2016 Lincoln University of Missouri and University of Missouri Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

University of Missouri

University of Missouri Research and Extension achieved its goals in the 2016 plan of work. Our program focused on food systems, natural resource management, and healthy people, families and communities. We developed and delivered high priority programs to address needs identified by our stakeholders despite declining budgets. In FY 2016, our programs had total contacts of more than 2.1 million from Missouri's 6.1 million citizens (1,163,102 direct contacts and 964,225 indirect contacts).

We continued to incorporate the use of technology in our delivery systems, online training resources for our stakeholders/county council members, and contributed to programming efforts in eXtension. In April 2016, a new more comprehensive and accessible online approach to learning was initiated, Nexus@mizzou. We continued to seek alternative funding from grants, gifts, and fee generation to leverage the resources that we receive from our state, federal, and county partners. Our goal is to be reliable, responsive and relevant. We accomplished that goal in 2016 by providing research-based knowledge to Missourians aligned with their priorities of jobs, health, and education.

Lincoln University of Missouri Cooperative Extension and Research

Agricultural teaching continues to be 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 a variety of areas. Lincoln University currently offers undergraduate degrees in agribusiness, agriculture and environmental science, and master's degrees in environmental science and integrated agricultural systems. All of our researchers are involved in the teaching programs at the undergraduate and/or graduate level.

Alan T. Busby Farm, an organic research farm, and other university research farms continue to be focal points for this highly integrated Extension and Research unit. Results from the research conducted at the farms are transmitted to limited-resource producers and families throughout Missouri. The farms complement our Extension urban family and youth development programs in Jefferson City, Kansas City, St. Louis and the Bootheel. Families and/or youth can be brought to campus for summer camps (accommodated in our youth development camp). Youth are exposed to agricultural practices and provided the opportunity to assist the manager. This is 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 continue at university farms. These projects 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 include animal science, plant science, human nutrition, food safety and environmental science.

Global Food Security and Hunger

Animal Science

The primary emphasis in animal science continues to be goat production systems but also includes grazing studies with sheep and cattle. These studies are highly integrated between Extension and Research, and between Lincoln University and the University of Missouri.

Researchers have been focused on breeding parasite-resistant goats through conventional breeding methods. Another project involved the biological prevention and control of foot rot diseases using molecular biology technologies. Researchers continue to evaluate the feasibility of developing a real-time biosensor for LH using nanotechnology-derived components.

Other studies are investigating goats to control invasive vegetation at Busby Farm. In concert with the NRCS, goats are being studied to control bush honeysuckle. In cooperation with Langston University, goats are being studied in the control of red cedar.

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

Aquaculture

This has become a prominent research area at Lincoln University, where information from ongoing and future studies will be made available for use by Extension personnel at Lincoln University and the University of Missouri. Areas of research include genetic improvement of bluegill and crappie for use as food fish, sunfish nutrition and culture methods suitable for small scale/entry level producers. Research is needed that is specific to Missouri because the state has such wide climatic variation. There are no current plans at the University of Missouri to conduct research in production aquaculture systems, and we will continue to fill this niche.

The aquaculture program is highly integrated with the Extension Innovative Small Farmers' Outreach Program (ISFOP). Studies continue to examine profitable and value-added products and the marketing of specialty crops and other plants with particular interest to the needs of underserved farmers with limited resources. Additionally, horticulture is a profitable enterprise on many small farm operations.

Plant Science

The sustainable hydroponic production system and high tunnel production system are integral components of horticulture. These systems provide research-based information on profitable resources and environmentally sustainable techniques for the commercial production of high-value vegetable and herb crop species. Farm growers continue to be educated on profitable crop and plant nutrient management strategies to ensure higher crop yields and marketable quality. Outreach audiences include current and prospective growers, hobbyists, Extension educators, K-12 teachers and students and international visitors. The agricultural audience and the public were engaged through frequent educational tours of the controlled environment greenhouses (CEHGs), field days, onsite one-on-one training of producers on the operation of the various hydroponic and high tunnel systems at George Washington Carver Farm, conference presentations and publications.

The Native Plants Program (NPP) is increasing awareness about native plants for their potential for human consumption and use as raw material to create value-added products. The Sprouts and Roots Program promotes gardening among youth and seniors. FINCA (Families Integrating Nature, Conservation, and Agriculture) focuses on growing native edible plants. The NPP is collaborating with the Center for Rural Affairs, located in Nebraska, to promote sustainable agriculture and organic practices. The NPP also has a cooperative agreement with the U.S. Forest Service to grow native plant seed and nursery stock, with an emphasis on species of concern; rare, Ozark endemics and those important to pollinators.

Crop breeding research is currently focused on developing soybean cultivars with value-added qualities and high yields for tofu production. Other projects involve the evaluation of specialty crops, such as sorghum and canola, that are adaptive to Missouri weather conditions and small farms.

The Integrated Pest Management (IPM) Program and organic farming research aim to develop and promote affordable, alternative insect pest management strategies to combat pests of vegetables and fruits. The IPM Program provided research-based information on effective and environmentally friendly tactics. Interaction included one-on-one discussions, workshops, presentations, publications and demonstration trials, with an emphasis on increasing profits, decreasing expenses and lessening the amount of pesticide use.

Climate Change

Environmental Science

Integrated risk management of impaired environments in Missouri is to improve the quality of life and sustain natural resources. A systematic study of our environment requires investigation of the intersections of many disciplines. Studies in environmental science will focus on minimizing the impacts of agriculture activities on soil, water and air quality. Studies include developing new technologies for drinking water treatment in small water systems; water quality monitoring and assessment in rural communities; watershed management for chemical control; soil health and remediation; agroforestry; and natural resource management.

Childhood Obesity

Human Nutrition

Basic as well as applied studies continue in this area, examining the causes and impacts of obesity and other related health issues in minority populations, particularly focused on the causes and prevention of obesity in both youth and adults.

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 has been the development of a novel 3-dimensional (3-D) interdigitated microelectrode array (IDE)-based impedance biosensor that is ready for the manufacturing stage. This biosensor is 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 enhances the sensitivity of impedance detection. Fresh and fresh-cut produce, including fruits and vegetables, is increasingly associated with foodborne disease outbreaks. Research is being carried out to develop new methods to reduce contamination by human pathogens.

Sustainable Energy

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.

Extension programs without strong research counterparts

Extension efforts to improve the educational and economic opportunities for underrepresented populations in Kansas City, St. Louis, Jefferson City and the Bootheel continue. Expansion of the programs in Southeast Missouri will occur through acquisition of property and construction of a facility. Programs in all these areas will assist families, youth and the elderly as well as entire communities that have underserved and underrepresented populations. The Paula J. Carter Center for Minority Health and Aging maintains programs addressing health literacy, health disparity reduction and chronic disease prevention for underserved audiences ages fifty and older.

Programs of this type include (1) family and youth development, (2) community development, and (3) minority health and aging, (4) expanded food and nutrition and (5) urban gardening.

A grant from the Missouri Department of Senior and Health Services funded the Abstinence Program, which is designed to reduce teen pregnancy and out-of-wedlock births.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	267.0	36.5	66.0	44.5
Actual	266.0	38.8	115.0	56.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

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

2. Brief Explanation

University of Missouri

University of Missouri Research and Extension faculty continued to engage stakeholders from all 114 counties to review our program needs assessment process and the outcomes report for research and extension programs. Regional and state faculty surveyed current literature and relevant national databases to identify statewide demographics, national and state trends, and discipline specific research related to program needs and effectiveness. Based on this review, statewide priorities were identified and programs implemented to address those priorities. The program priorities and outcomes models were reviewed by the appropriate state program leaders and research faculty to assure that the programs are both relevant and of high quality. County program plans were developed, implemented and their impact evaluated with engaged county extension councils.

Lincoln University of Missouri

Combined External and Internal University Panels
Expert Peer Reviews

III. Stakeholder Input

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

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

- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public

Brief explanation.

University of Missouri

University of Missouri Research and Extension faculty engage stakeholders in all 114 counties through a variety of methods. Extension faculty and county extension councils lead an annual program review process engaging a variety of community leaders targeting diverse populations in the county. Approximately 940 citizens participated in FY 2016 with the focus around the role of county extension councils in developing and implementing programs. Our goals in developing the methodologies for the stakeholder input process were to: diversify the audiences in order to gain a better perspective on the reach and effectiveness of our programs; to diversify the gathering process so that we could utilize the feedback for both program prioritization and to gain knowledge as to preferred delivery methods as well as general awareness of our programs; and, finally, to gather some program specific information and diversity needs information in a more substantive way in order to gain a better understanding of the issues underlying the needs in order for us to be more effective in our programming response.

