic methods.

Hydroponics:

The hydroponic research program has the goal of enhancing the development of sustainable hydroponic production technologies for limited resource growers in Missouri. It will contribute to the commercial development of many small-scale hydroponic industries in Missouri and the Midwest states. The program's objectives also meet the USDA-ARS's specific goals of enhancing economic opportunities for small-scale family farms, and improving the quality of life for rural citizens and communities. The project focuses on the following objectives:

1. Develop protocols for evaluating selected cultivars of leaf, fruit, and seed yielding specialty vegetables, herbs and spices, and to determine factors affecting their adaptation to sustainable hydroponic culture under controlled environment agriculture systems.
2. Assess the relative suitability of different mineral nutrient solution formulations for the growth, development, yield and marketable quality of selected specialty fruits vegetables, herbs and spices in both aggregate and liquid-culture hydroponic systems.
3. Evaluate the effect of different aggregate media or root support substrates on growth, yield and marketable quality of selected fruits vegetables, herbs and spices.
4. Investigate and develop improved nutrient management strategies for optimizing the nutrient-use efficiency of fruits vegetables, herbs and spices, and to minimize nutrient losses and potential environmental pollution through run-off from non-recirculating hydroponic systems.

Agriculture Economic/Business:

Study of Rural Entrepreneurship for Economic Development in Southeast Missouri Counties.

1. To identify factors that account for disparities in economic development within two sub-regions in the Southeast Missouri region; that is, between the western and eastern halves of the region;
2. To determine the difference in attitude towards entrepreneurship between the population of two sub-regions in Southeast Missouri; that is, between the western and eastern halves of the Southeast Missouri region.
3. To determine opportunities for entrepreneurial activities to boost economic development in the eastern half of the region.
4. To propose possible strategies to stimulate rural entrepreneurial activities to foster economic development in the region.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Assumptions:

- 1. 1). Funding--Program funding levels will increase at rate of 3% per year through the five-year period of this plan. There will be continuity in the funding of the program objectives over the stated time period
- 1. 2). Facilities and Equipment--Adequate facilities (research, education, and land) are available or will be acquired as required to support research and extension efforts in this program.
- 1. 3). Personnel--Skilled researchers, educators, and support staff having the appropriate knowledge bases are available or will be hired to support the efforts of this plan.
- 1. 4). Administrative Support--Skilled administrative support staff are available to provide required oversight, accounting, and periodic reporting tasks to enable researchers to remain focused on achieving program results. There will be stability in the administration, faculty, and staff over the stated period.
- 1. 5). Partnerships--Lincoln University will establish partnerships to promote achievement and dissemination of the results of this program. The program will continue to have sustained and continued stakeholder participation.
- 1. 6). Relevance for Program--Program is relevant to our targeted audience and stakeholders.
- 1. 7). Adoption of Techniques--Targeted audiences will accept and adopt the results of the research program.
- 1. 8). The objectives of the program are consistent with the University Mission.

2. Ultimate goal(s) of this Program

Goals:

- 1. To provide research and extension products that enable limited resource farmers in Missouri to improve profitability and sustainability for their agricultural enterprises resulting in an improved quality of life for the farm family.
- 2. To reduce the threat to Missouri residents from insect vector-borne diseases.
- 3. To build a strong farm economy and a satisfying family life. Promote sustainable farming practices (meaning those that are profitable, environmentally friendly, and socially responsible).
- 4. To increase the level of awareness and adoption of IPM components leading to increased profits while decreasing inputs and pesticide use.

1.

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	0.0	7.5	0.0	20.0

2018	0.0	7.5	0.0	20.0
2019	0.0	7.5	0.0	20.0
2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- a. Conduct research to control internal parasites and prevent diseases in small ruminants.
- b. Practice the use of artificial insemination in large and small ruminants to improve the genetics of herds and flocks.
- c. Determine embryonic and fetal loss in goats throughout gestation, using real-time ultrasound.
- d. Research biosensors to facilitate artificial insemination.
- e. Develop sunfish cultigens for distribution to the industry.
- f. Determine nutritional requirements of sunfishes.
- g. Develop optimal production dynamics for sunfishes.
- h. Provide aquaculture fish health services for stakeholders.
- i. Conferences, meetings, workshops, and training and educational opportunities for small farmers.
- j. Introduction and evaluation of new crops (especially native crops) and improved cultural practices.
- k. Abstracts, publications, grant proposals, and guide sheets.
- l. Promotion of backyard and community gardening.
- m. Conduct analysis of the challenges of rural entrepreneurship and their impact on the prospects of community development.
- n. Develop effective and environmentally and grower friendly IPM approaches to manage key insects of small fruits and vegetables.

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"> ● Workshop ● Group Discussion ● One-on-One Intervention ● Demonstrations ● Other 1 (Field Days) ● Other 2 (Undergraduate Research) 	<ul style="list-style-type: none"> ● Public Service Announcement ● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Festivals and Fairs)

3. Description of targeted audience

Lincoln University's Cooperative Research and Extension programs focus on enhancing the quality of life for diverse, limited resources audiences. Low-income, limited resource farmers and ranchers, and underserved population in rural and urban communities.

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

- Projects completed, presentations and manuscripts.
Enhanced profitability of small farms.
Enhanced vitality and strengthening of rural communities.
- 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	Livestock-Develop improved approaches to internal parasite control and disease prevention. Develop improved production management systems through enhancing reproduction, genetics, and nutrition. Aquaculture- Define sunfish nutritional requirements. Develop a fast growing sunfish cultigen. Identify viable production systems for sunfishes. Make available a fish health protocol. Insects and Pests-IPM: Improved knowledge and awareness of the environmental and economic benefits associated with IPM implementation by growers and Extension educators, increased awareness of pesticide and nutrient impacts on non-target organisms and habitats, increased protection and promotion of high-value agricultural products, reduced pesticide use by farmers, increased production of vegetables and small fruits grown with reduced-risk pesticides and with organic methods.
2	Transfer new technologies for sunfish, small and large ruminant production to farmers. Farmers will use learned technologies.
3	Farmers adopt new technologies for increased and sustainable production.
4	Create conditions for the minority, underserved farmers to be able to earn a reasonable income, continue to live on farms, and develop educational programs and opportunities that will encourage minority youth to get involved in farming. Increase or at least maintain the number of minority farms in the state. More farmers are adopting sustainable farming practices (profitable, environmentally friendly, and socially responsible). Increase the income level of the collaborating small farmers and ranchers on an average of \$5,000 per family.
5	Enhanced profitability of small farmers and ranchers, and enhanced viability of rural communities. Increase the average small farm gross income of the collaborating farmers by \$5,000. Increase retention rates of the collaborating farmers and ranchers through providing appropriate education and information.

Outcome # 1

1. Outcome Target

Livestock-Develop improved approaches to internal parasite control and disease prevention. Develop improved production management systems through enhancing reproduction, genetics, and nutrition. Aquaculture- Define sunfish nutritional requirements. Develop a fast growing sunfish cultigen. Identify viable production systems for sunfishes. Make available a fish health protocol.

Insects and Pests-IPM: Improved knowledge and awareness of the environmental and economic benefits associated with IPM implementation by growers and Extension educators, increased awareness of pesticide and nutrient impacts on non-target organisms and habitats, increased protection and promotion of high-value agricultural products, reduced pesticide use by farmers, increased production of vegetables and small fruits grown with reduced-risk pesticides and with organic methods.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 313 - Internal Parasites in Animals
- 311 - Animal Diseases
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems
- 303 - Genetic Improvement of Animals
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 2

1. Outcome Target

Transfer new technologies for sunfish, small and large ruminant production to farmers. Farmers will use learned technologies.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 307 - Animal Management Systems
- 313 - Internal Parasites in Animals

- 301 - Reproductive Performance of Animals

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 3

1. Outcome Target

Farmers adopt new technologies for increased and sustainable production.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 313 - Internal Parasites in Animals
- 311 - Animal Diseases
- 307 - Animal Management Systems
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 216 - Integrated Pest Management Systems

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 4

1. Outcome Target

Create conditions for the minority, underserved farmers to be able to earn a reasonable income, continue to live on farms, and develop educational programs and opportunities that will encourage minority youth to get involved in farming. Increase or at least maintain the number of minority farms in the state. More farmers are adopting sustainable farming practices (profitable, environmentally friendly, and socially responsible). Increase the income level of the collaborating small farmers and ranchers on an average of \$5,000 per family.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 604 - Marketing and Distribution Practices

- 405 - Drainage and Irrigation Systems and Facilities
- 205 - Plant Management Systems
- 212 - Diseases and Nematodes Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 111 - Conservation and Efficient Use of Water
- 601 - Economics of Agricultural Production and Farm Management
- 102 - Soil, Plant, Water, Nutrient Relationships
- 216 - Integrated Pest Management Systems
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 5

1. Outcome Target

Enhanced profitability of small farmers and ranchers, and enhanced viability of rural communities. Increase the average small farm gross income of the collaborating farmers by \$5,000. Increase retention rates of the collaborating farmers and ranchers through providing appropriate education and information.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 503 - Quality Maintenance in Storing and Marketing Food Products
- 111 - Conservation and Efficient Use of Water
- 212 - Diseases and Nematodes Affecting Plants
- 205 - Plant Management Systems
- 204 - Plant Product Quality and Utility (Preharvest)
- 405 - Drainage and Irrigation Systems and Facilities
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 102 - Soil, Plant, Water, Nutrient Relationships
- 216 - Integrated Pest Management Systems
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Extension
- 1890 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.)

