

2013 Lincoln University of Missouri Combined Research and Extension Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

Missouri ranks second only to Texas in the number of farms. Of the 108,000 farms in Missouri, approximately 101,600 are considered small farms. This is based on farms with gross annual sales less than \$250,000 excluding government payments (National Agriculture Statistics Service NASS). These traditional farms represent a way-of-life that Missourians and other rural citizens have taken for granted over much of the nations' history. However, prime farmland in Missouri, as well as in the remaining states, is being lost rapidly due to urban sprawl. This loss of farmland across the United States occurs at a rate of 50 acres every hour, which is one-half million acres per year. A major reason for this loss is because our increasing population results in cities expanding into areas traditionally used by farmers. During encroachment, farmland becomes too valuable to farm and is purchased for commercial development. A major component of this modified land use is for housing developments.

Incorporation of an integrated/organic agricultural production system resulting in high dollar products that are produced in an environmentally friendly manner should be 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 can be evaluated at this location 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 the focal point for this highly integrated research and extension unit at Lincoln University. Results from the research conducted at the farm will be transmitted 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 (they will be accommodated in our youth development camp). Youth will be exposed to agricultural practices at Busby and will be provided the opportunity to assist the manager. 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.

Agricultural teaching is an important aspect of Cooperative Research Programs and we train both graduate and undergraduate students as they participate in hands-on activities performing research under the supervision of the research faculty in different areas. Lincoln University currently offers undergraduate degrees in Agri-business, Agriculture, and Environmental Science. The Agriculture curriculum provides a choice of emphasis between Animal Science, Plant/Soil Science and Natural Resources. There is also a

Master's Degree program in Environmental Science. All of our researchers are involved in the teaching programs at the undergraduate and/or the graduate level

Global Food Security and Hunger

Animal 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 the Evans Allen grant at Lincoln University. The general objectives of research are to establish genetic footrot disease resistance in hair sheep with DNA marker assisted selection; divergent selection for internal parasite resistance in goats; and improving grazing efficiency and reducing embryonic waste in small ruminant animals. Another project is evaluating the feasibility of developing a real-time biosensor for LH using nanotechnology derived components. These studies are highly integrated between research, extension and education at LU and 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. Investigators with training in pasture and forage production have been added with a split research and teaching appointments.

Mosquitoes are responsible for transmitting the causative agents of some of the most widespread and prevalent infections of humans, including malaria, lymphatic filariasis, yellow fever, dengue fever, and encephalitis. The significance of mosquito-borne disease transported internationally was observed in the United States during the outbreak of the West Nile virus in New York City and surrounding areas in 1999. In order to control populations of disease vectors and, in turn, control the disease agents they transmit, an extensive and thorough knowledge of the life cycle and ecology of these arthropods must be developed. This project examines the biology of mosquitoes from the viewpoint of interactions between mosquito populations and their ecosystems. Through this project we can gain a better understanding of the role that environmental factors play in larval development, adult mosquito production and fitness, and population dynamics.

Aquaculture

Aquaculture continues to grow significantly at Lincoln University with construction of a new facility. Research-based information is being made available to the aquaculture stakeholders in Missouri through Lincoln University Cooperative Extension. Following are the goals of the on-going and future research and extension activities that address the aquaculture priorities in Missouri and the region:

1. Develop least-cost diets that meet the nutritional requirements for different life stages of bluegill and related food fish species in Missouri.
2. Develop bluegill, through selective breeding, that is suitable for food-fish production and determination of gross nutrient requirements for the same fish by practical diet formulations.
3. Develop optimized methods for producing early life-stage sunfish indoors to enable year-round availability.
4. Develop and demonstrate production methods for a stock of domesticated and rapid growing crappie utilizing indoors and pond systems
5. Develop rapid disease identification technologies for crappie in culture systems and determine effective treatments and bio-security standards to maintain disease free stock.

Plant Science

This 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. Additionally, horticulture is a profitable enterprise on many small farm operations.