The methods used in our stakeholder input gathering include community conversations, diversity discussions, web-based survey, county and regional needs assessments, advisory groups and meetings with state agencies.

Lincoln University of Missouri

The types of actions taken by Lincoln University Cooperative Extension and Research (LUCER) depended on the location and type of activity. For example, the targeted audiences for the Kansas City Urban Impact Center (KCUIC) Senior Program were seniors, persons with disabilities and the homeless. The Lincoln University Center for Community and Leadership Development planned and scheduled meetings with stakeholders to discuss and identify community issues. Stakeholders provided input to develop the method of approach. In Southeast Missouri, individuals were identified from the community who represented various entities, such as the church, school, nonprofit organizations, youth and parents. Semiannual meetings were held to address community needs. For the Native Plants Program (NPP), a sign-up sheet was passed around at every educational event (seminars, workshops, conferences, field days, tours, a booth at the LU Farmers' Market and volunteer days). In addition, pre-and post-testing were conducted to identify changes in knowledge, evaluations and exploratory surveys using a Likert scale for all. The NPP also employed one-on-one conversations as well as direct contact via email and social media, especially Facebook.

In general, invitations were sent to traditional and nontraditional stakeholder groups and individuals. Traditional and nontraditional stakeholder groups were also surveyed. And surveys were specifically conducted of nontraditional groups and individuals.

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Needs Assessments
- Use Surveys

Brief explanation.

University of Missouri

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Lincoln University of Missouri

Lincoln University Cooperative Extension and Research (LUCER) used the following methods to identify stakeholder groups and individuals: advisory committees, external focus groups, needs assessments and surveys. The types of actions depended on the location, type of activity and type of information required. All of the programs used a combination of multiple methods, employing those that would most accurately identify interested individuals and groups.

All major programs have advisory committees/boards. Stakeholders serving on the boards are surveyed for input at least once per year, with programming adjusted based on needs and feedback.

Participants were identified by the program specialist during face-to-face conversations, interviews and telephone conversations, responses to email questions from individuals and referrals from other Extension staff, minority stakeholders and collaborators.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

Brief explanation.

University of Missouri

University of Missouri Research and Extension faculty engage stakeholders in all 114 counties through a variety of methods. Extension faculty and county extension councils lead an annual program review process engaging a variety of community leaders targeting diverse populations in

the county. Approximately 940 citizens participated in FY 2016 with the focus around the role of county extension councils in developing and implementing programs. Our goals in developing the methodologies for the stakeholder input process were to: diversify the audiences in order to gain a better perspective on the reach and effectiveness of our programs; to diversify the gathering process so that we could utilize the feedback for both program prioritization and to gain knowledge as to preferred delivery methods as well as general awareness of our programs; and, finally, to gather some program specific information and diversity needs information in a more substantive way in order to gain a better understanding of the issues underlying the needs in order for us to be more effective in our programming response.

The methods used in our stakeholder input gathering include community conversations, diversity discussions, web-based survey, county and regional needs assessments, advisory groups and meetings with state agencies.

Lincoln University of Missouri

Each program that is a part of Lincoln University Cooperative Extension and Research (LUCER) has a diverse advisory committee that meets at least twice annually. When committees are assembled, input is sought from that body. LUCER also used meetings with traditional stakeholder groups and individuals, surveys of stakeholder groups and individuals, and meetings made specifically with nontraditional groups and individuals as well as meetings with invited selected individuals from the general public.

Individual opinions were solicited and received on issues affecting stakeholders. Surveys and meetings were used to collect information from larger groups of people.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

University of Missouri

University of Missouri Research and Extension faculty used the information gathered from the needs assessment and environmental scanning of national databases as a foundation of the program development process to set program priorities for the coming years. The input was used to strengthen and focus efforts in needed areas; adjust extension activities and the content of presentations; make recommendations to the administrator regarding new positions needed to address expressed needs.

Lincoln University of Missouri

The input received by Lincoln University Cooperative Extension and Research (LUCER) is used to redirect Extension and Research programs, as needed; in the staff hiring process; and to set priorities. The input is used to strengthen and focus efforts in needed areas and to adjust Extension and/or Research activities and the content of presentations. Recommendations were made to the administrator regarding new positions needed to address expressed needs. The core staff of Extension and/or Research will be expanded in response to information gathered.

Additional workshops were organized to cover additional training. Requested information was

used to submit grant proposals. Information was passed on to other agencies if needed.

Brief Explanation of what you learned from your Stakeholders

University of Missouri

University of Missouri Research and Extension stakeholders continue to support and value our research and programing priorities while articulating the need for more programming from us at a time of diminishing budget. We continue to incorporate the use of technology in our delivery systems, increase distance learning tools and to leverage the human capacity with volunteers and community partnerships. MU is contributing to programming efforts in eXtension and has developed a more comprehensive and accessible website for our stakeholders. We are also seeking alternative funding from grants, gifts, and fee generation to leverage the resources that we receive from our state, federal, and county partners.

Lincoln University of Missouri

There was a high interest and strong desire for continuous learning in composting, health, diet/nutrition, landscaping, environmental improvement, edible native plants and learning about the importance of native plants as pollinators.

Many times, minority stakeholders are difficult to reach and sometimes were not willing to be identified. In general, they are interested in learning more about native plants to improve their way of life by improving biodiversity and providing an alternative source of income (direct or indirect). Minorities whose language is not English have a hard time understanding the opportunities available from the USDA. For example, more time and effort is needed to reach out to Hispanics,.

There is a huge desire to engage, network, connect and share resources, information, services and programs. The stakeholders were able (and willing) to readily identify areas of concern and needs in their respective communities and their perspective of the causal agents. Getting their buy-in to their own community and providing a platform for change provided more of a vested interest in the success of the programs.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
9144244	3354495	6169347	3718460

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	9144244	2981416	6981965	1747187
Actual Matching	9144244	1310871	7066890	1108499
Actual All Other	0	88584	14505799	107606
Total Actual Expended	18288488	4380871	28554654	2963292

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Sustainable Food Production/Security and Environment/Natural Resource Management

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	4%	0%	4%	0%
111	Conservation and Efficient Use of Water	2%	0%	2%	0%
112	Watershed Protection and Management	2%	0%	2%	0%
123	Management and Sustainability of Forest Resources	6%	0%	6%	0%
135	Aquatic and Terrestrial Wildlife	5%	0%	5%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	12%	0%	12%	0%
205	Plant Management Systems	8%	0%	8%	0%
206	Basic Plant Biology	8%	0%	8%	0%
216	Integrated Pest Management Systems	2%	0%	2%	0%
301	Reproductive Performance of Animals	12%	0%	12%	0%
302	Nutrient Utilization in Animals	7%	0%	7%	0%
303	Genetic Improvement of Animals	10%	0%	10%	0%
307	Animal Management Systems	2%	0%	2%	0%
402	Engineering Systems and Equipment	4%	0%	4%	0%
502	New and Improved Food Products	3%	0%	3%	0%
601	Economics of Agricultural Production and Farm Management	5%	0%	5%	0%
605	Natural Resource and Environmental Economics	8%	0%	8%	0%
	Total	100%	0%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	100.0	0.0	65.0	0.0
Actual Paid	110.0	0.0	115.0	0.0

Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
3749140	0	6981965	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
3840582	0	7066890	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	14505799	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

University of Missouri

University of Missouri is actively programming in agriculture, plant and animal sciences and scientists will conduct basic and applied research necessary to develop crop varieties and production strategies that can maintain high productivity in the face of increased climate variability and change.

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

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

Basic and applied research will be conducted to address underlying principles related to natural resources and to assist in the implementation of efficient, effective management actions to conserve natural resources and ensure the sustainable use of those resources.

On-farm research and demonstrations will be used to evaluate production and economic efficiencies. Campus-based and region-based faculty members will, in partnership with commodity groups, conservation partners, the general public, and private industry will:

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

Isaac Walton League, and Walnut Council).

