

# 2017 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 2017 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 2017, our programs had total contacts of nearly 1.7 million from Missouri's 6.1 million citizens (988,856 direct contacts and 671,364 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 December 2017, a new more comprehensive and accessible approach to online learning, onsite event registration, web information and publications was launched, Nexus@Mizzou. Our Extension website had 31,592,678 page views; 3,369,265 publication views; and 8,385,866 content downloads. 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 2017 by providing research-based knowledge to Missourians aligned with their priorities of jobs, health, and education.

#### Lincoln University of Missouri Cooperative Extension and Research

##### A Synopsis of Accomplishments

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 Southeast and Southwest Missouri. Families and/or youth can be brought to campus for summer camps (accommodated in our youth development camp). Youth are exposed to agricultural practices.

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.

###### 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 and K-12 teachers.

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.

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.

**Climate Change**

**Environmental Science**

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**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 Southeast and Southwest Missouri 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 farmers, families, youth and the elderly as well as entire communities that have underserved and underrepresented populations. Programs of this type include (1) 4H, youth development, (2) family development, (3) community development, (4) health and aging, (5) food and nutrition and (5) urban gardening.

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

**Total Actual Amount of professional FTEs/SYs for this State**

Year: 2017	Extension		Research	
	1862	1890	1862	1890
Plan	266.0	36.5	66.0	44.5
Actual	262.0	39.5	110.0	55.0

**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 engage stakeholders in all 114 counties through a variety of methods. In 2017, MU Extension conducted a comprehensive needs assessment

called "Building Our Future Together," incorporated peer review from six nationally-recognized experts of other universities, an interdisciplinary faculty data-informed assessment of Missouri-needs, and an independent quantitative analysis of the impact and value of extension's programs. This review, conducted by TEconomy Partners, showed that a \$86 million total investment in Extension and continuing education leverages \$945 million in economic impact for the state.

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

#### **Brief explanation.**

##### **University of Missouri**

University of Missouri Research and Extension faculty engage stakeholders in all 114 counties through a variety of methods. In 2017, MU Extension conducted a comprehensive needs assessment called "Building Our Future Together," that brought new insights from outside experts, faculty analysis of data, and - most importantly - 42 community conversations with 1,200 participants held around the state (four were presented in Spanish). In addition, senior university leaders visited all 114 counties, with formal presentations and listening conversations with county Commissions and public Extension Council meetings. Finally, county faculty and staff meet monthly with county extension councils comprised of publicly-elected and statutorily-appointed stakeholders to guide programming.

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 to gain a better understanding of the issues underlying the needs in order for us to be more effective in our programming response.

### **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) 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
- Open Listening Sessions
- Needs Assessments
- Use Surveys

### **Brief explanation.**

#### **University of Missouri**

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Conversations were in partnership with elected/appointed county extension councils across the state, higher education institutions (including Lincoln University), and other community partners.

Participants were recruited broadly through invitations, public announcements, and recruitment through partner community organizations.

#### **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. In 2017, MU Extension conducted a comprehensive needs assessment called "Building Our Future Together," that brought new insights from outside experts, faculty analysis of data, and - most importantly - 42 community conversations with 1,200 participants held around the state (four were presented in Spanish). In addition, senior university leaders visited all 114 counties, with formal presentations and listening conversations with county Commissions and public Extension Council meetings. Finally, county faculty and staff meet monthly with county extension councils comprised of publicly elected and statutorily appointed stakeholders to guide programming.

Community conversations utilized a structured protocol to surface understanding across the state.

From the reports submitted outlining the results of each conversation, a list of 158 unique issues was compiled. This list was then coded for themes using qualitative methods, and the issues were organized under the resulting themes and subthemes. Definitions for each category were developed from the words participants used to define the issues in their communities. Conversations with commissioners and councils in each county included shared discussion points, documented feedback forms, and subsequent analysis to identify themes and patterns.

**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 once 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 engage stakeholders in all 114 counties through a variety of methods. In 2017, MU Extension conducted a comprehensive needs assessment called "Building Our Future Together," that brought new insights from outside experts, faculty analysis of data, and - most importantly - 42 community conversations with 1,200 participants held around the state (four were presented in Spanish). In addition, senior university leaders visited all 114 counties, with formal presentations and listening conversations with county Commissions and public Extension Council meetings. Finally, county faculty and staff meet monthly with county extension councils comprised of publicly elected and statutorily appointed stakeholders to guide programming.