Description

A major factor regarding the aquaculture program are energy costs for maintaining facilities at the proper temperature, as well as water quality issues. For the Small ruminant program, it will be dependent upon the ability to find and acquire appropriately trained personnel and long-term demand for goat meat and fiber.

For plant science, changes in the Federal Government's agricultural and economic policies could have an adverse effect on planned programs. That is the same if local and State government policies change. Stakeholder expectations and natural disasters could also negatively impact programs and outcomes.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Many of these programs at the current time are still at the level of determining appropriate research methods. The economics of these will be determined and if the program appears to be economically feasible, then it will be transferred and evaluated under field conditions as case studies.

The plant science program will undergo annual evaluations and a comprehensive evaluation at the end of the five year period.

Evaluations will be performed by distributing written surveys to all program participants. The surveys will be conducted both pre- and post-program and will ask questions designed to glean information learned to increase agricultural profitability. The surveys will help us measure the percentage of program participants who increased their knowledge and ultimately increased their profits.

The results of the surveys will be distributed to unit heads and program coordinators to determine continuation, modification, or elimination.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Community and Leadership Development

2. Brief summary about Planned Program

The Community and Leadership Development (CLD) planned program will include: community and organizational-based workshops, meetings, trainings, curriculum implementation, community assistance, organizational development, fund development, community and organizational planning, and information exchange to communities and organizations that help improve the overall quality of life and standard of living for those communities and enhance the efficiency and effectiveness of those organizations. The CLD program creates, applies and transfers multidisciplinary knowledge to help people understand community change and identify opportunities in a collaborative manner.

A recently approved project will conduct a study of Rural Entrepreneurship for economic development in Southeast Missouri Counties. The findings of this project should help in the development of policies and programs to help alleviate poverty in rural communities.

The targeted audience will be under-served and under-represented communities. Also targeted among adults will be those who are currently serving in, or aspire to serve in, a leadership role or in an agency, organization, neighborhood, club, community, business.

3. Program existence : Intermediate (One to 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 : 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
602	Business Management, Finance, and Taxation	0%	15%	0%	0%
608	Community Resource Planning and Development	0%	25%	0%	0%
802	Human Development and Family Well-Being	0%	5%	0%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%	5%	0%	0%
805	Community Institutions and Social Services	0%	15%	0%	0%
806	Youth Development	0%	10%	0%	0%
901	Program and Project Design, and Statistics	0%	10%	0%	0%
902	Administration of Projects and Programs	0%	10%	0%	0%
903	Communication, Education, and Information Delivery	0%	5%	0%	0%
	Total	0%	100%	0%	0%

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

1. Situation and priorities

Situation

Due to the rapid growth of small towns and the numerous laws associated with managing them, many community leaders have requested training to assist them in executing their duties. Small towns and community leaders are often unprepared for their roles in administration and management, especially when it comes to expending tax payer's money.

Many small towns and community leaders find that their administrators, officers, supervisors and managers have not had any formal training in the responsibilities or expectations for these positions. Lack of skills result in the individual either replicating "what we've always done" or asking other supervisors, who also may not be trained, what to do.

Unprepared supervisors, officers, and managers can result in lost time and production due to grievances and poor employee/membership relations. While it is essential to improve the efficiency and effectiveness of frontline supervisors, few small towns and community organizations are large enough or have the internal resources to provide training.

Hundreds of small town administrators in the State of Missouri are entrusted with managing the day-to-day affairs of their communities, from issuing permits and licenses, to handling local elections, to collecting taxes. These persons must comply with a variety of local and state laws and ordinances set forth by elected officials at all levels of government, as well as answer to their local constituents. Keeping up with thousands of laws and processes is not easy for the small town administrators in Missouri. They need

training in how to manage their responsibilities and to keep up with constantly changing policies. Many organizations and agencies are finding their managers/officers have not had formal training in how to manage organizations, other people, and/or the public. As a result, there are often miss-steps and time lost as these individuals learn "on the job."

When officers or administrators in small towns or community organizations don't have the skills needed to manage projects, it costs the organization in efficiency and effectiveness - affecting profitability, membership and poor public relations. Many organizations don't have the internal resources to provide training in many of these needed areas of administration. They are constantly looking for affordable experts at the university to provide applicable skills in a format useful to the learner.

Training will help participants become more effective within their organizations and ultimately enhancing the quality of life and standard of living within the communities they serve. Communities reap rewards when residents become involved, raise their awareness of issues, and improve their leadership skills. Building a community where people want to live, work and play has its long term rewards.

The Lincoln University Center for Community and Leadership Development (LUCCLD) has developed training sessions and workshops in leadership and administrative management that help participants work more effectively with village, town, and city boards; communicate with citizens; and establish policies that use local resources wisely. The program also helps participants build a professional network for continued learning and support. The sessions often focus on leadership skill development, laws, rules, and regulations that affect small towns and communities. Sessions will also focus on the effects of educational processes, governmental administration, business and economic development, public health and human services.

Training and workshops in this area aims to better prepare supervisors and officers for their position and responsibilities. Workshop topics are Basic Leadership Skills, Work Planning and Goal Setting, Customer/ Resident Relations, Effective Communication Skills, Budgeting, Fund Accounting and Grant Administration, "Nuts and Bolts" of Personnel Management, Managing "Troubled" and "Problem" Employees, and Negotiations.

The LUCCLD has developed a series of workshops and training sessions to help individuals become better administrators. Critical skill areas include: Leadership, Community Resource Planning, Negotiation Skills, Planning and Development, Communication Skills, Youth Development, and General Community and Organizational Skills. The goals of this training are to assist individuals to be more professional and effective with personnel issues and when communicating with citizens and employees.

The LUCCLD has also launched efforts aimed at empowering citizens with information and skills to heighten awareness and deepen civic involvement. The goals of these workshops and training are to improve participants' skills in working with others, to increase citizen involvement, and effective decision-making to affect change.

Priorities

- Improving small towns and community organization efficiency through teaching and improving leadership and management skills will be emphasized.
- Provide leadership and organizational development training for small towns and communities in Missouri.
- General community and organizational skill building leadership programs.
- Preparing small town and community leaders to work more effectively with the public.
- Training and skills that improve small town, community and organizational efficiency and effectiveness.

- Leadership management skills for improved efficiency and human relations.

2. Scope of the Program

- In-State Extension

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

1. Assumptions made for the Program

- That the program is assured of continuous funding.
- That the stakeholders will use the information provided to enhance their community interaction.
- That people will accept training opportunities offered to them by the program.
- That policy makers will be persuaded to enact appropriate legislation, if necessary.
- That there will be adequate personnel to operate the program.
- That there will be adequate administrative support to maintain the program.

2. Ultimate goal(s) of this Program

- Community goal attainment.
- Increased capacity to deal with current and future issues.

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	0.0	1.0	0.0	0.0
2018	0.0	1.0	0.0	0.0
2019	0.0	1.0	0.0	0.0
2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Strengthening leadership and management skills for small towns, communities, and organizations

Workshops and training sessions covering critical skill areas and topics such as: leadership, community resource planning, negotiation skills, planning, communication skills, self-awareness, understanding and leading people, getting results, strategic thinking, basic leadership skills, work planning and goal setting, customer/resident relations, effective communication skills, budgeting, funding accounting and grant administrations, managing personnel issues, and negotiations.

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"> ● Education Class ● Workshop ● Group Discussion ● One-on-One Intervention 	<ul style="list-style-type: none"> ● Newsletters ● Web sites other than eXtension ● Other 1 (Word of mouth and announcements)

3. Description of targeted audience

Small towns, community organizations and agencies.

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

- Informational sessions including, workshops, presentations and face-to-face meetings.
- 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	Demonstrate increased knowledge and understanding of community development planning. Demonstrate increased partnerships and resources for the community. Demonstrate increased civic engagement in deliberating community issues.
2	Community decision makers will increase inclusivity when seeking stakeholder input. Stakeholders will be empowered and concerned about improving the quality of life in their community. Community decision makers will seek extramural funds to make improvements. Community decision makers will review, and update ordinances to make operation more efficient.
3	Evidence of community goal attainment <ul style="list-style-type: none"> * Increased capacity to deal with future issues *Change in community practice *Improved community fiscal and economic performance * Those participating in local government are more representative of the population of the community * Sustained capacity for informed local decision making

Outcome # 1

1. Outcome Target

Demonstrate increased knowledge and understanding of community development planning.
Demonstrate increased partnerships and resources for the community.
Demonstrate increased civic engagement in deliberating community issues.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being
- 602 - Business Management, Finance, and Taxation
- 903 - Communication, Education, and Information Delivery
- 608 - Community Resource Planning and Development
- 902 - Administration of Projects and Programs
- 901 - Program and Project Design, and Statistics
- 806 - Youth Development
- 805 - Community Institutions and Social Services
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 2

1. Outcome Target

Community decision makers will increase inclusivity when seeking stakeholder input. Stakeholders will be empowered and concerned about improving the quality of life in their community. Community decision makers will seek extramural funds to make improvements. Community decision makers will review, and update ordinances to make operation more efficient.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 902 - Administration of Projects and Programs
- 602 - Business Management, Finance, and Taxation
- 903 - Communication, Education, and Information Delivery
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions and Social Services
- 802 - Human Development and Family Well-Being

- 806 - Youth Development
- 608 - Community Resource Planning and Development
- 901 - Program and Project Design, and Statistics

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 3

1. Outcome Target

Evidence of community goal attainment

- * Increased capacity to deal with future issues
- * Change in community practice
- * Improved community fiscal and economic performance
- * Those participating in local government are more representative of the population of the community
- * Sustained capacity for informed local decision making

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being
- 805 - Community Institutions and Social Services
- 903 - Communication, Education, and Information Delivery
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 602 - Business Management, Finance, and Taxation
- 608 - Community Resource Planning and Development
- 902 - Administration of Projects and Programs
- 901 - Program and Project Design, and Statistics
- 806 - Youth Development

4. Associated Institute Type(s)

- 1890 Extension

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.)