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

2. Brief description of the target audience

University of Missouri

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

3. How was eXtension used?

86 MU Extension experts answered 895 questions from Missouri Citizens and 1,249 out-of-state questions during 2016. MU Extension faculty are engaged in 50 of the 68 communities of practice.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	94468	199369	14963	19017

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

Patent Applications Submitted

Year:	2016
Actual:	6

Patents listed

Rivera, Rocio (GenBank submission) principal author
Gene Expression Omnibus (GEO) database, www.ncbi.nlm.nih.gov/geo (accession no.GSE63509).
Taylor, Jerry (patent)
Neibergs HL, R Zanella, JF Taylor, Z Wang, E Scraggs, S White, RD Schnabel, C Van Tassell. 2015. Compositions and methods for diagnosis of genetic susceptibility, resistance, or tolerance to infection by mycobacteria and bovine paratuberculosis using promoter variants of EDN2. US patent No. 9,133,519. Issued 09/15/15.
Schmidt, Frank (patent)
US Patent 9,051,581 ?Defense peptides against fungal infection and method of their use.? Zhiwei Fang, James T. English, James E. Schoelz, Francis J. Schmidt, inventors. Issued June 9, 2015.
Lin, Chung-Ho (patent)
A contaminant reducing functionalized carbon conjugate (Granted 2013, US 13/448,065)
Lin, Chung-Ho (patent)
Development of nanocarbon-based biocatalyst for remediation of environmental pollutants and (US2013/0280781 A1 Second Divisional Patent)
Lin, Chung-Ho (patent)
Development of spore-based biocatalyst for remediation of pollutants and biofuel production (Granted, U.S. Application Serial Nos. 13/089,015, USA 14/849,295. 2015; Spin-off: Elemental Enzymes Inc.)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	74	494	531

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer reviewed journal articles. Number of other peer reviewed publications book chapters, proceedings, abstracts, etc. Number of invited papers and invited presentations. Number of graduate degrees awarded. Number of in-service training session(s)for regional Extension specialists on an annual basis. Print and electronic newsletters developed and distributed to regional specialists and other clientele. Provide in-service training session(s) for regional Extension specialists on an annual basis. Develop or revise guide sheets annually for regional Extension specialists to use in producer meetings. Develop or revise manuals on an annual basis for regional Extension specialists to use in producer meetings. Provide training sessions for Extension specialists and/or state/federal natural resource professionals. Coordinate delivery of natural resource/watershed management education via 'live' short courses, field days, and workshops. Assist groups and individuals to develop and implement forest, wildlife, and watershed plans.

Year	Actual
2016	283

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Missouri's crop and livestock producers and its agribusiness sector will improve their knowledge resulting in increased productivity, economic viability, regulatory compliance and profitability through the adoption of research based integrated management practices/systems and information provided by CAFNR and MU Extension.
2	Missouri farmers, business, communities and homeowners will increase their knowledge and skills and adopt new research based best management practices that will improve and protect the state's water, environment and natural resources.
3	Basic and applied research efforts will result in new knowledge that will improve our understanding of animal physiology, genetics, reproduction, nutrition, growth, and animal well-being. This knowledge will be translated into improved animal production practices that will be disseminated through the integrated livestock extension program.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	145980

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The MU Certified Strip Trial program is a signature Missouri program helping farmers validate management decisions on their farm and document efficiency and environmental stewardship. Strip trials are focused and easily implemented experimental tests that farmers can perform on their fields using their equipment. Typically, strip trials provide side-by-side comparisons of an agronomic practice.

What has been done
The Missouri program builds an alliance that ensures that farmers have the technical support they need to implement a statistically valid test on their farm while providing the framework that integrates results of individual tests into MU recommendations. This alliance between MU and agricultural organizations will demonstrate farmers commitment to sustainable management.

Results
There are strip trials in progress in 22 counties in Missouri. Guidance and assistance from extension specialists helps ensure growers receive a reliable, statistically valid and unbiased evaluation of a particular practice, method or idea. Growers receive a personalized report and have access to aggregated results from trials in their area and across the state to evaluate the effectiveness and the economic pros and cons of the different management practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships

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

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	17819

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Missouri Master Naturalist is a community based natural resource education and volunteer program. Its purpose is to develop a corps of well-informed volunteers to provide education, outreach and service dedicated to the beneficial management of natural resources and natural areas within their communities for the State of Missouri.

What has been done
The Missouri Master Naturalist Program, created in 2004, in partnership with the Missouri Department of Conservation, provides citizens with science-based information in natural resources and conservation and expanded opportunities for volunteer service within their community. Advisors with MU Extension and the MDC facilitate activities and programs at the local level in collaboration with each of the 12 Master Naturalist Chapters in the state.

Results
Volunteers are certified as Master Naturalists by completing a minimum 40-hour training and fulfilling a minimum of 8-hours of advanced training and 40-hours of volunteer service on an

annual basis. Over 387,000 hours of community service have been conducted since 2004. The cumulative economic impact of Missouri Master Naturalist volunteer service is valued at $8,391,151. Approximately 125 organizations have partnered with Master Naturalist chapters at the local level.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
135	Aquatic and Terrestrial Wildlife
205	Plant Management Systems
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
307	Animal Management Systems
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Basic and applied research efforts will result in new knowledge that will improve our understanding of animal physiology, genetics, reproduction, nutrition, growth, and animal well-being. This knowledge will be translated into improved animal production practices that will be disseminated through the integrated livestock extension program.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	40130

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increasingly, women involved in agriculture own and operate their own farms and ranches. A recent study found that the number of women-operated farms nearly tripled from 1978 to 2007. The study also reported that the number of women-operated farms increased in all sales classes, suggesting that size does not matter when it comes to agricultural opportunity for women. Younger women are also entering the farming industry faster than older women are retiring.

What has been done

Pearls of Production is a two-day leadership and hands-on educational program developed for women involved in livestock production in Missouri. The classroom portion is presented by female industry leaders and focuses on key animal production topics and various other issues facing women in agriculture. The rest of the program focuses on five areas of production key to the Missouri economy through hands on training at the respective University of Missouri research facilities.

Results

This program is in its infancy, so long-term impacts have yet to be realized. However, short-term impacts were measured through a program exit survey. Nearly all women attending the conference reported an increase of understanding in each area of focus. One-hundred percent of women attending reported that they would recommend the program to other women in the industry.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

University of Missouri

Substantial drops in commodity prices over the last 24 months put significant economic

pressures on producers throughout the state. Our MU Agriculture and Natural Resources Extension team coordinated with USDA-NRCS, USDA Farm Services agencies, the Missouri Department of Agriculture, the Missouri Department of Natural Resources and several agribusiness entities to respond to producer needs and concerns.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

University of Missouri

Agriculture and Natural Resources programs at the University of Missouri are all expected to evaluate impact. Many of those results are listed in the preceding narratives. Broadly, our ANR programs provide more than $1 Billion in economic impact to Missouri each year.

Key Items of Evaluation

University of Missouri

Declining state and federal funds cloud the future for our programs. Without this base funding, continuity and "programmatic risk-taking" is hard. While our faculty have done well in generating new revenue, in real-terms, our programs in the future will undoubtedly be smaller.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Personal, Family and Community Wellbeing

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
607	Consumer Economics	3%	0%	0%	0%
608	Community Resource Planning and Development	7%	0%	0%	0%
610	Domestic Policy Analysis	1%	0%	0%	0%
703	Nutrition Education and Behavior	13%	0%	0%	0%
724	Healthy Lifestyle	13%	0%	0%	0%
801	Individual and Family Resource Management	9%	0%	0%	0%
802	Human Development and Family Well-Being	6%	0%	0%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	4%	0%	0%	0%
805	Community Institutions, Health, and Social Services	2%	0%	0%	0%
806	Youth Development	42%	0%	0%	0%
	Total	100%	0%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	167.0	0.0	1.0	0.0
Actual Paid	156.0	0.0	0.0	0.0
Actual Volunteer	9140.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
5395104	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
5303662	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

University of Missouri

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

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

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

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

2. Brief description of the target audience

University of Missouri

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

Targeted audiences are all social groups in the community, including low-income and minorities, non-English speaking, community leaders and organizations, local government, professionals working in

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

3. How was eXtension used?

University of Missouri

Overall, state and regional faculty were engaged in 24 Communities of Practice related to this program. They also answered questions and participated as experts as well as contributed to the overall knowledge base and development of new materials. Faculty regularly participated in professional development offered via eXtension. Faculty regularly drew upon CoPs to answer questions and find resources not available in Missouri as we responded to the complexities of programming. Faculty also contributed to the various eXtension learning communities and material development.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	144852	633280	908913	71238

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	16	11	22

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

related social media sites. Number of unique website visits. Number of guide sheets distributed. Number of in-service opportunities offered.