Analysis of community conversations, data reviews of needs, external review of our operations, and county-by-county feedback are driving the way MU Extension is structured and our programmatic priorities. The data and feedback have been used to restructure the regional specialist workforce, and to align investments for the future.

##### **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**

From the Building Our Future Together needs assessment, three grand challenges emerged as focal points for the University of Missouri's extension and engagement efforts: economic opportunity, healthy futures, and educational access and excellence. In response to this, MU Extension has divided its regional specialist workforce in half - with half serving as "County Engagement Specialists" focused on assessing needs and connecting programming in the grand challenge areas, and half serving as "Field Specialists" providing more targeted educational programming and interventions to communities. In addition, we are further investing in technology resources to connect with Missourians in order to deliver programming, show value to communities, and help communities to partner to better themselves.

##### **Lincoln University of Missouri**

There is a 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
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
<b>Actual Formula</b>	9136022	2462132	6137786	2134640
<b>Actual Matching</b>	9136022	1384647	8030908	889332
<b>Actual All Other</b>	0	125091	14620354	18937
<b>Total Actual Expended</b>	18272044	3971870	28789048	3042909

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



**V. Planned Program Table of Content**

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

**V(A). Planned Program (Summary)**

**Program # 1**

**1. Name of the Planned Program**

Sustainable Food Production/Security and Environment/Natural Resource Management

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%
	<b>Total</b>	100%	0%	100%	0%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	95.0	0.0	65.0	0.0
<b>Actual Paid</b>	99.0	0.0	110.0	0.0

<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0
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**2. Actual dollars expended in this Program (includes Carryover Funds from previous years)**

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
3897656	0	6137786	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
3908117	0	8030908	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	14620354	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

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

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

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

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

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

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

**2. Brief description of the target audience**

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

**3. How was eXtension used?**

Individual extension faculty participated in eXtension activities, but it did not represent a significant activity for this program.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	32731	50620	4902	6576

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

**Patent Applications Submitted**

Year: 2017  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	0	182	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of peer reviewed journal articles.

**Year                      Actual**

2017

182

**Output #2**

**Output Measure**

- Number of other peer reviewed publications book chapters, proceedings, abstracts, etc.  
Not reporting on this Output for this Annual Report

**Output #3**

**Output Measure**

- Number of invited papers and invited presentations.  
Not reporting on this Output for this Annual Report

**Output #4**

**Output Measure**

- Number of graduate degrees awarded.  
Not reporting on this Output for this Annual Report

**Output #5**

**Output Measure**

- Number of in-service training session(s) for regional Extension specialists on an annual basis.

<b>Year</b>	<b>Actual</b>
2017	120

**Output #6**

**Output Measure**

- Number of new or revised guide sheets annually for regional Extension specialists to use in producer meetings.

<b>Year</b>	<b>Actual</b>
2017	0

**Output #7**

**Output Measure**

- Number of groups and individuals assisted to develop and implement forest, wildlife, and watershed plans.

<b>Year</b>	<b>Actual</b>
2017	66

**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**

<b>Year</b>	<b>Actual</b>
2017	74728

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Missouri Department of Agriculture investigated more than 280 dicamba-related injury reports over 325,000 acres of soybean in 54 Missouri counties in 2017. Collectively, state agriculture departments around the United States reported 2,708 dicamba-related injury investigations. This included 3.6 million acres of soybean with dicamba damage. University of Missouri Extension weed scientists, agronomists, horticulturists and economists led the way to educate the public on how to properly use dicamba for weed control.

**What has been done**

MU Extension weed scientists made 51 presentations on dicamba from January to September 2017, and at the annual MU Extension Crop Management Conference. MU specialists and administrators met numerous times with dicamba company representatives, agency partners, and agri-businesses to present the dicamba dilemma and offer recommendations based upon unbiased research. MU weed scientists and researchers outlined four main routes of off-target movement of dicamba: physical drift, tank contamination, temperature inversions, and volatility.