Description

All these factors may affect our planned outcomes, directly and/or indirectly.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Since the majority of our programming will come as the result of invitations from small towns and organizations for specific programming; behavioral modification and anecdotal evidence will comprise a large portion of our programming evaluations.

Evaluations will also be performed by distributing pre- and post-surveys to all program participants. The survey will focus on questions pertaining to their increased knowledge in the areas of leadership and community building. The results of the surveys will be distributed to unit heads and program coordinators to determine whether to continue, modify, or eliminate specific programs.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Family and Youth Development

2. Brief summary about Planned Program

The needs of families today are complex and require many skills to become or maintain self-sufficiency. The focus of the programs and activities will promote positive human development. Activities will extend knowledge to participants and convey a sense of belonging, teach life skills, and provide opportunities for mastery, competence and independence. This work also includes a focus on the educational, social, health, and emotional development of program participants.

3. Program existence : Mature (More than 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
607	Consumer Economics	0%	10%	0%	0%
724	Healthy Lifestyle	0%	5%	0%	0%
801	Individual and Family Resource Management	0%	5%	0%	0%
802	Human Development and Family Well-Being	0%	20%	0%	100%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%	5%	0%	0%
805	Community Institutions and Social Services	0%	6%	0%	0%
806	Youth Development	0%	40%	0%	0%
901	Program and Project Design, and Statistics	0%	4%	0%	0%
903	Communication, Education, and Information Delivery	0%	5%	0%	0%
	Total	0%	100%	0%	100%

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

1. Situation and priorities

Situation

In the United States, more than 43% of youth live in low-income families. This means the parents of these children made less than 200% of the poverty guidelines established by the federal government. The statistics concerning children living in poverty are again rising after a 10-year period of decline (National Center for Children in Poverty, 2010).

According to The National Center for Children in Poverty (NCCP), minority children are more likely to live in poverty than those from the majority population. These minority children are also the group that leads the recent statistics showing increases of children in poverty. Low-income families tend to have high mobility rates. High rates of mobility create instability and turmoil associated with issues such as the increasing educational achievement gap in low income and minority children.

Looking at The National Assessment of Educational Progress (NAEP), also known as "the Nation's Report Card," data, the Education Trust concluded that, "By the time (minority students) reach grade 12, if they do so at all, minority students are about four years behind other young people. Indeed, 17 year-old African American and Latino students have skills in English, Mathematics and Science similar to those of 13 year-old white students." Another way to measure the achievement gap is to compare the highest level of educational attainment for various groups. Here too, there are gaps at all levels. Hispanic and African-American high school students are more likely to drop out of high school in every state. Of these high school graduates, college matriculation rates for African-American and Hispanic high school students remain below those of white high school graduates - although they have risen in recent years. Furthermore, of those students enrolling in college, Hispanic and black young adults are only half as likely to earn a college degree as white students.

Findings in the NAEP primer suggest that the most successful policy initiatives recognize the critical role that parents and communities play in the care and education of young children. These efforts also encourage integration of existing programs, services, and funding streams into a flexible and comprehensive system of supports for children and families.

Difficulties in school typically result in fewer youth graduating which results in a cycle of poverty because about two-thirds of children, whose parents have no high school diploma, live in low-income families.

Consistent with targeting requirements of the Older Americans Act (OAA), the Paula J. Carter Center on Minority Health and Aging places emphasis on services to persons with the greatest social and economic need, including members of racial and ethnic minority groups. Among the OAA Title III service recipients, 21.8% were members of racial and ethnic minority groups.

The efforts of Lincoln University's extension programs are concentrated in areas of Kansas City, St. Louis and Southeast Missouri. Lincoln University provides services in and around the Jefferson City area. In Jefferson City, many of the families residing in public housing are from the large urban areas of Kansas City and St. Louis. Conditions reflect the critical educational needs of this audience as well as the opportunity to share life development skills.

In an effort to meet the needs of this diverse audience of low-income children, families, and elders, various programs must be developed and implemented that offer a level of success that has measurable outcomes. The needs for this audience are complex and generally have not been met adequately by existing programs. New ways of "reaching, teaching and inclusion" for this audience must be developed and discovered. Traditional methods are not adequate.

Priorities

Priorities of these programs are to: 1) develop leadership skills, 2) improve the literacy rate of

minority and under-represented groups, 3) and, provide a learning environment for after school enrichment, including school homework assistance. Leadership development programs will provide guidance in volunteerism, sense of belonging, development of social skills and mentoring skills.

The Abstinence Education Program, funded by a grant from the Missouri Department of Health and Senior Services, will provide education on teenage pregnancies and out of wedlock births and support decisions by adolescents to abstain from sexual activity.

The special health, psychological and social needs of the minority and underserved older adults are only partially being met. As the population continues to age, it reflects the faces of many races and cultural lifestyles. The implications of these demographic changes indicate that current barriers still exist, precluding entry into the healthcare system. Not only will these systems have to accommodate a vastly larger number of older persons in the new millennium, but, those whose needs are more diverse and more complex.

There is a lack of accessibility, adequate training and affordability that affect the already overworked healthcare system. An increased awareness of cultural needs, diversity, and disparity can serve as a benefit to the growing number of underserved. For Missouri to advance into a working multicultural system, all residents and providers of the state must have access to information to ensure that health management occurs.

2. Scope of the Program

- In-State Extension
- Multistate Extension

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

1. Assumptions made for the Program

- a). There is adequate financial support and human resources available.
- b). Continued concentrations of efforts in four regions of the state; Central Missouri, Kansas City, St. Louis and the Southeast region.
- c). The objectives of the program remain consistent with the University's Mission.
- d). Additional personnel increases will result from increased success in obtaining extramural funding.
- e). The clientele served are motivated to implement what they learn.

2. Ultimate goal(s) of this Program

To decrease poverty, in the minority and under-represented population that have received our services. Ultimately, the decreased poverty should be no higher than the averages throughout the state of Missouri.

V(E). Planned Program (Inputs)

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

Year	Extension		Research	
		1862	1890	1862

2017	0.0	22.0	0.0	0.0
2018	0.0	22.0	0.0	0.0
2019	0.0	22.0	0.0	0.0
2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

The activities in the four regions; Kansas City, St. Louis, Central, and Southeast regions have similarities and differences. However, all have been developed to design, implement, and evaluate educational programs for youth and families at-risk. Program implementation includes club member retention, workshops, camps, and after-school programs.

Specific examples of activities from the Kansas City area include:

- Mentoring Program that matches community volunteers who will spend time with interested youth. Delta Sigma Theta sorority and Phi Beta Sigma and Alpha Phi Alpha fraternities often assist with this program.
- ACT Preparation: Work with students to prepare for the English and Math portions of the ACT test.
- Fatherhood Programs: This includes youth and adults and these are meetings that address topics related to self-esteem, nutrition, fitness, computer skills, relationships and parenting.
- Afterschool Tutoring Program: Programs are to assist students K-8 with homework, tutoring, computer classes, reading and math labs, life skills, arts, and crafts and recreation. Collaboration with the National Book Bank provides donations of books to non-profit organizations.
- Fitness Program: LUCE currently offers the Division of Youth Service classes in their physical education component. The community also participates in exercising to increase their energy level and to improve their overall health.
- The Abstinence Program, for youth to learn the advantages of remaining abstinent.

Specific examples of activities from the St. Louis area include:

- Teen Drop In: This program has open enrollment for neighborhood youth and is to provide an after-school community safe haven. The teen drop in offers an array of opportunities for youth between the ages of 12 to 17. Activities and educational workshops include but will not be limited to homework assistance, open-microphones to develop their skills in public speaking/poetry, teen talk to discuss youth community issues and concerns, and educational games as well as activities that teach to enhance their life skills. Offered through the school year.
- After School Neighborhood Initiative: Our initiative is to provide a power-hour implementing homework assistance for youth after school, provide life skills activities that teach addressing communication skills, drug and alcohol prevention, conflict resolution, etc., as well as health and nutrition via snacks and physical activity. This program offers open enrollment to youth participants.
- Urban Garden Beautification Project: This collaborative effort works with communities to continue transforming weed infested vacant lots into a neighborhood asset that will assist in stabilizing the neighborhood and revitalize community.

Specific examples of activities in the Southeast Missouri Region include:

- Health and Fitness Classes.