Year	Actual
2016	62255

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants adopting research based practices as result of increasing their knowledge of family resource management, healthy food and nutrition practices, and healthy lifestyles.
2	No. of youth who pursue study in science career path as the result of participating in programming with direct access to the technological and research advances in agriculture, life sciences, human development, social sciences and engineering, young people in MU Extension's 4-H Youth Development programs that build problem-solving skills and increase their interest in STEM.
3	Communities, community organizations, and local governments will be resilient and socially and economically viable as a result of learning and increased citizen participation occurring from resource planning; business development, community, economic and entrepreneurial development and engagement, community emergency management, and community leadership and nonprofit development programming.
4	No. of persons reporting taking on new leadership roles as a result of their engagement in community development programs (decision making, emergency management, leadership development, organizational development and capacity building, community economic development, etc.).

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	240812

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Missouri is a state with high levels of poverty and obesity, both of which are associated with poor nutritional status and poor health outcomes. These issues are a challenge in Missouri's two urban centers (St. Louis and Kansas City) as well as in the rural areas across the state. University of Missouri Extension provides a much-needed statewide service delivery system to meet the educational needs of residents across the state.

What has been done
University of Missouri Extension provides direct education on nutrition, resource management, housing, and positive family relationships. We leverage our strong partnerships with state and local agencies to enhance these efforts through coordination of services, referrals, and collaboration. Together these efforts reinforce individual and community changes to enhance the ability of Missourians to make healthy lifestyle choices.

Results
Missouri residents receive education on nutrition, food safety and physical activity for lifelong health and fitness. Education for adults also involves lessons on food resource management. Nutrition education for youths provides information in kid-friendly terms and lessons with hands-on activities. Activities include opportunities for taste-testing healthy foods and practicing skills that lead to good health. Evaluation data collected across the state reflect the positive impacts that occur in every county. Additionally in FY16, University of Missouri Extension has helped file 10,284 federal returns for low- to moderate-income individuals, with a total federal refund in excess of $6 million. Assuming that the average tax return costs $200 to prepare, this has saved Missouri residents roughly $20 million in tax preparation costs, not counting other fees like Refund Anticipation products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
703	Nutrition Education and Behavior
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

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	7611

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Youth today must be prepared to live and work in a world that we cannot completely envision - for jobs that do not yet exist, using technologies that have yet to be invented, solving problems that have not yet been identified. Changes in technology increases the demand for trained scientists and engineers and a broader understanding of technology and science by all citizens. The need for advanced technology abilities cuts across all types of communities, professions and skill levels.

What has been done

Ninety 4-H field faculty, campus faculty and staff engage with 9,138 volunteers to reach 62,128 youth across Missouri with on-going science experiences. Missouri 4-H has positioned to enable 4-H youth to enter the workforce with the knowledge, skills, attitudes and health needed for the 21st century workforce. In order to measure progress of youth gaining workforce skills, 4-H faculty are trained using 4-H Common Measures.

Results

Missouri 4-H program links thousands of young people, parents, volunteers and professionals to MU. The large volunteer force (9,138) enables Missouri 4-H members to engage with more adult mentors than their non-4-H peers. Positive and sustained relationships between young people and adults are a predictor of the program's effectiveness in helping youth gain confidence, achieve competency and learn generosity. More than 5,000 youth from 106 different counties connected with MU faculty for 4-H educational events and camps; 7,611 high school and college freshman 4-H'ers are studying science and considering careers in science. Underserved youth make college an achievable goal through 4-H Youth Futures. Campus experiences, coupled with a caring adult mentor, motivate young people and help them navigate the steps of attending and remaining in college. Recent data show 62% of eligible seniors pursue higher education. Another 14% enter the workforce.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Communities, community organizations, and local governments will be resilient and socially and economically viable as a result of learning and increased citizen participation occurring from resource planning; business development, community, economic and entrepreneurial development and engagement, community emergency management, and community leadership and nonprofit development programming.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Poverty in Missouri declined by only 0.5% between 2010 and 2015. The failure of traditional community economic development strategies forces communities to seek new ways to spur economic activity, and community resilience is important in light of many changes. In order to build sustainable communities, research shows participants need to learn about their communities, build decision skills and be provided an authentic voice and opportunity to affect the outcomes.

What has been done

We provided decision-support research to Missourians by providing policy-support research services to communities, state agencies, internal collaborators, and non-profits. We offered SET, Community Development Academy, Cambio de Colores Conference, facilitated planning, fostered community arts and tourism development, provided training and support (workshops, guide sheets, online, etc.) for a community capacity building and community emergency preparedness and recovery.

Results

Engaged citizens, belief in the future of the area, broader inclusion of community members, community buy-in, policy adoption/implementation, and increased economic activity are indicating increased capacity for sustained community viability. Green Hills Heritage Highway and Parkland REDI regional SET groups developed plans. Local leaders in Lexington credit the MU Extension community arts partnership for strengthened community, engaged youth and new businesses.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	168

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many community members, leaders, and local elected officials lack an understanding of the factors that influence the community, as well as basic leadership skills, and understanding of collaboration to make an impact on the collective future of the community.

What has been done
We conducted ten in-depth community leadership training programs and multiple short workshops for urban, rural and suburban youth and adults; and piloted ICLDP international program with S. Africa. We engaged in partnership with Community Action Agencies to train low-income leaders. We developed and piloted a peer-reviewed online community leadership course (with high touch coaching) targeted to millennials (launch at end of FY). We conducted board training through online and workshops.

Results
St. Louis Neighborhood Leadership Academy graduates formed a local school community council, a housing development tenants' association, the St. Charles Co council to assist homeless, and two sought public office. S. African and MO ICLD participants created a MO farmers market, SA Women's Cooperative Partnership for Organic Community Gardening; as well as youth literacy training projects, a school resource center; and created new community engagement. Barton Co. teens leveraged funds, offered programs, and updated a city park.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

University of Missouri

The most significant factors affecting outcomes include limitations of faculty time and pressures with flat federal and local funding and reduced access to state funds. Internal to the university, some resources were redirected away from extension affecting personnel as well as operating funds. With faculty turnover especially due to retirements, about 30% of those conducting local community programming have come into the position within the last two years. We also supported teams for development of new curriculum for health, leadership, and tourism development.

We also experienced several top leadership changes in the university and extension during this fiscal year, adding uncertainty. Funding from grants, contracts and fees is essential at a time when many rural areas continue to experience economic depression and state agencies are still experiencing funding limitations.

Additionally, starting programs and collecting longer-term impacts take a few years. Finally, tracking communities for outcomes over longer periods of time is both difficult and expensive and the causation effect becomes problematic due to other factors that influence action in the community arena.

We are also working to bring into alignment our reporting system with the impact indicators and to provide sufficient training for faculty and staff in evaluation and reporting. The past year was one of transition between reporting systems, which added some uncertainty as well as affected reporting of outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

University of Missouri

Results and impact reported by Community Development program participants during FY16, including long-term results not previously reported include $2.19 million in grants and other resources or efficiencies acquired by communities and organizations; $87,520 in volunteer hours generated by CD Extension to conduct programs. $118,143 in volunteer hours generated by communities and organizations as a result of programs. 258 participants reported taking on new roles; 47 community and organizational plans developed; 26 community/organizational programs and activities initiated or completed, 95 community and organizational policies/plans adopted/implemented. 11 businesses created; 12 jobs created/retained; 44 new organizations created; 1.03 weighted average change in mean score of participants' self-report of learning from post-/pre-post survey

using 5 pt. Likert scale. Missouri River corridor and other flooded areas continued significant recovery with at least 26 COADs working statewide in disaster preparedness and recovery. 93% would recommend our programs to others and rated the value of the training at 4.29 on average on 5 pt. Likert scale (with 5=highest). The audience included rural and urban, all levels of the socio-economic spectrum, youth and adults, and 7.1% minority races and 4% Hispanic/Latinos.