**Results**

MU Extension, with funding from Missouri Soybean Association, updated nine weather stations to give real-time information to alert chemical applicators to inversions. MDA lifted the ban placed on dicamba use in July, with restrictions, including spraying during certain times of the day and under specific wind speeds. In October, the Environmental Protection Agency announced an agreement with three major herbicide manufacturers to minimize potential for off-target movement of dicamba and ensure use of their three approved pesticide products. MDA issued a 24cSpecial

Local Need label for each of those products. All three labels contain the same restrictions, which are mandatory certification for pesticide sale and use, training requirements, notice of application form, restricted application timing, and cutoff dates for use.

#### 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
2017	9359

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Water typically abounds in Missouri and underpins the economy for its value in Ag production. In north Missouri, human needs intersect more so with Ag and industry because of water quantity/quality/infrastructure deficits. This problem compounds during severe droughts. In 2012 human needs trumped Ag and left some livestock producers without water. We intend to estimate current water demand from ag production and project future demand under different scenarios of industry growth and climate simulations. These data allow planners to address shortages and



avert crises in the future.

**What has been done**

We identified production acres of all major crops in Missouri by county. Irrigation demand was modeled based on crop, recorded weather, and yield data. Based on region, a ratio of surface/groundwater was identified as the source of water used. All classes of livestock were inventoried by county and average daily water use per animal was calculated for the functional life of the animals. Likewise, the ratio of surface/groundwater by region was applied to document the sources of water drawn upon.

**Results**

Water withdrawals from groundwater and surface sources totaled 500 billion gallons for all crops statewide (all major cash crops plus orchards, vegetables, fruits and nuts, etc.). Water used in animal agriculture is still being tabulated. These data are assimilated by county and we can pool across different HUC levels to give insight at watershed levels. CDM Smith is concurrently tabulating water use by municipal, public, and other entities. They will merge our Ag data with their data to provide a comprehensive report on water supply and demand in the state. The complete dataset will be invaluable to stakeholders and policy-makers making proactive decisions regarding water use in the future.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
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
2017	10665

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

January 1, 2017 marked the beginning of significant changes to availability and use of medically important feed grade and water-soluble antimicrobials in animal health. These changes require animal owners to have a Veterinary Feed Directive or prescription from their veterinarian before using these antimicrobials ? many of which were available over-the-counter in 2016. Because of this, educational efforts were needed to prepare animal owners, veterinarians, and feed distributors for the changes that were to come.

#### What has been done

In FY2017, information related to the Veterinary Feed Directive was presented at 2 national conferences, 2 regional conferences, 36 extension meetings, and 12 veterinary meetings. Prior to FY2017, VFD information was presented at 1 national conference, 4 regional conferences, 63 extension meetings and 3 veterinary meetings. In addition to face-to-face meetings, two webinars were offered through the Missouri Veterinary Medical Association, numerous interviews were provided to news outlets, both print media and radio, and a local PBS station filmed a VFD episode for Show-Me Ag that aired on local PBS stations in Missouri.

#### Results

The overall impact of the program is difficult to quantify. Comments from the state veterinarian and representatives from animal health companies and feed distributors indicated Missouri was better prepared for the changes than most states due to the efforts of University of Missouri Extension.

While the majority of meetings offered were for animal owners and feed distributors, the meetings specifically designed for veterinarians were of the utmost importance because of the role they would play in the VFD process. The 12 veterinary meetings offered in FY2107 served as training seminars and were designed to familiarize veterinarians with the rules and regulations associated with the antimicrobial label changes and the process for filling out a legal Veterinary Feed Directive. Approximately 250 veterinarians attended these meetings. Surveys indicated the average level of understanding of the VFD process was 3.7 (scale of 1-10) prior to the meeting and 7.2 at the conclusion.

### 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**

In August, state agriculture departments around the United States reported 2,708 dicamba-related injury investigations. This included 3.6 million acres of soybean with dicamba damage. Two hundred eighty reports covering 325,000 acres were in Missouri alone. Additionally, continued drops in commodity prices 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**

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**

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. The University of Missouri changed the faculty accomplishments reporting system in 2017. Data represented in this program update under-reports faculty publications, guide sheets, and other activities. Updated data will be available in the future.

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

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	171.0	0.0	0.0	0.0
<b>Actual Paid</b>	163.0	0.0	0.0	0.0
<b>Actual Volunteer</b>	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
5238366	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
5227905	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**

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

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

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

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

**2. Brief description of the target audience**

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

Targeted audiences are all social groups in the community, including low-income and minorities, non-English speaking, community leaders and organizations, local government, professionals working in community and economic development, local businesses and potential business owners, home builders, and agencies that assist in disaster. We place no limitation on gender, ethnic or religious diversity, lifestyle choice, etc. We also will make a concerted effort to reach military personnel, veterans and their families.