- Health fair designed to educate youth on nutrition, fitness, and the dangers of alcohol, tobacco, and other drugs.
- Field Days - a culmination of educational workshops on a variety of topics for all ages.
- HIV/AIDS/STD Awareness Day.
- Summer Camps, to provide fitness and health, character development, arts and crafts, self-esteem building, recreation, and field trips for 5 weeks.
- Women's Wellness Conference.

Specific activities in the Central Region include:

- Underserved minorities and other disadvantaged older adults 50+ in Cole County area will become more aware and knowledgeable about importance of adopting a healthy lifestyle.
- Participants will become proactive in seeking health information.
- Participants will become more aware of ways to manage their personal health.
- Youth will develop increased communication skills, receive feedback, certificates of award and recognition for their efforts.
- Provision of culturally specific parenting education classes.
- Family and community empowerment experiences to assist parents helping their children to close the educational achievement gap.

Activities that have been implemented in all four Regions include:

- Black History Programs for youth (K-12) in the school districts. This is an educational program on the accomplishments and struggles of African-Americans.
- Program to address childhood obesity for parents and youth.
- Financial Management and Youth Program, which is designed to teach youth about basic financial management in order to help them make better economic and life decisions.
- A Gathering of Kings Conference develops skills for making healthy choices when dealing with oppressive issues. By providing youth with positive mentors and role models, the issue of increased high school dropout rate is addressed and children are more likely to complete high school and attend college. By providing the youth with positive mentors and role models we are also aiding suicide prevention and combating in lowering suicide attempts

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"> • Education Class • Workshop • Group Discussion • Demonstrations 	<ul style="list-style-type: none"> • Newsletters • TV Media Programs • Web sites other than eXtension

3. Description of targeted audience

Minority and other under-represented youth in urban St. Louis, Kansas City and selected locations in the Bootheel region of the state (Primarily Sikeston, Charleston, and Caruthersville). Minority and under-represented populations in Central Missouri, especially those living in housing developments.

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

- Education classes, invited speeches, workshops, in-service education, consultations, media appearances, web sites, newsletters
- 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	Short term: 1) Enhanced academic productivity, 2) Improved rate of community volunteerism 3) Development of leadership skills, 4) Increased knowledge and life skills.
2	Medium term: 1) Completion of current grade and promotion to the next, 2) Increased graduation rates from high school, 3) Reduced probability of acts of crime, 4) Increased self-esteem, and 5) Better life choices.
3	Long term: 1) Improved education levels, 2) Increased standard of living, 3) improved quality of life.

Outcome # 1

1. Outcome Target

Short term: 1) Enhanced academic productivity, 2) Improved rate of community volunteerism 3) Development of leadership skills, 4) Increased knowledge and life skills.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics
- 903 - Communication, Education, and Information Delivery
- 805 - Community Institutions and Social Services
- 802 - Human Development and Family Well-Being
- 801 - Individual and Family Resource Management
- 607 - Consumer Economics
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 724 - Healthy Lifestyle
- 806 - Youth Development

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 2

1. Outcome Target

Medium term: 1) Completion of current grade and promotion to the next, 2) Increased graduation rates from high school, 3) Reduced probability of acts of crime, 4) Increased self-esteem, and 5) Better life choices.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being
- 903 - Communication, Education, and Information Delivery
- 801 - Individual and Family Resource Management
- 724 - Healthy Lifestyle
- 805 - Community Institutions and Social Services
- 806 - Youth Development
- 901 - Program and Project Design, and Statistics
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 607 - Consumer Economics

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 3

1. Outcome Target

Long term: 1) Improved education levels, 2) Increased standard of living, 3) improved quality of life.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 724 - Healthy Lifestyle
- 806 - Youth Development
- 801 - Individual and Family Resource Management
- 607 - Consumer Economics
- 805 - Community Institutions and Social Services
- 802 - Human Development and Family Well-Being
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1890 Extension

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

Description

Numerous external factors can have a profound influence on outcomes. These include factors such as long-term support of the programs, personnel available, and public funding changes due to

changes in priorities and legislative action.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Extension administrators, as well as, advisory groups will be used to monitor progress of the programs and make recommendations regarding any changes that need to be made. Surveys will be distributed to all program participants at the pre- and post-program levels. The surveys will measure the percentage of program participants who increased their knowledge in the areas of Academic Achievement, making good choices, etc. The results of the surveys will be distributed to unit heads and program coordinators to determine if specific programs should be continued, modified, or eliminated.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Climate Change

2. Brief summary about Planned Program

The overall goal of the plan is: Integrated Risk Management of Impaired Environments in Missouri for Improving Quality of Life and Natural Resources Sustainability. A systematic study of our environment requires investigation of intersections of many disciplines.

"Risk characterization" which includes:

1. Survey of impaired soils, lands and waters in Missouri.
2. Identify major contaminants that threaten human health and ecosystem.
3. Characterize physical and chemical properties of contaminated sites.
4. Determine the degree and extent of contamination and geospatial distribution of contaminants.
5. Investigate the environmental behaviors and fates of contaminants.

"Integrated Risk Assessment" which includes:

1. Determination of the health and toxicological effects of identified contaminants.
2. Evaluate the ecological impacts of contaminants on soil quality, water quality, microbial community vegetation, wildlife, etc.
3. Investigate the environmental behaviors and fates of contaminants.

"The cost-effective and environmental-friendly" remedial technology development, which includes:

1. In-situ chemical immobilization (metals/soil).
2. Phytoremediation (metals and organics/soil).
3. Bioremediation (organics/soil-water).
4. Nanotechnology (metals-organic/waters).

"Integrated Risk Management" which will include:

1. Evaluation of long-term efficacy of remedial technology for ecological and health risk reductions, field-testing and validation and field restoration.
2. Environmental monitoring.
3. Pollution Control.

3. Program existence : Intermediate (One to 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
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	0%	25%
111	Conservation and Efficient Use of Water	0%	5%	0%	0%
112	Watershed Protection and Management	0%	15%	0%	20%
123	Management and Sustainability of Forest Resources	0%	5%	0%	0%
125	Agroforestry	0%	5%	0%	0%
134	Outdoor Recreation	0%	5%	0%	0%
136	Conservation of Biological Diversity	0%	25%	0%	10%
141	Air Resource Protection and Management	0%	0%	0%	10%
205	Plant Management Systems	0%	5%	0%	0%
213	Weeds Affecting Plants	0%	5%	0%	0%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%	0%	0%	10%
401	Structures, Facilities, and General Purpose Farm Supplies	0%	5%	0%	0%
403	Waste Disposal, Recycling, and Reuse	0%	15%	0%	5%
502	New and Improved Food Products	0%	5%	0%	0%
704	Nutrition and Hunger in the Population	0%	5%	0%	0%
723	Hazards to Human Health and Safety	0%	0%	0%	20%
	Total	0%	100%	0%	100%

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

1. Situation and priorities

Water Quality Studies:

Priority: Test water quality of selected Missouri streams to determine runoff/seepage impacts from cattle and swine wastes.

Risk Reductions and Remediation of metal-Contaminated Mining Wastes in Missouri

Priority: Determine if in situ soil treatment can reduce the risks and remediate of metal contaminated soils in Missouri

Watershed Based Studies

Priorities: To identify and map abandoned mines in a watershed context, and to identify and map

contaminations that may arise from the abandoned mines.

Air Quality Studies

Priorities:

1. Clarify the relationship between static and dynamic soil characteristics.
2. Develop a soil quality index to assess the relationship between soil properties and gas fluxes.
3. Improve methods to measure, monitor, quantify, and predict greenhouse gas fluxes and soil properties.

Behavior of Silver Nanoparticles in Soil: Interactions with Physicochemical and Microbiological Properties

1. Identify the microbial consortia that will evolve in the soil exposed to AGNPs.
2. Determine the effect of different AGNPs on plant nutrient uptake.
3. Measure the activities of enzymes involved in the cycling of C, N, P and S in the presence of AGNPs.
4. Determine the impacts of soil physicochemical properties (e.g, pH, CEC, free Fe and Al oxides, organic C, particle size distribution) on sorption of AGNPs in soils.

Hydrologic Processes Controlling Stream Water Quality in Missourian Watersheds

Priorities:

1. Collect water samples from precipitation, groundwater wells and streams in the Goodwater Creek Watershed. Deploy soil moisture sensors and observatory experiment of seep flow.
2. Develop modeling using Soils and Water Assessment Tool (SWAT) to understand how land use/cover changes affect stream water quality.
3. Provide a solid foundation for watershed management to mitigate the contaminations of stream water by agricultural runoff, fertilizer and herbicide uses and animal feeding practices.

Bacterium Faecalibacterium for Tracking Agricultural Sources of Fecal Pollution in Water

The objective of this project is to use the anaerobic fecal bacterium *Faecalibacterium* as an alternative fecal indicator for the accurate determination of agricultural sources of fecal pollution in water. Genetic markers of the bacterium, which are unique to feces of cattle, swine, or poultry, will be identified and used to develop PCR-based methods for identification of the sources of fecal pollution in water.

A Comparative Study of Two Integrated Systems for The Production of Bioenergy and Biochar from Switchgrass.

Priorities:

1. Investigate the technical feasibility of using microwave organic acid assisted pretreatment for switchgrass prior to biochemical conversion processes.
2. Optimize the biomethane production of different mixtures of pretreated switchgrass and microalgae.
3. Study the feasibility of using the anaerobically digested materials to produce biochar and bioenergy via pyrolysis process.