Qualitative data indicated expanded citizen engagement and leadership, broader inclusion of community members, buy-in from the community, adoption of policies, implementation of plans, sound proposals put before voters, and increased economic activity. Communities benefit from wise use of public and private resources.

Key Items of Evaluation

University of Missouri

Data collection on community impacts is consistent with the key outcome indicators developed in the North Central region for CRED programs. Most workshops and trainings use a similar survey at the end of the session to assess post-pre and post perceptions of learning and intent to apply learning. Collection of impact data entail use of ripple effect mapping, follow-up surveys and key informant interviews and rely on attribution. Participants in in-depth community, youth and family trainings receive follow-up surveys after 3-12 months to determine application. Case studies and the ability to tell the story over time are important, as the results are contextual. Rarely are we able to prove causation. Communities and participants report that money was saved, but do not report an amount. Because real impact occurs over time for CRED, there are many other contributors and we often fail to ask about ongoing impact, the impact is likely much higher than what we do collect.

From work with COADs, emergency preparedness and disaster recovery is yielding more prepared communities with capacity to respond and recover, and they are much better at advocating for themselves in the policy arena as well. FEMA considers us a critical player. Important to note is that the COAD Guidance Manual has proven to be a resource that should be of benefit to any state or locality in the US.

MU Extension continues to be an active participant in the Excellence in Extension/Land-Grant Impacts databases. More program impact statements are available online at https://landgrantimpacts.tamu.edu/extension/extension-impacts

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	0%	8%
111	Conservation and Efficient Use of Water	0%	0%	0%	5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	25%	0%	2%
204	Plant Product Quality and Utility (Preharvest)	0%	0%	0%	5%
205	Plant Management Systems	0%	0%	0%	7%
212	Pathogens and Nematodes Affecting Plants	0%	25%	0%	2%
216	Integrated Pest Management Systems	0%	50%	0%	5%
301	Reproductive Performance of Animals	0%	0%	0%	5%
302	Nutrient Utilization in Animals	0%	0%	0%	5%
303	Genetic Improvement of Animals	0%	0%	0%	10%
307	Animal Management Systems	0%	0%	0%	15%
311	Animal Diseases	0%	0%	0%	8%
313	Internal Parasites in Animals	0%	0%	0%	5%
601	Economics of Agricultural Production and Farm Management	0%	0%	0%	8%
604	Marketing and Distribution Practices	0%	0%	0%	5%
721	Insects and Other Pests Affecting Humans	0%	0%	0%	5%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	7.5	0.0	20.0
Actual Paid	0.0	1.8	0.0	31.0
Actual Volunteer	0.0	0.2	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	911658	0	94124
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	1111341	0	811195
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	26178	0	100888

V(D). Planned Program (Activity)

1. Brief description of the Activity

Lincoln University of Missouri

a. Conduct research to control internal parasites and prevent foot rot diseases in small ruminants.

b. Practice the use of artificial insemination in large and small ruminants to improve the genetics of herds and flocks.

c. Determine embryonic and fetal loss in goats throughout gestation, using real-time ultrasound.

d. Research biosensors to facilitate artificial insemination.

e. Develop sunfish cultigens for distribution to the industry.

f. Determine nutritional requirements of sunfishes.

g. Develop optimal production dynamics for sunfishes.

h. Provide aquaculture fish health services for stakeholders.

i. Conferences, meetings, workshops, and training and educational opportunities for small farmers.

j. Introduction and evaluation of new crops (especially native crops) and improved cultural practices.

k. Abstracts, publications, grant proposals, and guide sheets.

l. Promotion of backyard and community gardening.

m. Conduct analysis of the challenges of rural entrepreneurship and their impact on the prospects of community development.

n. Develop effective and environmentally and grower friendly IPM approaches to manage key insects of small fruits and vegetables.

o. Develop technology to reduce mosquito populations responsible for transmitting the causative agents of some of the most widespread and prevalent infections of humans.

The LUCE Integrated Pest Management (IPM) Program wrote newspaper articles and conducted field days, workshops and one-on-one interactions targeting underserved audiences and organic producers. The IPM Program also educated Extension educators and agricultural service providers.

The LUCE Plant Pathology Program (PPP) conducted workshops, demonstrations and research at George Washington Carver Farm and Alan T. Busby Farm and presented at community and growers educational events related to plant pathology (e.g., identifying and managing diseases of vegetables and small fruit; environmentally friendly disease management options for tomatoes). The PPP also collaborated with other Lincoln University Cooperative Extension and Research (LUCER) and University of Missouri (MU) faculty on various grants, and a PPP faculty member was a co-PI on two graduate student projects. In addition, the PPP assisted growers with the monitoring, diagnosis and identification of vegetable and small fruit diseases, which included on-site farm visits year-round.

2. Brief description of the target audience

Lincoln University's Cooperative Research and Extension (LUCER) programs focus on enhancing the quality of life for diverse, limited-resource audiences: low-income, minority and limited-resource farmers and ranchers and underserved population in rural and urban communities. In addition, LUCER works with gardeners, commercial farms, organic and small fruit farmers, commercial vegetable farmers and beginning farmers.

3. How was eXtension used?

Ask an Expert was used to search for solutions for various client questions, to respond to a client question and also by posing questions from clientele.

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1175	4532	35	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	16	59	75

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Projects completed, presentations and manuscripts. Enhanced profitability of small farms. Enhanced vitality and strengthening of rural communities.

Year	Actual

2016	80

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Livestock-Develop improved approaches to internal parasite control and disease prevention. Develop improved production management systems through enhancing reproduction, genetics, and nutrition. Aquaculture- Define sunfish nutritional requirements. Develop a fast growing sunfish cultigen. Identify viable production systems for sunfishes. Make available a fish health protocol. Insects and Pests-IPM: Improved knowledge and awareness of the environmental and economic benefits associated with IPM implementation by growers and Extension educators, increased awareness of pesticide and nutrient impacts on non-target organisms and habitats, increased protection and promotion of high-value agricultural products, reduced pesticide use by farmers, increased production of vegetables and small fruits grown with reduced-risk pesticides and with organic methods.
2	Transfer new technologies for sunfish, small and large ruminant production to farmers. Farmers will use learned technologies.
3	Farmers adopt new technologies for increased and sustainable production.
4	Create conditions for the minority, underserved farmers to be able to earn a reasonable income, continue to live on farms, and develop educational programs and opportunities that will encourage minority youth to get involved in farming. Increase or at least maintain the number of minority farms in the state. More farmers are adopting sustainable farming practices (profitable, environmentally friendly, and socially responsible). Increase the income level of the collaborating small farmers and ranchers on an average of $5,000 per family.
5	Enhanced profitability of small farmers and ranchers, and enhanced viability of rural communities. Increase the average small farm gross income of the collaborating farmers by $5,000. Increase retention rates of the collaborating farmers and ranchers through providing appropriate education and information.

Outcome #1

1. Outcome Measures

Livestock-Develop improved approaches to internal parasite control and disease prevention. Develop improved production management systems through enhancing reproduction, genetics, and nutrition. Aquaculture- Define sunfish nutritional requirements. Develop a fast growing sunfish cultigen. Identify viable production systems for sunfishes. Make available a fish health protocol. Insects and Pests-IPM: Improved knowledge and awareness of the environmental and economic benefits associated with IPM implementation by growers and Extension educators, increased awareness of pesticide and nutrient impacts on non-target organisms and habitats, increased protection and promotion of high-value agricultural products, reduced pesticide use by farmers, increased production of vegetables and small fruits grown with reduced-risk pesticides and with organic methods.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4749

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This research will help small, limited-resource farmers improve production and increase profits. It will also increase profits for commercial fish farmers and add to the economy of Missouri. Many limited-resource, minority, socially-disadvantaged and beginning farmers find it hard to get technical advice on pest management tools and strategies that are simple, effective and affordable. Killing pest organisms with toxic chemicals has been the prevailing pest control strategy for many years, in part due to a lack of IPM knowledge by Extension educators and farmers. This results in excessive pesticides being applied to crops, leading to increased risks and expenses. The small average scale of organic vegetable farms in Missouri hastens the need for scale-appropriate solutions to the critical management concerns of these growers, especially solutions to pest problems that affect vegetable production.