**3. How was eXtension used?**

Individual extension faculty participated in eXtension activities, but it did not represent a significant activity for this program.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	103041	43022	715522	408371

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

**Patent Applications Submitted**

Year: 2017

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	11	0	11

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of youth engaged in science learning experience.

Year	Actual
2017	48470

**Output #2**

**Output Measure**

- Number of adults engaged in leading science experiences for youth.

Year	Actual
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2017 6696

**Output #3**

**Output Measure**

- Number of in-depth training programs conducted.

<b>Year</b>	<b>Actual</b>
2017	38

**Output #4**

**Output Measure**

- Number of other conferences, courses, and workshops held.

<b>Year</b>	<b>Actual</b>
2017	51489

**Output #5**

**Output Measure**

- Percent of participants in workshops and training indicating they would recommend the program to others.

<b>Year</b>	<b>Actual</b>
2017	96

**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	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**

<b>Year</b>	<b>Actual</b>
2017	85

**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 tax year 2016, University of Missouri Extension 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 dollars 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**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation
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
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**

<b>Year</b>	<b>Actual</b>
2017	5176

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

4-H prepares youth for the work place. Youth today must be prepared to live and work in a changing world ? competing for jobs that do not yet exist and using technologies that have not yet been invented to solve problems that have yet to be identified. Rapid changes in technology have increased the demand for trained scientists, engineers and a broader understanding of technology by all citizens. 4-H is the only youth development program with direct access to technological advances in agriculture, life sciences, engineering, learning technologies and social

sciences from the university system. This brings relevant science content and hands-on learning to help youth thrive.

**What has been done**

4-H field and campus faculty and staff work with 6,696 volunteers to engage 48,470 youth across Missouri with ongoing science/STEM education. Due to campus and agency partnerships, Missouri 4-H is positioned to enable 4-H youth to enter the workforce with the knowledge, skills, attitudes and health needed for the workplace. The 4-H Common Measures evaluation tool is used to measure progress of youth gaining workforce skills.

**Results**

Missouri 4-H connects thousands of youth, parents, volunteers and professionals to MU. A volunteer system of 6,696 enables Missouri 4-H members to engage with more mentors than their non- 4-H peers. Positive and sustained relationships between youth and adults are a predictor of the program’s effectiveness in helping youth gain citizenship, leadership and life skills that enable them to be career ready. In 2017, 5,176 4-H members from 106 counties and 16 other states engaged with MU faculty and staff through 4-H events, contests and conferences studying science and considering careers in science/STEM. The 4-H Youth Futures College within Reach program promotes college for underserved youth through mentoring and college orientation conferences. Fifty-two percent of high school seniors enroll in higher education and 18% enter the workforce.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
806	Youth Development

**Outcome #3**

**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
2017	56

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Government representatives, civic leaders and community members at large often have ideas about what they would like to see changed in their community such as educational opportunities for youth, internet broadband access, improved infrastructure and a host of other issues. However, they often lack the capacity or understanding about how to become effectively engaged in addressing the issues of concern to them and their communities.

**What has been done**

Leadership programs were conducted (29) and conferences, workshops and courses were held (185) to develop the individual capacities of people to effectively participate in their communities and embrace leadership opportunities. Plans were developed with communities and organizations (34) to help people identify key issues and organize effective responses and new organizations were created (32) to provide leverage resources in the community and provide opportunities for new leadership to emerge.