Characteristics of Biochar Produced from Different Feedstocks and Effects on Soil Physicochemical and Biological Properties

Priorities:

1. To design and build a simple pyrolyzer that achieves temperature values ranging from 400 to 600°C to produce biochar from different feedstocks and woody biomass.
2. To establish bioenergy crop production plots for switchgrass (*Panicum virgatum*) and miscanthus (*Miscanthus giganteus*).
3. To characterize biochar produced from different biomass feedstocks chemically and physically including the presence of any PAH compounds.

4. To determine the effect of biochar from various feedstocks on soil enzyme activities.
5. To investigate effects of biochar on corn plant growth and to determine chemical and physical properties of soil as affected by biochar.
6. To develop an index to rank biochar.

Agriculture Economic/Business: Farm Level Economic Analysis of Biomass Feedstock Supply

Priorities: Measure the impact of "off-farm" work, farm size, attitudes, social acceptability, and risk on biomass feedstock supply by farmers.

Natural Resource Diversity Studies:

Priorities: Examine how to manage, use, and restore grasslands to affect, increase, and conserve their biological diversity.

2. Scope of the Program

- In-State Research
- Integrated Research and Extension

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

1. Assumptions made for the Program

- (a) That the program is assured of continuous funding.
- (b) That farmers will be motivated to change their management practices.
- (c) That policy makers will be persuaded to enact appropriate legislation.
- (d) That people will accept training opportunities offered to them by the program.
- (e) That information supplied by the program will result in awareness and knowledge of environmental issues.

2. Ultimate goal(s) of this Program

The goals of these studies are to:

1. Provide baseline data on which relationships between human activities and natural ecosystems could be analyzed, and comprehensive management strategies developed.
2. Train future caretakers of the environment.
3. Raise awareness on major consequences of improper human activities on our cherished natural resources.
4. Improve environmental quality and sustainability.

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	0.0	2.0	0.0	16.0
2018	0.0	2.0	0.0	16.0
2019	0.0	2.0	0.0	16.0

2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Water Quality Studies

Missouri region is one of several areas in the United States having confined animal feeding operations (CAFOs) under various animal units' classifications. Water quality of streams near CAFOs may deteriorate due to inputs of Escherichia Coli (E. coli), nitrogen (N), phosphorus (P), and antibiotic drugs from animal wastes. In addition, land use and management practices in various watersheds may also impact surface water quality. Also, understanding the distribution and fate of pollutants from animal wastes in environmental media (soil, sediment, surface and groundwater) and the potential public health risks are necessary. Protection of water resources is important for human, aquatic and environmental health. The hypothesis to test is that there are significant contributions of N, P, E. coli, metals, pesticides and antibiotic drugs from runoffs/seepage from cattle and swine wastes and various land uses on water quality of selected Missouri streams. A recently approved project will explore ecological links between bioindicators of environmental health, i.e., the role of water quality, nutrient flow, and invasive species in determining species abundance of aquatic turtles and mussels.

Risk Reductions and Remediation of metal-Contaminated Mining Wastes in Missouri

Characterize the physical/chemical properties of the tailings and determine the spatial variability of metal contamination in the areas. This objective will focus on the collection of soil and water samples within the study site, the analyses of metal concentration and metal species in samples, and the determination of the extent or degree of the contamination and spatial distribution of contaminants. This study will provide base information of the site for selecting in situ treatment.

Watershed Based Studies

The specific objective of the geospatial studies is to create a geospatial digital database for the Lake of the Ozarks, Lamine, Lower Missouri-Moreau, and Osage watersheds. The primary task is to locate and assemble relevant geospatial data from the various state and federal agencies. The database will consist of various layers including digital elevation models, land use/land cover, geology, soil, hydrology, mine locations, wetlands, flood plains, and remote sensing data (satellite and air photo).

Air Quality Studies

The atmospheric concentration of CO₂, CH₄ and N₂O is ever increasing and a good deal of research has been conducted to estimate emissions of these greenhouse gases from soils. Although numerous measurements have been made, emissions from soils still show variability based on a number of controlling factors. In fact, differences in soil type, moisture, temperature, season, crop type, fertilization, and other agricultural practices apparently all play a part in emissions from soils.

Behavior of Silver Nanoparticles in Soil: Interactions with Physicochemical and Microbiological Properties

Properties:

1. Identify the microbial consortia that will evolve in the soil exposed to AGNPs.
2. Determine the effect of different AGNPs on plant nutrient uptake.
3. Measure the activities of enzymes involved in the cycling of C, N, P and S in the presence of AGNPs.

4. Determine the impacts of soil physicochemical properties (e.g, pH, CEC, free Fe and Al oxides, organic C, particle size distribution) on sorption of AGNPs in soils.

Hydrologic Processes Controlling Stream Water Quality in Missouri Watersheds

Stream water contamination by soil applied herbicides and nutrients continue to be a major water quality problem in Missouri watersheds. The project is aimed at improving our understanding on the controls of stream water quality in Missouri. The research objectives are to understand the hydrologic pathways controlling stream flow under storm event and baseflow conditions at multiple catchment scales and the factors controlling nutrient and herbicide transport to stream water.

Differentiation of Environmental E. coli from Enteric E. coli

E. coli is a fecal bacteria indicator. It is used in testing worldwide to determine water quality and manage water safety. E. coli is used because it is a part of the bacteria living in the intestines of warm-blooded animals. However, a significant part of the global E. coli population might come from outside the body. These "environmental" E. coli can be a factor in the high number of E. coli in water. This causes false alarms of fecal pollution. Thus, methods must be developed to tell the difference between "environmental" E. coli and enteric (in the intestine) E. coli. A newly funded project is to develop a rapid assay to do the differentiation, which can reduce unnecessary beach closures and other management procedures

A Comparative Study of Two Integrated Systems for The Production of Bioenergy and Biochar from Switchgrass

In this study, two integrated systems, for the production of biogas, biooil and biochar, are compared. The results of this study will provide the basic scientific knowledge for comparing and optimizing different technologies for the production of bioenergy and biochar. The ultimate goal of this project is to maximize the bioenergy (biomethane, and bio-oil) production from switchgrass with producing biochar as a valuable soil amendment.

Characteristics of Biochar Produced from Different Feedstocks and Effects on Soil Physicochemical and Biological Properties.

The focus of this study is to characterize biochar produced from various biomass feedstocks physically and chemically and to determine how biochar affects the activities of select soil enzymes.

Agriculture Economic/Business:

The primary goal of this project is to conduct an analysis of the challenges of rural entrepreneurship and their impact on the prospects of community economic development within the Southeast region of Missouri.

Natural Resource Diversity Studies:

Most tallgrass prairies of the central United States, dominated by warm season grasses and diverse forbs, have been lost to the plow and urban development, or degraded by introduced vegetation. Prairies are the most endangered ecosystem in North America. Birds and other taxa that depend on prairies have declined in response to loss of habitat. Key to conservation and management is restoration of warm season grassland vegetation either on wildlife refuges and nature preserves, or on Conservation Reserve Program (CRP) fields.

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

Extension

Direct Methods	Indirect Methods
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<ul style="list-style-type: none">● Education Class● Workshop● Demonstrations● Other 1 (Student research and training)	<ul style="list-style-type: none">● Newsletters● Web sites other than eXtension
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3. Description of targeted audience

- (a) Farmers
- (b) Engineers
- (c) Policy makers
- (d) Students
- (e) Community leaders
- (f) Local citizens
- (g) Extension workers
- (h) Scientists & other Researchers
- (i) Regulatory Agencies

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

- Short term output measures are: Abstracts(16), Presentations (20), Training students (10),and Workshops (4).
Intermediate output measures are publications.

Long-term: After five years

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	Chemical and biological characterization of the ecosystems.
2	Expected change in agricultural practices from farmers. Better management of agricultural and natural ecosystems complex.
3	Environmental sustainability; Improved quality of life
4	Contribution to understanding of interactions between human practices and natural ecosystems; Enhanced stakeholders knowledge and understanding of environmental issues; Better management of agricultural and natural ecosystems complex.