Climate Change

Environmental Science

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.

Childhood Obesity

Human Nutrition

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.

Food Safety

Food Safety

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. This design is *unique* in the use of a 3-D IDE which increases the surface area compared to a single (2-D) IDE sensor. The increased surface area will enhance the sensitivity of impedance detection.

Sustainable Energy

Sustainable Energy

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, energy derived from biomass, is an important source in the future supply of energy in the US. More than one-third of the transportation fuel consumption in the US could be produced from lignocellulosic materials. 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 application of biochar to soil is 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 study will examine potential hazards associated with biochar applications.

Programs without strong research counterparts

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 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.

A grant from the Susan G. Komen Foundation will fund a new Breast Cancer Awareness Program in the Cole County area.

The Abstinence Education Program, funded by a grant from the Missouri Department of Health and Senior Services, will 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
2013	0.0	36.0	0.0	44.5
2014	0.0	36.5	0.0	44.5
2015	0.0	36.5	0.0	44.5
2016	0.0	36.5	0.0	44.5
2017	0.0	36.5	0.0	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

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?

Multi-state programming -The Change Agent States project is a catalytic step in beginning the transformation of the Land Grant system. It is a consortium of land grant institutions in fourteen states bringing the needed technical skills and training to each of the member states. Through this multistate approach, the consortium is developing successful models and systemic change strategies to support greater diversity and welcoming climates throughout the system.

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)?

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 and Kansas City, and Southwest Missouri. Lincoln University also benefits through the infrastructure support that UME provides.

One of the targets of the goat program will be with Hispanic 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 this population.

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

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

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 concentrate efforts on fewer 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.

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. New releases inform and invite the general public. Efforts are evaluated and the results are used to modify and/or redirect formats as needed.

A statewide survey was distributed previously, with over 3,000 stakeholders responding.

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 External Focus Groups
- Needs Assessments
- Use Surveys

Brief explanation.

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
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

Some of the non-traditional and traditional groups includes vegetable producers 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

- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- To Set Priorities

Brief explanation.

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	Global Food Security and Hunger
2	Community and Leadership Development
3	Family and Youth Development
4	Climate Change
5	Food Safety
6	Sustainable Energy
7	Childhood Obesity

V(A). Planned Program (Summary)

Program # 1

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 their 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 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.

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

Mosquitoes are responsible for transmitting the causative agents of some of the most widespread and prevalent infections of humans and animals. A variety of environmental factors contribute to the growth and development of larval mosquitoes and to the consequent production of adults. By examining the biology of mosquitoes from the viewpoint of interactions between mosquito populations and their ecosystems, we can gain a better understanding of the role that environmental factors play in larval development, adult mosquito production and fitness, and population dynamics all of which contribute to their ability to transmit diseases.

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 bluegill and related food fish species in Missouri.
- 2). Develop bluegill through selective breeding that is suitable for food-fish production and determination of gross nutrient requirements for same fish by practical diet formulations.
- 3). Develop optimized methods for producing early life-stage sunfish indoors to enable year-round availability.
- 4). Develop and demonstrate production methods for a stock of domesticated and rapid growing crappie utilizing indoors and pond systems
- 5). Develop rapid disease identification technologies for crappie in culture systems and determine effective treatments and bio-security standards to maintain disease free stock.

Insects and other pests:

- 1). Determine cooperation and competition in mosquito populations.
- 2). Determine how factor modification affects developmental responses in larval mosquitoes.
- 3). Collect and maintain mosquito strains from various geographic locales having phenotypic plasticity.
- 4). Perform phenotypic and genetic variation analysis among strains from different geographic locales.
- 5). Determine genetic loci associated with variation.

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.

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). 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
- 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.
- 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.
- 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.
- 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.
- 6). Relevance to Program--Program is relevant to our targeted audience and stakeholders.
- 7). Adoption of Techniques--Targeted audiences will accept and adopt the results of the research program.
- 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 enables 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).