What has been done

Aquaculture: Application of research diets; verification of cage studies for food-sized sunfish. Conversion of empty swine facilities to aquaculture farming; raising food fish. Transfer new technologies for sunfish, small and large ruminant production for farmers. Refining recirculating aquaculture systems to be sustainable on small farms. Workshops have reached approximately 1,000 potential fish farmers.

Small Ruminants: Apply the use of herb cultivars on three farms for the control of internal parasites, using native plant cultivars for grazing sheep and goats.

Comprehensive educational materials and activities, such as one-on-one interactions, field days, workshops and trainings, have been delivered to many farmers (i.e., underserved, minority, limited-resource, beginning, conventional and organic) throughout the state. The IPM program also provided training to Extension educators and agricultural service providers so that they were better able to assist farmers. Efforts were made to reduce insecticide use, which should lead to increased profits. Organic producers were taught fundamental, multidisciplinary IPM knowledge and skills to improve their farming operations. Skill sets were taught in the classroom and the field, with hands-on training and demonstrations.

Results

Several novel bluegill crosses have been created with considerable variation in their performance. Data indicates that higher protein and lipid feeds resulted in greater growth and fillet yields in bluegill sunfish. Although the data is not completely analyzed, the higher cost (higher protein, higher lipid) feeds appear to produce a lower cost of fish produced per pound of feed. Survival of hybrid sunfish in the laboratory was excellent. Survival of cold-shocked fish was higher than expected. These fish are currently being grown to a stage were ploidy can be determined with a Coulter Counter.

As a result of the research and educational activities that were implemented, Missouri farmers increased the production of high-quality vegetable crops, using sustainable methods, by applying simple and effective IPM strategies. Several farmers in Missouri eliminated insecticides in their cucurbit crops. Some of these producers reduced the inputs and costs by not spraying any insecticides on the cash crop. At least 20 farmers adopted trap cropping as an effective IPM strategy to control pests. By informing customers that the produce was not sprayed with insecticides, some farmers increased sales, and they spent less time in the field.

As a result of research on trap cropping, mass trapping, insectary plants and biological control as well as the educational and Extension activities that were implemented, Missouri's organic farmers increased production of high-quality vegetable crops using sustainable methods, by applying simple and effective IPM strategies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
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

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Farmers adopt new technologies for increased and sustainable production.

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	745

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Extreme weather manifested in excessive precipitation, a wet/humid summer and early warm temperatures in the spring was typical on many farms in Missouri in 2016. Consequently, there was an increased incidence of diseases and frequent requests for farm visits, with many calls and emails needed to respond to client requests. There was a great demand for LUCE to showcase integrated approaches to vegetable disease management.

What has been done
Three field trials on university farms modeled crops and demonstrated various identification and disease prevention techniques, which were shared during workshops and field days. The results of a three-year study on MELCAST (MELon disease foreCASTer) were presented at professional and growers conferences. Experts on disease diagnostics, organic disease management, weather prediction and fruit disease management trained Missouri farmers on how to keep diseases at bay. Master Gardener students were educated on the importance of early diagnosis, disease monitoring and prevention to maintain healthy plants in their gardens and enjoy a bountiful harvest. Three raised beds at the community garden were used to teach various skills and aspects of tomato production. FFA and senior high school students were taught the art and science of plant pathology and its career opportunities. The PPP collaborated with Jomo Kenyatta

University (JKUAT), Kenya, on a project that focused on using affordable and environment friendly disease management options for tomatoes. Year-round services on disease identification (monitoring, diagnosis and identification) included on-site farm visits.

Results

The use of integrated approaches and the overall reduction in the incidence of plant diseases based on applying new information improved productivity for gardeners and farmers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
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

Outcome #4

1. Outcome Measures

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.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

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.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Lincoln University of Missouri

Lincoln University Cooperative Extension and Research (LUCER) was affected by flat federal and local funding and reduced access to state funds.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Community and Leadership Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	0%	50%	0%	50%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%	50%	0%	0%
901	Program and Project Design, and Statistics	0%	0%	0%	25%
903	Communication, Education, and Information Delivery	0%	0%	0%	25%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	1.0	0.0	0.0
Actual Paid	0.0	2.5	0.0	1.5
Actual Volunteer	0.0	5.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	65053	0	126357
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Lincoln University of Missouri

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.

- The Lincoln University Center for Community and Leadership Development (LUCCLD) trained the Clarkton mayor and board members on "Fourth-class Cities Guidelines" and procedures related to daily city activities.
- The LUCE St. Louis Urban Impact Center (SLUIC) taught "Let's Be Technical" provided computer literacy/technology workshops to adults and youth.

2. Brief description of the target audience

Lincoln University of Missouri

The target audience included underserved communities and fourth-class cities as well as senior citizens and school-aged youth with limited resources and limited access to computers and the internet.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	366	42	171	28

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total

Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Informational sessions including, workshops, presentations and face-to-face meetings.

Year	Actual
2016	102

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

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. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As the communities of Hayti Heights, Hometown, Caruthersville and Poplar Bluff continue to grow, local officials and community members are constantly challenged by the need to balance fiscal, social, economic and environmental goals. One aspect of this challenge is deciding how much and what types of new development the community can accommodate without compromising the day-to-day quality of life for residents. Socioeconomic impact assessment is designed to assist communities in making decisions that promote long-term sustainability, including economic prosperity, a healthy community and social well-being. The proposed development will change the lives of current and future residents of these communities, bringing new business opportunities, employment, private investments and housing development. It will provide the space for business development workshops and conferences.
Computer classes are needed to minimize the digital divide for low-income seniors and youth.

What has been done
This outreach effort used leading-edge thinking, with practical applications to enhance the capacity of people to work effectively with a broad range of community issues. Each issue required some form of decision-making process and implementation in the community beyond the individual, the family or the business. It is imperative that each stakeholder unit work and communicate effectively in addressing these issues. The LUCCLD assisted communities and organizations in effectively addressing these issues.
The computer classes at the SLUIC taught basic computer hardware and software, including Microsoft Word, Excel, PowerPoint and how to use and apply internet skills, including, but not limited to, applications on cellular phones parallel to those on desktops, laptops and tablets. In addition, students learned how to read and compose email, how to text, how to find and review various websites, how to use self-service computers at the gas station and grocery store, how to use a bank ATM, how to interact using social media, how to pay bills using online banking as well

as tips for planning travel using online resources.

Results

The LUCCLD assisted communities in the development of processes that allowed them to create their desired future and also developed practical skills and programs to effectively involve and empower local citizens to become more effective leaders.

The participants learned valuable computer skills that they could apply in the real world.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

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.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

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

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Lincoln University of Missouri
Lincoln University Cooperative Extension and Research (LUCER) was affected by flat federal and local funding and reduced access to state funds.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Pre and Post testing was done to determine whether information was understood.
Follow up conversations were conducted with some program participants to determine intermediate and long term behavior change.

Key Items of Evaluation

In all cases skills were built and used in to solve problems in the community, city and family

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Family and Youth Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	0%	20%	0%	0%
724	Healthy Lifestyle	0%	20%	0%	0%
801	Individual and Family Resource Management	0%	20%	0%	0%
806	Youth Development	0%	40%	0%	0%
	Total	0%	100%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	22.0	0.0	0.0
Actual Paid	0.0	6.0	0.0	0.0
Actual Volunteer	0.0	75.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	1830917	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	30187	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	60907	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Lincoln University of Missouri

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

Specific examples of activities from the Kansas City area include:

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

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

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

Specific examples of activities in the Southeast Missouri Region include:

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

Specific activities in the Central Region include:

- Underserved minorities and other disadvantaged older adults 50+ in Cole County area will become

more aware and knowledgeable about importance of adopting a healthy lifestyle.

- Participants will become proactive in seeking health information.
- Participants will become more aware of ways to manage their personal health.
- Youth will develop increased communication skills, receive feedback, certificates of award and recognition for their efforts.
- Provision of culturally specific parenting education classes.
- Family and community empowerment experiences to assist parents helping their children to close the educational achievement gap.

Activities that have been implemented in all four Regions include:

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

2. Brief description of the target audience

Lincoln University of Missouri

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

- LUCE developed and/or conducted several programs designed to increase the capacity, knowledge and skill level of youth around the state. These included the Young Medics Camp, a teen abstinence program, AgDiscovery and the Cole County Youth Day, which focused on youth development, health, nutrition, healthy choices and leadership.