Outcome # 1

1. Outcome Target

Chemical and biological characterization of the ecosystems.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 123 - Management and Sustainability of Forest Resources
- 704 - Nutrition and Hunger in the Population
- 502 - New and Improved Food Products
- 141 - Air Resource Protection and Management
- 112 - Watershed Protection and Management
- 403 - Waste Disposal, Recycling, and Reuse
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 102 - Soil, Plant, Water, Nutrient Relationships
- 136 - Conservation of Biological Diversity
- 205 - Plant Management Systems
- 134 - Outdoor Recreation
- 723 - Hazards to Human Health and Safety
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 125 - Agroforestry
- 213 - Weeds Affecting Plants

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 2

1. Outcome Target

Expected change in agricultural practices from farmers.
Better management of agricultural and natural ecosystems complex.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

- 112 - Watershed Protection and Management
- 125 - Agroforestry
- 102 - Soil, Plant, Water, Nutrient Relationships
- 205 - Plant Management Systems
- 502 - New and Improved Food Products
- 123 - Management and Sustainability of Forest Resources
- 111 - Conservation and Efficient Use of Water
- 213 - Weeds Affecting Plants
- 141 - Air Resource Protection and Management
- 134 - Outdoor Recreation
- 723 - Hazards to Human Health and Safety
- 704 - Nutrition and Hunger in the Population
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 403 - Waste Disposal, Recycling, and Reuse
- 136 - Conservation of Biological Diversity

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 3

1. Outcome Target

Environmental sustainability;
Improved quality of life

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 502 - New and Improved Food Products
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 102 - Soil, Plant, Water, Nutrient Relationships
- 213 - Weeds Affecting Plants
- 111 - Conservation and Efficient Use of Water
- 141 - Air Resource Protection and Management
- 403 - Waste Disposal, Recycling, and Reuse
- 112 - Watershed Protection and Management
- 723 - Hazards to Human Health and Safety
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

- 134 - Outdoor Recreation
- 125 - Agroforestry
- 136 - Conservation of Biological Diversity
- 704 - Nutrition and Hunger in the Population
- 205 - Plant Management Systems
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 4

1. Outcome Target

Contribution to understanding of interactions between human practices and natural ecosystems; Enhanced stakeholders knowledge and understanding of environmental issues; Better management of agricultural and natural ecosystems complex.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 723 - Hazards to Human Health and Safety
- 205 - Plant Management Systems
- 136 - Conservation of Biological Diversity
- 134 - Outdoor Recreation
- 502 - New and Improved Food Products
- 403 - Waste Disposal, Recycling, and Reuse
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 102 - Soil, Plant, Water, Nutrient Relationships
- 213 - Weeds Affecting Plants
- 125 - Agroforestry
- 111 - Conservation and Efficient Use of Water
- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 112 - Watershed Protection and Management
- 704 - Nutrition and Hunger in the Population
- 123 - Management and Sustainability of Forest Resources
- 141 - Air Resource Protection and Management

4. Associated Institute Type(s)

- 1890 Extension
- 1890 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
- Government Regulations

Description

Natural disasters: Any natural disaster will change the overall outlook of the results and will limit our ability to collect the needed samples.

Government Regulations: If there are new EPA regulations, specifically related to Hazardous Waste, Material, and/or Remediation then the overall focus or outcome of these studies could be altered.

Appropriation Changes: The funding for this program comes from legislative appropriation. Any changes in appropriation that removes this program as a funding priority could shut down this program since the existence of the program is dependent on funding.

Public Policy Changes: Currently, the areas designated are protected from direct human activities like residential and commercial real estate. A change in public policy that removes this restriction will make the sites vulnerable to human activities. Thus, the project will automatically come to a halt.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Biological, chemical, and microbiological analysis will be carried out on the samples. Results obtained will be statistically compared with those obtained from the surrounding environments. Both intra and inter-parametric interpretations will be given to obtained statistics. This will form the basis of recommendations for appropriate management strategies to be put in place.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

2. Brief summary about Planned Program

Detection and identification of bacteria and food pathogens is an essential step in food safety inspection. This step will provide valuable information to consumers which could be used to prevent health problems. The current conventional methods used to detect and identify bacteria in food are reliable for ensuring food safety. They have been used for nearly a century as the official food screening procedure established by Food and Drug Administration (FDA). These methods are time consuming (5-7 days), labor intensive, and therefore, are not suitable to monitor food quality and to provide timely response to possible risks. By the time E-coli is detected in raw material, the product will be sold and consumed (Swaminathan and Feng, 1994; Yang, Bashir, 2008; Vasavada et al., 1997). The slow response of these biosensors has prompted numerous groups in the last decade to develop other techniques to reduce the detection time. The objectives are: 1) Designing and fabricating MEMS based impedance biosensor system. The device will consist of two arrays of 3-D interdigitated electrodes (IDE) and a fluidic channel with an inlet and outlet. Each IDE array will consist of 100 pairs of gold electrode fingers fabricated using surface micromachining and photoresist sacrificial layer. 2) Immobilizing the antibody using the Self-Assembled Multilayer (SAM) process. We will use the Self-Assembled Multilayer (SAM) process to immobilize the antibodies onto the IDE. This stage will provide the binding between bacteria and antibodies due to the high affinity between them. 3) Testing the device using impedance measurements. We will analyze the biosensor for the detection and selective identification of E. coli O157:H7 in beef when used in conjunction with the immobilized antibodies, and determine the magnitude and phase of the impedance of the bacteria effect alone. The effect of frequency on impedance measurements will be monitored and analyzed.

Fresh and fresh-cut produce, including fruits and vegetables, is increasingly associated with foodborne disease outbreaks. Research is also being carried out to develop new methods to reduce contamination of fresh and fresh-cut produce by human pathogens.

3. Program existence : Intermediate (One to five years)

4. Program duration : Medium Term (One to 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
402	Engineering Systems and Equipment	0%	0%	0%	25%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%	0%	0%	50%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	100%	0%	25%
	Total	0%	100%	0%	100%

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

1. Situation and priorities

Recent outbreaks of E. coli-related illnesses in the US and in Europe underline the need for more effective monitoring and remediation technologies for bacterial contamination in food. The Centers for Disease Control and Prevention (CDC) reported Escherichia coli O157:H7 outbreaks in beef in 2010 for 16 states (2010). According to the Food and Drug Administration, outbreaks of food-borne illnesses due to consumption of contaminated produce has increased over the past decade. The 2006, fresh spinach outbreak, for example, infected 205 persons and caused 102 hospitalizations and 3 deaths. These multi-state outbreaks of E. coli O157:H7 caused harm to the safety and well-being of those affected. Along with the threat to human health and safety, there was also a major economic impact. According to the United States Department of Agriculture (USDA), the economic impact in the year 2003, associated with E. coli illness totaled 405 million dollars (2008).

Priorities:

The overall goal of the research effort is to evaluate proof-of-concept and early development of a fluorogenic immunosensor using MUG as a fluorescent reporter. The detection scheme must have good sensitivity with a low detection limit of around 10^5 CFU/ml, which is an order of magnitude below the threshold recommended by the USDA. Most importantly, the fluorescent immunosensor must achieve rapid detection. A response time of less than one hour will be suitable, and it is expected that the sensor system may achieve a response time of 10 minutes or less.

- Examine the fluorogenic response of MUG to viable E. coli O157:H7 in solution. This objective will ensure that the enzymatic reaction of β -glucuronidase to cleave the MUG and produce the fluorescent product is sufficient for the proposed sensing scheme.
- Develop an immobilization strategy for covalently linking the anti-E. coli IgG antibody onto a glass substrate. A strong immobilization reaction will result in a more robust sensing scheme.
- Test binding of E. coli to the immobilized IgG antibody by fluorescent microscopy. The E. coli bacteria will be fluorescently labeled and exposed to the glass substrate with immobilized antibody. Fluorescence microscopy imaging will be used to observe and affirm successful binding of the antigen to the surface.
- Study the fluorogenic response of the antigen-antibody complex bound to the glass substrate when exposed to a solution containing MUG. The MUG concentration will be adjusted to achieve the strongest fluorescent response with the lowest concentration, and therefore, smallest amount of reporter material.
- Quantitatively determine the sensitivity and lower limit of detection, response time, selectivity, repeatability, and longevity of the fluorescent sensing scheme. These are standard metrics that will be

compared with currently available methods for monitoring E. coli contamination.

- Validate the performance metrics of the sensing system on contaminated and non-contaminated food samples. Various types of food samples, including poultry, beef, and spinach, will be contaminated with E. coli and the ability of the sensing scheme to detect the pathogen determined.

2. Scope of the Program

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

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

1. Assumptions made for the Program

1. Funding will be secure throughout the course of the project.
2. Extramural funds can be obtained to assist in expanding efforts with this project.
3. Maintain adequate number of personnel with the appropriate skills to complete the work.

2. Ultimate goal(s) of this Program

Measurable improvements in public health by modifying dietary practice and lifestyle changes and reduction of health care costs for specific populations such as African-Americans, low-income and other under-represented groups.

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	0.0	2.0	0.0	4.0
2018	0.0	2.0	0.0	4.0
2019	0.0	2.0	0.0	4.0
2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

1. Perform experiments and publish results.
2. Presentation of experimental results in scientific conference and seminars.
3. Conduct workshops.
4. Distribution of information on nutrition and physical activity to clientele.

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"> ● Workshop ● One-on-One Intervention 	<ul style="list-style-type: none"> ● Web sites other than eXtension ● Other 1 (Nutrition education materials)

3. Description of targeted audience

African-Americans, low-income families and other under-represented groups in St. Louis, Kansas City, Bootheel and Jefferson City areas in the state of Missouri.

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 publication, presentations, workshops and contacts.

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	Measurable improvements in public health and reduction in health care costs for specific population such as African-Americans, low-income families and other under-represented groups. Expect 80% positive response of those contacted.
2	Children and adults make short-term and long-term decisions on healthier choices and increased physical activities.