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
2013	0.0	7.0	0.0	20.0
2014	0.0	7.5	0.0	20.0
2015	0.0	7.5	0.0	20.0
2016	0.0	7.5	0.0	20.0
2017	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. Develop technology to reduce mosquito populations responsible for transmitting the causative agents of some of the most widespread and prevalent infections of humans.
- j. Conferences, meetings, workshops, and training and educational opportunities for small farmers.
- k. Introduction and evaluation of new crops (especially native crops) and improved cultural practices.
- l. Abstracts, publications, grant proposals, and guide sheets.
- m. Promotion of backyard and community gardening.
- n. Conduct analysis of the challenges of rural entrepreneurship and their impact on the prospects of community development.

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-Develop better understanding of environmental factors which contribute to the mosquito's ability to transmit disease to humans and animals. To develop mosquito population management strategies focused on manipulation of environmental factors to influence the mosquito's ability to transmit disease.
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.
6	Enhanced profitability of small farms. Increase farm growth income by \$5,000. Enhanced vitality and viability of rural communities. Increase farm retention rates.

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-Develop better understanding of environmental factors which contribute to the mosquito's ability to transmit disease to humans and animals. To develop mosquito population management strategies focused on manipulation of environmental factors to influence the mosquito's ability to transmit disease.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 307 - Animal Management Systems
- 311 - Animal Diseases
- 313 - Internal Parasites in Animals
- 721 - Insects and Other Pests Affecting Humans

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)

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

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)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems
- 405 - Drainage and Irrigation Systems and Facilities
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices

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)

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

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 6

1. Outcome Target

Enhanced profitability of small farms. Increase farm growth income by \$5,000. Enhanced vitality and viability of rural communities. Increase farm retention rates.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 212 - Pathogens and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems
- 405 - Drainage and Irrigation Systems and Facilities
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 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 # 2

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, information exchange, etc, 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 underserved and underrepresented 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		15%		0%
608	Community Resource Planning and Development		25%		0%
802	Human Development and Family Well-Being		5%		0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities		5%		0%
805	Community Institutions, Health, and Social Services		15%		0%
806	Youth Development		10%		0%
901	Program and Project Design, and Statistics		10%		0%
902	Administration of Projects and Programs		10%		0%
903	Communication, Education, and Information Delivery		5%		0%
	Total		100%		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 results 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 them administer better. Critical skills 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 participant's skills in working with others, to increase citizen involvement, and effective decision-making to affect change.

Many of the training sessions and workshops will be based on the cohort model, meaning that the same group of individuals will participate in a series of sessions from start to finish (two-nine hour sessions). Program sessions will focus on such topics as self-awareness, understanding and leading people, getting results, and strategic thinking.

Priorities

- Improving small towns and community organization efficiency through teaching and improving

leadership and management skills of 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 Improves 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
2013	0.0	2.0	0.0	0.0
2014	0.0	2.0	0.0	0.0
2015	0.0	2.0	0.0	0.0
2016	0.0	2.0	0.0	0.0
2017	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 * 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)

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

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)

- 602 - Business Management, Finance, and Taxation
- 608 - Community Resource Planning and Development
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions, Health, and Social Services
- 806 - Youth Development

- 901 - Program and Project Design, and Statistics
- 902 - Administration of Projects and Programs
- 903 - Communication, Education, and Information Delivery

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)

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

- 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 # 3

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 : 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
607	Consumer Economics		10%		0%
724	Healthy Lifestyle		5%		0%
801	Individual and Family Resource Management		5%		0%
802	Human Development and Family Well-Being		20%		100%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities		5%		0%
805	Community Institutions, Health, and Social Services		6%		0%
806	Youth Development		40%		0%
901	Program and Project Design, and Statistics		4%		0%
903	Communication, Education, and Information Delivery		5%		0%
	Total		100%		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 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 percent 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 where poverty levels exceed 50%. 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. About 50% of the parents in this housing have not graduated from high school (JCHA, 1999). These statistics 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.