- In Southeast Missouri, LUCE offered educational workshops, conferences, camps and afterschool and summer enrichment programs to address leadership development, fitness and nutrition, abstinence, college prep, STEAM (Science, Technology, Engineering, Agriculture and Math) and agriculture opportunities.
- In the St. Louis Area, the Men on Business program was developed as acollege assurance program. The program targets African American young men and assists them in successfully matriculating through middle, junior and high school.Resources are supportive resources are provided to let them know graduation from college can be in their future.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1800	3200	4024	11300

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	1	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Education classes, invited speeches, workshops, in-service education, consultations, media appearances, web sites, newsletters

Year	Actual
2016	15

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

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

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	400

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Young people throughout Missouri continue to face challenges with education, violence, media influence and parental relations as well as with their overall health and activity levels. Unhealthy lifestyles and behavioral choices have continued to cause an increased mortality rate, a propensity toward criminal activity and addictive/destructive behaviors, which follow youth into adulthood. Peer pressure, low self-esteem, image disorders and finding a healthy identity all challenge our youth, making it hard for them to conceptualize a healthy life and to pursue healthier living practices. Through education, youth can become a potent force in combating social issues that impact their peers and other teens.

What has been done
Young Medics Camp targeted about 50 youth in a three-day camp that teaches about anatomy, CPR, first aid, leadership skills, team building, etc. LUCE collaborated with the Missouri Department of Health and Human Services on the teen abstinence program, with middle and high school students gathering from throughout Missouri to address issues and practices that improve healthy choices. AgDiscovery was held at the Busby Farm Youth Development Camp, and teaching leadership, while engaging in plant and animal science. LUCE, in cooperation with the Cole County Commission, initiated the Cole County Youth Day, which focused on youth development, health, nutrition, healthy choices and leadership. Men on Business youth on youth mentoring program.

Together, these programs taught young people about leadership, peer pressure, value-based living, economic integrity, organizational leadership, healthy eating choices and nutrition. Participant groups were invited to multiple-day training experiences where hands-on instruction and individual/group development were encouraged.

Results

The above programs have cultivated a positive atmosphere, where students demonstrated knowledge retention and an insightful ability to apply new strategies and techniques in their daily lives. Through regional and statewide planning and implementation, over 500 youth responded positively to our program objectives and methods of delivery. Students were able to demonstrate critical thinking skills, engage in meaningful dialogue about sociopolitical and cultural issues and set goals and create new aspirations as a result of their engagement in these programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
801	Individual and Family Resource Management
806	Youth Development

Outcome #2

1. Outcome Measures

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.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2875

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Most impoverished counties in Missouri can be found in Southeast Missouri (the Bootheel). One of the largest employers in the area just closed its doors. Transportation barriers continue to be problematic. Without adequate education, young people are relegated to low-paying, unskilled service jobs that will trap them into a lifetime of poverty, affecting not only these youth but the community at large.

What has been done

LUCE Southeast provided the underserved and minority population with an array of educational programs that addressed youth and leadership development, life skills, fitness, nutrition, teen pregnancy prevention, academic achievement and STEAM.

Results

Participants in the LUCE Southeast programs increased their knowledge base and approximately two-thirds of participants reported attending college or trade school, enlisting in the military or being gainfully employed.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
801	Individual and Family Resource Management
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected 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.)

Brief Explanation

Lincoln University of Missouri

One of the most significant factors affecting outcomes is flat federal and local funding and reduced access to state funds.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Pre and Post Tests are administered at program the beginning and end of programs to determine knowledge acquisition.

Because the programs are comprehensive and individuals participate for many years, observations are made and participants are interviewed to determine/track real changes in behavior.

Key Items of Evaluation

Where the graduation rate for African American males in the United Staets is about 60 percent, the participants in the Men on Business program have a graduation rate of more than 70 percent.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Climate Change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	0%	25%
112	Watershed Protection and Management	0%	0%	0%	10%
123	Management and Sustainability of Forest Resources	0%	0%	0%	5%
125	Agroforestry	0%	0%	0%	5%
136	Conservation of Biological Diversity	0%	0%	0%	10%
141	Air Resource Protection and Management	0%	0%	0%	10%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%	0%	0%	15%
403	Waste Disposal, Recycling, and Reuse	0%	0%	0%	10%
723	Hazards to Human Health and Safety	0%	0%	0%	10%
	Total	0%	0%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	2.0	0.0	16.0
Actual Paid	0.0	0.0	0.0	15.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	0	325343
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	93177
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	796

V(D). Planned Program (Activity)

1. Brief description of the Activity

Water Quality Studies

The Missouri region is one of several areas in the United States having confined animal feeding operations (CAFOs) under various animal unit classifications. The water quality of streams near CAFOs may deteriorate due to inputs of Escherichia coli (E. coli), nitrogen (N), phosphorus (P) and antibiotic drugs from animal wastes. In addition, land use and management practices in various watersheds may also impact surface water quality. It is also necessary to understand the distribution and fate of pollutants from animal wastes in environmental media (soil, sediment, surface and groundwater) and the potential public health risks. 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 runoff/seepage from cattle and swine wastes and various land uses on the water quality of selected Missouri streams. A recently approved project will explore the ecological links between bio indicators 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

This project characterizes the physical/chemical properties of the tailings and determines 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 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 photos).

Greenhouse Gas Studies

The atmospheric concentration of CO_2, CH_4 and N_2O is ever increasing, and a good deal of research has been conducted to estimate emissions of these greenhouse gases from soils. Although numerous measurements have been made, emissions from soils still show variability based on a number of controlling factors. In fact, differences in soil type, moisture, temperature, season, crop type, fertilization and other agricultural practices apparently all play a part in emissions from soils.

Enhanced in Situ Biodegradation of Pesticides under Modified Soil Conditions Priorities:

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

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

It is anticipated that within ten years, each product sold in the marketplace will contain at least one nanomaterial for use in enhancing the efficiency or durability of the merchandise. Due to this unprecedented growth, the Earth will be exposed to a huge number of nanomaterials--on the order of several thousand tons. Therefore, it is important to understand and prepare for the changes that are expected to occur in microbial surroundings upon such a large and pervasive exposure to nanomaterials. Soils are being continuously exposed to large amounts of engineered nanoparticles (ENPs), especially AgNPs. The influence of the nanomaterials in altering the ecological balance and the environmental risks associated with this exposure need to be understood very clearly. The overall goal of this project is to understand the effect of Nano particulate silver on the soil environment. Specifically, we will investigate the effect of AgNPs upon interaction with soil physicochemical properties and study their effects on microbial population and diversity.

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 of the controls of stream water quality in Missouri. The research objectives are to understand the hydrologic pathways controlling stream flow under storm event and base flow conditions at multiple catchment scales and the factors controlling nutrient and herbicide transport to stream water.

Faecalibacterium-like Bacteria for Tracking Agricultural Sources of Fecal Pollution in Water:

The objective of this project was 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, bio-oil 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 (bio methane and bio-oil) production from switchgrass by 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 a loss of habitat. Conservation and management is key to the restoration of warm-season grassland vegetation either on wildlife refuges and nature preserves or on Conservation Reserve Program (CRP) fields.

2. Brief description of the target audience

(a) Farmers
(b) Engineers
(c) Policy makers
(d) Students
(e) Community leaders
(f) Local citizens
(g) Extension workers
(h) Scientists and other researchers
(i) Regulatory agencies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	625	950	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	23	0

V(F). State Defined Outputs

Output Target

Output #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 Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

Chemical and biological characterization of the ecosystems.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lead contamination in soil is causing serious health problems for children. The chemical and toxic leachates, pathogens and biological organisms can negatively impact public health, groundwater and streams. Water runoff from CAFOs contaminates the water quality of streams near CAFOs.

What has been done
We started mapping and analyzing rock, mineral and water samples from seven abandoned mines. We identified potential soil controlling factors for greenhouse emissions from soil and increased our knowledge of Pb behaviors and risks in the soil ecosystem. Water samples near CAFOs were collected to evaluate levels of E. coli, nitrogen, phosphorous and antibiotic drugs from animal waste.