Outcome # 1

1. Outcome Target

Measurable improvements in public health and reduction in health care costs for specific population such as African-Americans, low-income families and other under-represented groups. Expect 80% positive response of those contacted.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
- 402 - Engineering Systems and Equipment

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 2

1. Outcome Target

Children and adults make short-term and long-term decisions on healthier choices and increased physical activities.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
- 402 - Engineering Systems and Equipment
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Appropriations changes

Description

Planned research and extension activities are supported by external funding. Therefore, appropriations changes will directly affect the planned activities. The changes in US economy may affect the living standard and opportunities for education of clientele and eventually influence the outcome of research and extension activities.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Surveys will be conducted before and after each research and workshops to evaluate impact of research and extension activities. Specific questions will focus on information learned from programs on food storage, and food preparation. The results of the surveys will be distributed to unit heads and program coordinators to determine if certain programs should be continued, modified, or eliminated.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Sustainable Energy

2. Brief summary about Planned Program

A recent article titled, "The end of cheap oil," in National Geographic, highlights a well-known fact that the world is in the twilight of plentiful petroleum oil and that alternative sources of energy and raw material must be developed. Biofuel in the form of biodiesel offers one of the most attractive direct replacements of fossil fuel. Significant efforts in this area are already underway as evident from the increasing number of newly installed biodiesel plants in Missouri and around the world. The most common process for producing biodiesel is through the transesterification reaction of vegetable oil or animal fat with an alcohol and a catalyst.

One proposed study is designed to fully develop, evaluate, and demonstrate the capabilities of the innovative technology for economical and efficient production of algae-derived oils for use as the source of biofuel. To achieve the overall goal, the proposed work will be performed in two major areas: 1) Micro-algae cultivation and harvest, and 2) Algae oil extraction and transesterification.

The ultimate goal of another project is to maximize the bioenergy (biomethane, and bio-oil) production from switchgrass with producing biochar as a valuable soil amendment. To achieve this goal, experiments along with energy and mass balance models will be combined to optimize the net energy production from two conversion systems including integrated biochemical and thermochemical conversion processes. Microalgae will be used as an amendment to adjust the C:N ratio and moisture content of switchgrass prior to the biochemical conversion processes.

A third study will evaluate the application of biochar to soil as a novel approach to establish a long-term sink for atmospheric carbon dioxide in the terrestrial ecosystem. The application of biochar to soil has the potential to improve soil fertility and increase crop production. This project will address whether carcinogenic polycyclic aromatic hydrocarbons (PAHs) are formed in the process of slow pyrolysis of air-dried biomass, and if so, how the process could be modified and standardized to reduce or eliminate the possibility of PAHs formation. A "Biochar Thermal Index" will be developed based on thermochemical decomposition of lignin constituent of biomass. In addition, efforts are being made to generate bioenergy from agriculture waste including animal manures.

3. Program existence : Intermediate (One to 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
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	0%	10%
111	Conservation and Efficient Use of Water	0%	0%	0%	10%
131	Alternative Uses of Land	0%	0%	0%	5%
132	Weather and Climate	0%	20%	0%	5%
133	Pollution Prevention and Mitigation	0%	20%	0%	10%
141	Air Resource Protection and Management	0%	10%	0%	0%
402	Engineering Systems and Equipment	0%	20%	0%	0%
403	Waste Disposal, Recycling, and Reuse	0%	20%	0%	5%
404	Instrumentation and Control Systems	0%	10%	0%	0%
511	New and Improved Non-Food Products and Processes	0%	0%	0%	55%
	Total	0%	100%	0%	100%

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

1. Situation and priorities

Situation

A recent article titled, "The end of cheap oil," in National Geographic, highlights a well-known fact that the world is in the twilight of plentiful petroleum oil and that alternative sources of energy and raw material must be developed. Biofuel in the form of biodiesel offers one of the most attractive direct replacements of fossil fuel. Significant efforts in this area are already underway as evident from the increasing number of newly installed biodiesel plants in Missouri and around the world. The most common process for producing biodiesel is through the transesterification reaction of vegetable oil or animal fat with an alcohol and a catalyst.

Proposed studies are designed to fully develop, evaluate, and demonstrate the capabilities of the innovative technology for economical and efficient production of algae-derived oils for use as the source of biofuel. To achieve the overall goal, the proposed work will be performed in two major areas: 1) Micro-algae cultivation and harvest, and 2) Algae oil extraction and transesterification.

Aquatic microalgae are photosynthetic microorganisms that have great potential to be the solution to growing energy and environmental challenges. Multidisciplinary collaborative research is conducted to develop economically-feasible microalgae biotechnologies that utilize carbon dioxide and wastewater as nutrient sources and yield biomass that can be converted to biofuels and other bio products.

Priorities

The major focus or priorities of the research program are:

- Identification of high yielding, hardy, pest resistant microalgae strains.
- Development of economically-viable, commercial scale algae cultivating that mass produce algal biomass and abate carbon dioxide and wastewater.
- Development of an effective system for extracting oil from wet algae and converting to biodiesel.
- Testing methods for fermenting algal carbohydrates into ethanol.
- Proof of a concept for the self-supported system that integrates the microalgae cultivation processes with the bio-refinery, which is dedicated to algae-based biofuels and bio products.

The ultimate goal of another project is to maximize the bioenergy (biomethane, and bio-oil) production from switchgrass with producing biochar as a valuable soil amendment. To achieve this goal, experiments along with energy and mass balance models will be combined to optimize the net energy production from two conversion systems including integrated biochemical and thermochemical conversion processes. Microalgae will be used as an amendment to adjust the C:N ratio and moisture content of switchgrass prior to the biochemical conversion processes.

Another study will evaluate the application of biochar to soil as a novel approach to establish a long-term sink for atmospheric carbon dioxide in the terrestrial ecosystem. The application of biochar to soil has the potential to improve soil fertility and increase crop production. This project will address whether carcinogenic polycyclic aromatic hydrocarbons (PAHs) are formed in the process of slow pyrolysis of air-dried biomass, and if so, how the process could be modified and standardized to reduce or eliminate the possibility of PAHs formation. A "Biochar Thermal Index" will be developed based on thermochemical decomposition of lignin constituent of biomass.

Priorities

1. Investigate the technical feasibility of using microwave organic acid assisted pretreatment for switchgrass prior to biochemical conversion processes.
2. Optimize the biomethane production of different mixtures of pretreated switchgrass and microalgae.
3. Study the feasibility of using the anaerobically digested materials to produce biochar and bioenergy via pyrolysis process.

2. Scope of the Program

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

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

1. Assumptions made for the Program

- That the program is assured of continuous funding.
- That stakeholders will be motivated to change their practices.
- That policy makers will be persuaded to enact appropriate legislation.
- That stakeholders will accept training opportunities offered to them by the program.
- That information supplied by the research will result in heightened awareness and knowledge of alternative fuel options and environmental issues.

2. Ultimate goal(s) of this Program

- Provide alternative fuel and energy sources.

- Train future stewards of the environment.
- Improve environmental quality and sustainability.
- Mass cultivation of Microalgae in the mid-western United States.

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	0.0	1.0	0.0	2.0
2018	0.0	1.0	0.0	2.0
2019	0.0	1.0	0.0	2.0
2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Proposed studies are designed to fully develop, evaluate, and demonstrate the capabilities of the innovative technology for economical and efficient production of algae-derived oils for use as the source of biofuel. To achieve the overall goal, the proposed work will be performed in two major areas: 1) Microalgae cultivation and harvest, and 2) Algae oil extraction and trans esterification.

The ultimate goal of another project is to maximize the bioenergy (biomethane, and bio-oil) production from switchgrass with producing biochar as a valuable soil amendment. To achieve this goal, experiments along with energy and mass balance models will be combined to optimize the net energy production from two conversion systems including integrated biochemical and thermochemical conversion processes. Microalgae will be used as an amendment to adjust the C:N ratio and moisture content of switchgrass prior to the biochemical conversion processes.

A third study will evaluate the application of biochar to soil as a novel approach to establish a long-term sink for atmospheric carbon dioxide in the terrestrial ecosystem. The application of biochar to soil has the potential to improve soil fertility and increase crop production. This project will address whether carcinogenic polycyclic aromatic hydrocarbons (PAHs) are formed in the process of slow pyrolysis of air-dried biomass, and if so, how the process could be modified and standardized to reduce or eliminate the possibility of PAHs formation. A "Biochar Thermal Index" will be developed based on thermochemical decomposition of lignin constituent of biomass.

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"> ● Workshop ● Demonstrations 	<ul style="list-style-type: none"> ● Newsletters ● Web sites other than eXtension

3. Description of targeted audience

- Undergraduate/graduate students
- Small Farmers
- Local Electric Cooperatives
- Scientists and other Researchers
- Extension workers
- Policy makers/ Regulatory Agencies
- Local Citizens/Community Leaders
- Engineers

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

- Short term output measures are: Abstracts, presentations, training students, and workshops. Intermediate output measures are 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(I). State Defined Outcome

O. No	Outcome Name
1	Identify high yielding, hardy pest resistant microalgae strains.
2	Develop commercial cultivation system for mass production of algal biomass
3	Educate stakeholders on research status for environmental solutions
4	Educate farmers, scientists, and engineers about the economic feasibility of biomass production.
5	A "Biochar Thermal Index" will be developed based on thermochemical decomposition of lignin constituent of biomass.