Many poor families are devastated by the incarceration of a parent. When a parent returns from prison, the problems do not decrease but tend to exacerbate dysfunction in families. Extension staff will develop programs to address incarcerated parents and ex-offenders reentry in to the community.

The special health, psychological and social needs of the minority and underserved older adults are only partially being met. As Missouri's population continues to age, it reflects the faces of many races and cultural lifestyles. The implications of these demographic changes for current barriers still exist that precludes 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 insure that health management occurs.

One recently approved project, from the Susan B. Koman for the Cure Organization, will advance breast cancer awareness and education for underserved minorities in the Cole County area.

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 4 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	1890
2013	0.0	22.0	0.0	0.0
2014	0.0	22.0	0.0	0.0
2015	0.0	22.0	0.0	0.0
2016	0.0	22.0	0.0	0.0
2017	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 all 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 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.

- North Side after School Neighborhood Initiative: This is a partnership between Lincoln University Urban Impact Center of St. Louis, community volunteers and two St. Louis Public grade schools. 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 in the school gymnasiums. This program offers open enrollment to youth participants. This activity uses 10 community volunteers.

- Urban Garden Beautification Project collaborative effort with the St. Louis Neighborhood Stabilization Office and community leaders to continue transforming a weed infested vacant lot 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 Day - a culmination of educational workshops on a variety of topics for all ages.
 - Fall into Fall, a back-to-school rally to prepare students for the upcoming school year.
 - HIV/AIDS/STD Awareness Day
 - Summer Camp, a partnership with YMCA, Mission Missouri, Weed & Seed, and DAEOC to provide fitness and health, character development, arts and crafts, self-esteem building, recreation, and field trips for 5 weeks.
 - Women's Wellness Conference
 - Teen Talk/Young Scholars, a weekly program that allows teenagers to express themselves freely on different topics.

Specific activities in the Central Region include:

- Underserved minorities and other disadvantaged older adults 50 + in Cole Co. 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 close the educational achievement gap.
- Leadership Retreat, for youth to develop good decision making skills.
- The Hip Hop Camp is designed to empower the youth to take an active role in becoming the leaders of tomorrow. Our program is also based on the belief that the youth themselves can become a potent force in combating social issues.

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 drop out 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, Lilbourn 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)

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

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)

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

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)

- 607 - Consumer Economics
- 724 - Healthy Lifestyle
- 801 - Individual and Family Resource Management
- 802 - Human Development and Family Well-Being
- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 805 - Community Institutions, Health, and Social Services
- 806 - Youth Development
- 901 - Program and Project Design, and Statistics
- 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 # 4

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

Priorities: 1) Investigate the changes in soil microbial consortia as affected by different surfactants.
2) Determine effect of different surfactants on plant nutrient uptake.
3) Measure the activities of enzymes involved in the cycling of C, N, and P.

Risk Reductions and Remediation of metal-contaminated soils in Missouri:

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

Enhanced In Situ Biodegradation of Pesticides Under Modified Soil Conditions

Priorities:
1) Determine optimum biofilter conditions for specific pesticide degradation.
2) Identify the microbial consortia that will evolve in the biofilter.
3) Construct a model in-situ biofilter for demonstration and conduct a workshop for extension personnel and other stakeholders on the potential application of this knowledge.

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
2013	0.0	2.0	0.0	16.0
2014	0.0	2.0	0.0	16.0
2015	0.0	2.0	0.0	16.0
2016	0.0	2.0	0.0	16.0
2017	0.0	2.0	0.0	16.0

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, landuse 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 landuses 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, floodplains, and remote sensing data (satellite and air photo).

Air Quality Studies:

The atmospheric concentration of CO₂, CH₄ and N₂O is ever increasing and 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.