**Results**

Community development academy participants reported leveraging 8314 volunteers hours valued at \$117,172, increased resources leveraged for their communities of \$1,625,000 and more than 30 new community projects. Planning in one community led to increased hiring and sales by local employers, new resources and increased participation in the community. Cambio de Colores fostered a network of educators around dual language learning and another for those in Latino youth development.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions 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**

The contemporary arena in which community actions are pursued can seem

overwhelmingly complex. Also affecting programming are the devolution of authority for action and service delivery; maintaining quality with fewer resources; expectations for shared power; increased diversity, challenges of collaboration, and reconciling local development with globalization. Competing public priorities force citizens to prioritize their time and energy and can lead to polarization and citizens feeling marginalized even when they offer their input. The decline in tax revenues for some communities and state programs has affected the ability to implement new projects and continue to support others at the same level. With term limits and tighter budgets at local and state levels and internal university pressures, our funding and program priorities may fluctuate. With the increasing number of weather-related disasters, our work fluctuates and some planned programs have to be delayed or cancelled. Finally the challenge of tracking and evaluating change in family, individuals and community contexts is complex, can be time consuming, and relies on voluntary participation. The ability to provide volunteer training and educational experiences for youth is dependent on having a well-educated and motivated local and state faculty to guide and support volunteers. Typically, we have vacancies and turn over that threatens the on-going delivery of quality programming.

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

Conduct post/pre-post evaluations at the conclusion of the training/course/workshop to determine learning and intent to apply learning. Conduct follow-up evaluation of application within three to twelve months for most offerings to determine application of learning. We will monitor changes and collect data based on attribution in communities and organizations over time for the indicators identified in the North Central Region. General data collection for learning and application will follow similar protocols so that data can be aggregated by sub-regions of the state, the state and multi-state North Central region. 4-H campus and field faculty will use the Quality Matters 4-H observation tool on a subset of 4-H clubs annually. Once a baseline of quality is determined, 4-H faculty will use the National 4-H Common Measures for Universal or Life Skills and Science. Campus and field faculty will determine jointly specific events (e.g., camps, robotics build and competition), to evaluate youth outcomes for increased interest and engagement in science, develop positive attitudes towards science, develop science skills and abilities and for older youth to apply and make a contribution through science.

### **Key Items of Evaluation**

In FY17, the Community Development program worked collaboratively with 88 communities and 195 additional partners to foster economic development and create capacity for sustainable communities and quality jobs through programs in economic development, leadership development, community decision-making, and building inclusive communities. Results reported included:

- 2.33 million grants and other resources or efficiencies acquired by communities and organizations
- \$66,999 in volunteer hours generated by CD Extension to conduct programs
- \$49,503 in volunteer hours generated by communities and organizations as result of programs
- 56 participants reported taking on new roles
- 47 community and organizational plans developed
- 14 community and organizational policies/plans adopted and/or implemented
- 67 community/organizational programs and activities initiated or completed

- 32 new organizations created

The University of Missouri changed the faculty accomplishments reporting system in 2017. Data represented in this program update under-reports faculty publications, guide sheets, and other activities. Updated data will be available in the future.

**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%	10%
212	Pathogens and Nematodes Affecting Plants	0%	25%	0%	5%
216	Integrated Pest Management Systems	0%	50%	0%	10%
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%	8%
311	Animal Diseases	0%	0%	0%	8%
313	Internal Parasites in Animals	0%	0%	0%	5%
503	Quality Maintenance in Storing and Marketing Food Products	0%	0%	0%	2%
601	Economics of Agricultural Production and Farm Management	0%	0%	0%	5%
604	Marketing and Distribution Practices	0%	0%	0%	2%
721	Insects and Other Pests Affecting Humans	0%	0%	0%	5%
	<b>Total</b>	0%	100%	0%	100%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	7.5	0.0	20.0

<b>Actual Paid</b>	0.0	19.0	0.0	31.0
<b>Actual Volunteer</b>	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	866905	0	814506
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	865163	0	767589
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**

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

**2. Brief description of the target audience**

Lincoln University's Cooperative Research and Extension programs focus on enhancing the quality of life for diverse, limited resources audiences. Low-income, limited resource farmers and ranchers, unserved and underserved populations in rural and urban communities. Public school students from elementary, middle and high schools in Central Missouri and Kansas City were targeted.

**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**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	5999	35243	1585	307

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

**Patent Applications Submitted**

Year: 2017  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	7	0	0

**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
2017	10

**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**

<b>Year</b>	<b>Actual</b>
2017	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Many minority and limited resource farmers own land. However, they are not making a profit from the land. The Horticulture program worked with farmers to connect them to resources available to them through USDA. Managing pests has been identified as the number one challenge faced by organic farmers in MO.

#### **What has been done**

Since food is a prerequisite to good health, programs are designed to teach individuals and communities to grow their own food.