Results
This project increased our understanding of greenhouse gas emissions from agricultural fields. Preliminary results showed that the H3PO4 treatment effectively immobilized soil Pb, thus lowering the risks to human health; however, more studies are needed. Extensive education was given to members of the target audience. This resulted in better management to improve water quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources

125	Agroforestry
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need to understand greenhouse gas emissions from agricultural fields and to devise strategies to mitigate these gases. Deterioration of water quality due to runoff from CAFOs is a problem. Conservation and protection of native plants and other natural resources helps to protect watersheds, which results in cleaner water, air, soil and healthier and safer environments.

What has been done
Field collections were made from agricultural fields, pastures and forests in Central Missouri to identify potential soil controlling factors for greenhouse gas emissions from soil. Water samples were collected to determine the levels of E.coli, nitrogen, phosphorous and antibiotic drugs. Through field days, conferences, seminars and other events, awareness was increased about the importance of protecting natural resources.

Results
We have a better understanding of greenhouse gas emissions and a new approach to measure these emissions from fields, pastures and forests. Stakeholders were educated to alter agricultural practices to reduce emissions from agricultural fields. Better management practices

are being used to improve water quality.

There are also positive changes associated with the LUCE Native Plants Program and native pollinator initiative and the restoration of warm-season grasses, but they are too hard to measure at this time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
125	Agroforestry
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Environmental sustainability; Improved quality of life

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lead-contaminated soil and contamination from runoff associated with abandoned mines and CAFOs is a health risk for those who live in and near contaminated sites. Treatment methods are needed, and the public needs to be informed on this topic.

What has been done
Risk reduction of lead (Pb) contamination in soils and lands through in situ phosphate treatment of contaminated soil was conducted. This helps reestablish vegetation cover to protect human and environmental contamination. Water samples were collected from streams near CAFOs. Participants in field days, seminars and workshops were introduced to conservation practices.

Results
The health and ecological risks associated with Pb in the soil ecosystem were reduced. This research sustained natural resources and improved environmental quality and quality of life. Better management practices were instituted.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
125	Agroforestry
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

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. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This research reduces the health and ecological risks associated with Pb in soil ecosystem, sustains natural resources and improves environmental quality and quality of life. Better management practices are needed.

What has been done
Numerous workshops and presentations were given to help educate the target audience. Tests were conducted to evaluate in situ phosphate treatment of contaminated soils. Samples were taken from abandoned mines and one stream for further analysis to help determine the level of contamination and impacts to groundwater.

Results
The overall results, so far, are a better understanding of the relationship between soil properties and greenhouse gas emissions. More of the target audience has been informed about environmental issues and the complex interaction between natural ecosystems and human practices. Better management practices and conservation practices have been instituted.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
125	Agroforestry
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Lincoln University of Missouri
These factors could have impacted outcomes, but in the past year, there were few external factors that did hinder the projects. The economy is always an issue, as joblessness, in

certain areas is more prevalent and creates anxiety and tension among families and communities.

There were some problems reaching out to Hispanic audiences because of immigration issues, as many people either do not have legal documents or have relatives who are undocumented. There is a false idea that universities are governmental organizations that will report undocumented immigrants to authorities.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
402	Engineering Systems and Equipment	0%	0%	0%	25%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%	50%	0%	50%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	50%	0%	25%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	2.0	0.0	4.0
Actual Paid	0.0	0.0	0.0	4.0
Actual Volunteer	0.0	2.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	151539	0	890404
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	169343	0	142009
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	1499	0	5922

V(D). Planned Program (Activity)

1. Brief description of the Activity

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

2. Brief description of the target audience

Ethnic Minorities, low-income families and other underrepresented groups in St. Louis, Kansas City, the Bootheel and the Jefferson City area in the state of Missouri.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6228	1230	679	9637

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	6	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of publication, presentations, workshops and contacts.

Year	Actual
2016	6

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

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. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All families that prepare food want to know that the food they purchase and prepare is free of bacteria and other pathogens.

What has been done
Workshops and presentations were made to community groups, schools and students to stress the importance of nutritious, fully cooked food.

Results
We expect an 80% positive response of those contacted.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Health officials, food processors and handlers as well as low-income and underserved populations are differentially impacted by this topic. Safe, clean food is necessary to help prevent illnesses and lower health care costs.

What has been done
Early testing of a sensor to more readily identify bacteria and other food pathogens has been done. Early experiments indicate that the testing device is very sensitive, with positive results so far.

Results
Early elimination of contaminated food to prevent human illnesses and costly market recalls. Experiments are still being conducted.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

Lincoln University of Missouri

Changes in any of these external factors could ultimately impact funding dollars that are necessary to continue with the project.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

To be determined.

Key Items of Evaluation

This project will decrease the evaluation time to detect E. coli and other bacteria and food pathogens. This detection and evaluation method will reduce the detection time and provide timely identification prior to the food being sold to consumers. An early determination of contamination will prevent the food from being sold, will prevent people from becoming ill and will prevent costly food recalls.

There has been a positive response from those contacted in regard to keeping food clean of bacteria and using proper cooking methods.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	0%	20%
111	Conservation and Efficient Use of Water	0%	0%	0%	10%
131	Alternative Uses of Land	0%	0%	0%	10%
132	Weather and Climate	0%	0%	0%	10%
133	Pollution Prevention and Mitigation	0%	0%	0%	20%
141	Air Resource Protection and Management	0%	0%	0%	5%
403	Waste Disposal, Recycling, and Reuse	0%	0%	0%	5%
511	New and Improved Non-Food Products and Processes	0%	0%	0%	20%
	Total	0%	0%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	1.0	0.0	2.0
Actual Paid	0.0	0.0	0.0	2.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	0	245026
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	62118
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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

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

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

2. Brief description of the target audience

- Undergraduate/graduate students
- Small farmers
- Local electric cooperatives
- Scientists and other researchers
- Extension workers
- Policy makers/ regulatory agencies
- Local citizens/community leaders
- Engineers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	4980	0	0

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

Patent Applications Submitted

Year: 2016

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	5	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Short term output measures are: Abstracts, presentations, training students, and workshops. Intermediate output measures are publications

Year	Actual
2016	15

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures**

Identify high yielding, hardy pest resistant microalgae strains.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Develop commercial cultivation system for mass production of algal biomass

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Educate stakeholders on research status for environmental solutions

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

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

2. **Associated Institution Types**

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

All stakeholders have an interest in finding viable environmental solutions.

What has been done
Numerous presentations, publications and workshops have informed all targeted audiences about the present research status.

Results
A more informed and interested stakeholder audience has resulted from educating farmers, scientists, etc.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes

Outcome #5

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All stakeholders have an interest in finding viable environmental solutions.

What has been done
Numerous presentations, publications and workshops have informed all targeted audiences about the present research status.

Results
A more informed and interested stakeholder audience has resulted.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Changes to any or all of these external factors could have a substantive impact on continued research. Research is dependent upon funding, which is a product of the economy, government regulations and changes in public policy and appropriations.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

More testing is still needed with the microalgal studies. Private companies do show an interest, but more information needs to be evaluated to determine the economic feasibility of both projects. Biochar studies need more information to present an in-depth evaluation.

Key Items of Evaluation

There is real interest from stakeholders in the future potential of alternative fuel sources. Stakeholders are willing to look to the future and maintain an open mind with regards to potential energy sources that are economically useable.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
607	Consumer Economics	0%	20%	0%	25%
701	Nutrient Composition of Food	0%	0%	0%	25%
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	0%	25%
703	Nutrition Education and Behavior	0%	30%	0%	0%
724	Healthy Lifestyle	0%	50%	0%	25%
	Total	0%	100%	0%	100%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	1.0	0.0	2.0
Actual Paid	0.0	2.5	0.0	2.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	22249	0	65933
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Perform experiments and publish results.
- Presentation of experimental results in scientific conference and seminars.
- Conduct workshops.
- Distribution of nutritional information and physical activities.

2. Brief description of the target audience

Etnic Minorities, low-income families and other underrepresented groups in St. Louis, Kansas City, the Bootheel, and Jefferson City areas in the state of Missouri.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1530	2000	1500	6500

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	0	1	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of publications, presentations, workshops, and contacts.

Year	Actual
2016	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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 Measures

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.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

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. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

607	Consumer Economics
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Pre- and post-program surveys will be utilized to measure educational and change results.

Key Items of Evaluation

Consistency with participants in following through with program events, goals, and plans can affect results.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
50	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
3	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
10000	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
4	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
100	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
2	Tons of feedstocks delivered.