Enhanced In Situ Biodegradation of Pesticides Under Modified Soil Conditions

Contamination of agricultural soils with pesticides has become a serious environmental problem that has ultimately led to surface and groundwater pollution, threatening human health. The proposed research focuses on investigating the possible application of in-situ "biofilter" technology to develop methods to promote the biodegradation of pesticides at points of contamination using microorganisms. An effective biofilter is defined as one that will retain and biodegrade selected pesticides completely over a relatively short period of time.

Hydrologic Processes Controlling Stream Water Quality in Missourian Watersheds

Stream water contamination by soil applied herbicides and nutrients continues to be a major water quality problem in Missourian 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.

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

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
<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

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)

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

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)

- 102 - Soil, Plant, Water, Nutrient Relationships

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

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)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 112 - Watershed Protection and Management
- 123 - Management and Sustainability of Forest Resources
- 125 - Agroforestry
- 134 - Outdoor Recreation
- 136 - Conservation of Biological Diversity
- 141 - Air Resource Protection and Management
- 205 - Plant Management Systems
- 213 - Weeds Affecting Plants

- 314 - Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
- 401 - Structures, Facilities, and General Purpose Farm Supplies
- 403 - Waste Disposal, Recycling, and Reuse
- 502 - New and Improved Food Products
- 704 - Nutrition and Hunger in the Population
- 723 - Hazards to Human Health and Safety

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)

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

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 # 5

1. Name of the Planned Program

Food Safety

2. Brief summary about Planned Program

Detection and identification of bacteria and food pathogen 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 one 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 the *E-coli* is detected in the raw material, the product will be sold out 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.

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%		25%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources		0%		50%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins		100%		25%
	Total		100%		100%

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

1. Situation and priorities

Recent outbreaks of E. coli-related illnesses in the US and, more recently, 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 proposed 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 1 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
2013	0.0	2.0	0.0	4.0
2014	0.0	2.0	0.0	4.0
2015	0.0	2.0	0.0	4.0
2016	0.0	2.0	0.0	4.0
2017	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 of 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)

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

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)

- 402 - Engineering Systems and Equipment
- 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
- 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 # 6

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 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.

Second project: 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. 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.

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%		10%
111	Conservation and Efficient Use of Water		0%		10%
131	Alternative Uses of Land		0%		5%
132	Weather and Climate		20%		5%
133	Pollution Prevention and Mitigation		20%		10%
141	Air Resource Protection and Management		10%		0%
402	Engineering Systems and Equipment		20%		0%
403	Waste Disposal, Recycling, and Reuse		20%		5%
404	Instrumentation and Control Systems		10%		0%
511	New and Improved Non-Food Products and Processes		0%		55%
	Total		100%		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 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 bioproducts.

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 bioproducts.

Second project: 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. 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 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.
- Deveop methods to collect, store, transport, and transform leaves into a useable fuel source.

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
2013	0.0	1.0	0.0	2.0
2014	0.0	1.0	0.0	2.0
2015	0.0	1.0	0.0	2.0
2016	0.0	1.0	0.0	2.0
2017	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 transesterification.

Second project: 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. 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 and increase crop production. This project will address whether carcinogenic polycyclic aromatic hydrocarbons (PAHs) are formed int 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)

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

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)

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

- 511 - New and Improved Non-Food Products and Processes

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)

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

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)

- 102 - Soil, Plant, Water, Nutrient Relationships

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

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)

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

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 and leaves 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 # 7

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 USA. 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		10%		0%
701	Nutrient Composition of Food		20%		25%
702	Requirements and Function of Nutrients and Other Food Components		25%		25%
703	Nutrition Education and Behavior		25%		25%
704	Nutrition and Hunger in the Population		20%		0%
724	Healthy Lifestyle		0%		25%
	Total		100%		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 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 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 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
2013	0.0	1.0	0.0	2.0
2014	0.0	1.0	0.0	2.0
2015	0.0	1.0	0.0	2.0
2016	0.0	1.0	0.0	2.0
2017	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 underrepresented 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)

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

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)

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

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.