In the Horticulture program, 118 farmers, in 12 counties, gained knowledge in vegetable and small fruit production through technical support. Research on mass trapping of Japanese beetles as a simple, effective, and affordable organic control IPM tool was conducted,

#### **Results**

Education and technical support provided to growers allowed them to adapt good agricultural practices. Growers were able to generate higher incomes. Growers increased the number of crops grown on their farm and increased their incomes by an average of \$2,000. Organic producers have benefited from the information concerning organic pest management. Farmers

have expressed satisfaction derived from the implementation of ecologically-based IPM in their high tunnel operations. Farmers used an IPM toolbox to determine the best strategies to address their pest issues.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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.

Not Reporting on this Outcome Measure

#### **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.

##### **2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Small farmers must be exposed to opportunities to make farming more profitable.

**What has been done**

The Innovative Small Farm Program reached over 25,124 people through direct and indirect contacts. African Americans Hmong and Hispanics were the main minority groups that benefited from multiple educational experiences.

**Results**

ISFOP assisted more than 84 farmers including 35 minority farmers, who reported an aggregate total annual income increase of \$242,600 or an average increase of \$2,888 per family. Additionally, 16 collaborating farmers received a total of \$134,000 in grants from various USDA agencies.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
503	Quality Maintenance in Storing and Marketing Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

## **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.

### **2. Associated Institution Types**

- 1890 Extension
- 1890 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The survival of rural America greatly depends on the ability of farmers to stay in business. Beyond Economics, land ownership contributes significantly to civic activities and political participation. Small-scale, underserved farmers have limited access to good research-based information.

#### **What has been done**

The ISFOP program reached over 25,124 through direct and indirect contact.

#### **Results**

ISFOP was able to document increase in knowledge and increases in income.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

216	Integrated Pest Management Systems
503	Quality Maintenance in Storing and Marketing Food Products
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**

###### **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. Lack of funding resulted in termination of campus and field staff

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

Pre and Post testing was done to determine whether information was understood. Follow up conversations and surveys were administered to determine changes in behavior and adoption of skills or practices.

##### **Key Items of Evaluation**

In all cases skills were built and used to improve outcomes.

**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
602	Business Management, Finance, and Taxation	0%	0%	0%	50%
608	Community Resource Planning and Development	0%	50%	0%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%	50%	0%	0%
806	Youth Development	0%	0%	0%	50%
<b>Total</b>		0%	100%	0%	100%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	1.0	0.0	0.0
<b>Actual Paid</b>	0.0	1.0	0.0	0.0
<b>Actual Volunteer</b>	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	44738	0	72785
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	236010	0	41753
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**

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

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

**2. Brief description of the target audience**

Small towns, community organizations and agencies.

**3. How was eXtension used?**

eXtension was not used in this program.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	932	437	447	296

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

**Patent Applications Submitted**

Year: 2017

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	0	0	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

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

<b>Year</b>	<b>Actual</b>
2017	10

**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
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

As small municipalities in Southeast Missouri gain population 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.

**What has been done**

Decision making training was conducted and best practices in community development were offered to municipal leadership. Support was given to municipal leaders to convene listening opportunities for stakeholders. The LUCCLD assisted communities and organizations in effectively addressing issues.

**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.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

**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.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

To address community issues like gun violence, high prevalence of breast cancer and bullying extramural funding was necessary.

**What has been done**

Staff assisted communities in the development of processes that allowed them to create their desired future. Funds for program support were solicited and raised.

**Results**

Over 30 thousand dollars was raised to support program efforts.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

**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

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

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

##### **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. Lack of funding resulted in termination of campus and field staff

#### **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
724	Healthy Lifestyle	0%	20%	0%	0%
801	Individual and Family Resource Management	0%	20%	0%	0%
802	Human Development and Family Well-Being	0%	20%	0%	0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%	20%	0%	0%
805	Community Institutions, Health, and Social Services	0%	10%	0%	0%
903	Communication, Education, and Information Delivery	0%	10%	0%	0%
	<b>Total</b>	0%	100%	0%	0%

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	22.0	0.0	0.0
<b>Actual Paid</b>	0.0	19.5	0.0	0.0
<b>Actual Volunteer</b>	0.0	138.0	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	1280436	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	254708	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**

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 and Teen Pregnancy Prevention Program, for youth to learn the advantages of making healthy behavior about sexual activity.