Outcome # 1

1. Outcome Target

Identify high yielding, hardy pest resistant microalgae strains.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 132 - Weather and Climate
- 141 - Air Resource Protection and Management
- 102 - Soil, Plant, Water, Nutrient Relationships
- 511 - New and Improved Non-Food Products and Processes
- 133 - Pollution Prevention and Mitigation
- 403 - Waste Disposal, Recycling, and Reuse
- 402 - Engineering Systems and Equipment
- 131 - Alternative Uses of Land
- 111 - Conservation and Efficient Use of Water
- 404 - Instrumentation and Control Systems

4. Associated Institute Type(s)

- 1890 Research

Outcome # 2

1. Outcome Target

Develop commercial cultivation system for mass production of algal biomass

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 132 - Weather and Climate
- 403 - Waste Disposal, Recycling, and Reuse
- 402 - Engineering Systems and Equipment
- 511 - New and Improved Non-Food Products and Processes
- 141 - Air Resource Protection and Management
- 131 - Alternative Uses of Land
- 133 - Pollution Prevention and Mitigation
- 111 - Conservation and Efficient Use of Water
- 102 - Soil, Plant, Water, Nutrient Relationships

- 404 - Instrumentation and Control Systems

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 3

1. Outcome Target

Educate stakeholders on research status for environmental solutions

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 111 - Conservation and Efficient Use of Water
- 511 - New and Improved Non-Food Products and Processes
- 404 - Instrumentation and Control Systems
- 133 - Pollution Prevention and Mitigation
- 131 - Alternative Uses of Land
- 141 - Air Resource Protection and Management
- 132 - Weather and Climate
- 403 - Waste Disposal, Recycling, and Reuse
- 102 - Soil, Plant, Water, Nutrient Relationships
- 402 - Engineering Systems and Equipment

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 4

1. Outcome Target

Educate farmers, scientists, and engineers about the economic feasibility of biomass production.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse

- 511 - New and Improved Non-Food Products and Processes
- 131 - Alternative Uses of Land
- 133 - Pollution Prevention and Mitigation
- 404 - Instrumentation and Control Systems
- 102 - Soil, Plant, Water, Nutrient Relationships
- 402 - Engineering Systems and Equipment
- 141 - Air Resource Protection and Management
- 132 - Weather and Climate
- 111 - Conservation and Efficient Use of Water

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 5

1. Outcome Target

A "Biochar Thermal Index" will be developed based on thermochemical decomposition of lignin constituent of biomass.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 131 - Alternative Uses of Land
- 511 - New and Improved Non-Food Products and Processes
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1890 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.)

Description

All of these external factors could seriously jeopardize continued research and the ability to educate farmers and other scientists about the benefits of biomass production as an alternative fuel source.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Biological, chemical, and microbiological analysis will be carried out during research. Results obtained will be statistically compared with those obtained from the surrounding environments. Both intra and inter-parametric interpretations will be given to obtained statistics. This will form the basis of recommendations for appropriate strategies to be put in place.

A "Biochar Thermal Index" will be developed based on thermochemical decomposition of lignin constituent of biomass.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Childhood Obesity

2. Brief summary about Planned Program

Optimal nutrition is important to the health and well-being of all people. Previous studies have shown that diet is a factor in 6 of the 10 leading causes of death in the U.S. Improved nutrition will increase quality of life and productivity, and reduce health care costs in populations throughout the nation. Lincoln University is continuing to focus their efforts on relationships between nutrition and health, and on establishing optimal nutrient requirements for diverse populations. Programs are designed to ensure that nutritious foods are affordable and available, and provide guidance so that individuals and families are able to make informed, science-based decisions about their health and well-being.

Specific areas of focus include the role of diet and exercise on the development of obesity, hypertension and type 2 diabetes and their subsequent contribution to development of cardiovascular diseases. We also focus on education of the public for prevention of these chronic diseases by life-style modification (healthy eating and increased physical activity). We also plan to study the biochemical and physiological basis for regulation of body weight and body fat distribution using a diet-induced obese animal model. While this research is relevant for all people, emphasis is primarily on specific subpopulations including African-Americans, low-income populations and other underrepresented groups. A new study will examine the effects of Omega-3 fatty acids on biomarkers of cardiovascular disease in obese individuals.

3. Program existence : Mature (More than 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
607	Consumer Economics	0%	10%	0%	0%
701	Nutrient Composition of Food	0%	20%	0%	25%
702	Requirements and Function of Nutrients and Other Food Components	0%	25%	0%	25%
703	Nutrition Education and Behavior	0%	25%	0%	25%
704	Nutrition and Hunger in the Population	0%	20%	0%	0%
724	Healthy Lifestyle	0%	0%	0%	25%
	Total	0%	100%	0%	100%

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

1. Situation and priorities

Nutrition-related chronic diseases are common in the State of Missouri and in the United States. Poor nutrition contributes to five of the ten leading causes of death (heart disease, cancer, stroke, type 2 diabetes and arteriosclerosis) costing the US economy an estimated \$250 billion annually. Nutrition research and education will improve the quality of the American diet and reduce health care costs.

The priorities of nutrition research will be finding the mechanism of how obesity contributes to the development of cardiovascular disease and finding reliable biomarkers for diagnosis of cardiovascular disease. The priority of nutrition extension will be prevention of nutrition-related chronic disease through nutrition education for improvement of nutrition and increased physical activity. A new study will examine the effects of fatty acids on biomarkers of cardiovascular disease in obese individuals.

2. Scope of the Program

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

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

1. Assumptions made for the Program

1. Funding will be secured throughout the course of the project.
2. Extramural funds can be obtained to assist in expanding efforts with this project.
3. Maintain adequate number of personnel with the appropriate skills to complete the work.

2. Ultimate goal(s) of this Program

Measurable improvements in public health by modifying dietary practice and lifestyle changes and reduction of health care costs for specific populations such as African-Americans, low-income and other

under-represented groups.

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	0.0	1.0	0.0	2.0
2018	0.0	1.0	0.0	2.0
2019	0.0	1.0	0.0	2.0
2020	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Perform experiments and publish results.
- Presentation of experimental results in scientific conference and seminars.
- Conduct workshops.
- Distribution of nutritional information and physical activities.
- Missouri Childhood Obesity Prevention and Double Dutch Program.
- Double Dutch Obesity Reduction Program.

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"> • Workshop • One-on-One Intervention 	<ul style="list-style-type: none"> • Web sites other than eXtension • Other 1 (Nutrition Education Materials)

3. Description of targeted audience

African-Americans, low-income families and other under-represented groups in St. Louis, Kansas City, the Bootheel, and Jefferson City areas in the state of Missouri.

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 publications, presentations, workshops, and contacts.

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	Increase knowledge of good nutrition measured by surveys pre- and post-nutrition education. Increased awareness about relationship between nutrition and physical activity and chronic diseases measured by periodic surveys. increase nutrition knowledge, awareness, and importance of nutrition for prevention of chronic diseases.
2	Number of citations of publications by other scientists in scientific papers. -Use of research results by nutrition extension and health care specialists. Improvement of eating behavior and physical activities. -Decrease in percentage of overweight and obesity in research and extension participants. Medium-term: 2010 - measurable weight reduction (1-5%) in overweight and obese subjects and clientele. Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). measurable weight reduction (1-5%) in overweight and obese subjects and clientele 2011 - Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). 2012 - Same as 2011. 2013 - Same as 2012 and number of citations of publications = 10 2014 - Same as 2013 and number of citations of publications = 15

Outcome # 1

1. Outcome Target

Increase knowledge of good nutrition measured by surveys pre- and post-nutrition education. Increased awareness about relationship between nutrition and physical activity and chronic diseases measured by periodic surveys. Increase nutrition knowledge, awareness, and importance of nutrition for prevention of chronic diseases.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior
- 702 - Requirements and Function of Nutrients and Other Food Components
- 704 - Nutrition and Hunger in the Population
- 607 - Consumer Economics
- 724 - Healthy Lifestyle
- 701 - Nutrient Composition of Food

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 2

1. Outcome Target

Number of citations of publications by other scientists in scientific papers.

-Use of research results by nutrition extension and health care specialists.

Improvement of eating behavior and physical activities.

-Decrease in percentage of overweight and obesity in research and extension participants.

Medium-term: 2010 - measurable weight reduction (1-5%) in overweight and obese subjects and clientele. Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). measurable weight reduction (1-5%) in overweight and obese subjects and clientele

2011 - Utilization of research outcomes by the extension specialist (2-3 good nutrition guides).

2012 - Same as 2011.

2013 - Same as 2012 and number of citations of publications = 10

2014 - Same as 2013 and number of citations of publications = 15

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle
- 703 - Nutrition Education and Behavior
- 701 - Nutrient Composition of Food
- 607 - Consumer Economics
- 702 - Requirements and Function of Nutrients and Other Food Components
- 704 - Nutrition and Hunger in the Population

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Appropriations changes

Description

Planned research and extension activities are solely supported by external funding. Therefore, appropriations changes will directly affect the planned activities. The changes in the US economy may affect the living standard and opportunities of clientele and eventually influence the outcome of Research and Extension activities.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Surveys will be conducted before and after each research and workshop to evaluate impact of research and extension activities. In the area of Obesity Reduction, a Body Mass Index will be taken for all youth participants at the beginning and end of all programs. An endurance test measuring the number of steps taken while walking, the number of jumps jumped, and the distance ran will be measured at the beginning and end of each program.

These surveys will measure the percentage of program participants who increased their knowledge in the area of Obesity and healthy food choices. The results of the survey will be distributed to unit heads and program coordinators to determine the continuation, modification, or elimination of specific programs.