**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.

- Low-income households are provided assistance with tax preparation.
- The Abstinence and Teen Pregnancy Prevention Program, for youth to learn the advantages of making healthy behavior about sexual activity.

**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 Days.
- 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 Conferences and meetings.
- The Abstinence and Teen Pregnancy Prevention Program, for youth to learn the advantages of making healthy behavior about sexual activity.

**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.
- 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.

## **2. Brief description of the target audience**

Minority and other under-represented, unserved and underserved families and youth in Central, urban St. Louis, Kansas City and Southeast (primarily the Bootheel) areas of the state.

- 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 a college 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 used to gather information and data regarding the target population.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	1570	3098	414	766

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

**Patent Applications Submitted**

Year: 2017  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	0	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

<b>Year</b>	<b>Actual</b>
2017	475

**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**

<b>Year</b>	<b>Actual</b>
2017	3875

### **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. As Missouri's population ages, there is greater need for health literacy for older Missourians.

#### **What has been done**

Seniors were offered a variety of classes to improve health and assist seniors in making healthy choices regarding food consumption and physical activity. LUCE collaborated with the Missouri Department of Health and Human Services on the teen pregnancy prevention 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.

#### **Results**

Senior reported an increase in mobility, flexibility and memory.

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.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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
903	Communication, Education, and Information Delivery

**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.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	5115

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

There are high drop out rates, truancy rates, in school suspensions in the population of youth served. In many cases, students are not successfully transitioning from one grade to the next.

**What has been done**

Academic achievement programs in our afterschool centers, teaches life skills and improves the academic attainment of underserved youth. Youth learn the importance of being engaged in school and completing assignments. As they work with a caring adult(s), they are able to successfully matriculate through the school system.

**Results**

Students have 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, set goals and develop 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
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
903	Communication, Education, and Information Delivery

#### 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
2017	323

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Low-income households are eligible for an Earned Income Tax Credit as well as other tax credits. Due to challenges experienced when completing income tax returns, many households fail to file.

###### **What has been done**

Volunteers were trained to prepare tax returns by staff from the IRS. Tax preparation sessions were conducted for 10 weeks. Volunteers provided service for approximately 300 hours.

###### **Results**

Volunteers completed 243 federal returns and 313 state returns. The total amount refunded to the tax payer was \$296,861. On average, each household received \$1,914.52 from the Earned Income Tax Credit.

#### 4. Associated Knowledge Areas

<b>KA Code</b>	<b>Knowledge Area</b>
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
903	Communication, Education, and Information Delivery

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- 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**

###### **Lincoln University of Missouri**

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

##### **Key Items of Evaluation**

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.

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%	25%	0%	10%
111	Conservation and Efficient Use of Water	0%	0%	0%	5%
112	Watershed Protection and Management	0%	0%	0%	5%
123	Management and Sustainability of Forest Resources	0%	0%	0%	5%
125	Agroforestry	0%	0%	0%	5%
134	Outdoor Recreation	0%	0%	0%	5%
136	Conservation of Biological Diversity	0%	10%	0%	10%
141	Air Resource Protection and Management	0%	0%	0%	5%
205	Plant Management Systems	0%	25%	0%	10%
213	Weeds Affecting Plants	0%	10%	0%	5%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%	0%	0%	10%
403	Waste Disposal, Recycling, and Reuse	0%	0%	0%	10%
502	New and Improved Food Products	0%	15%	0%	0%
704	Nutrition and Hunger in the Population	0%	15%	0%	5%
723	Hazards to Human Health and Safety	0%	0%	0%	10%
	<b>Total</b>	0%	100%	0%	100%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	2.0	0.0	16.0
<b>Actual Paid</b>	0.0	0.0	0.0	17.0
<b>Actual Volunteer</b>	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	98823	0	232173
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	28766	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	10747	0	18937

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

**Water Quality Studies**

Missouri region is one of several areas in the United States having confined animal feeding operations (CAFOs) under various animal units' classifications. Water quality of streams near CAFOs may deteriorate due to inputs of Escherichia Coli (E. coli), nitrogen (N), phosphorus (P), dissolved organic matter (DOM), metals, and antibiotic drugs from animal wastes. In addition, land use and management practices in various watersheds may also impact surface water quality. The studies were to determine if there are significant contributions of N, P, E. coli, metals, pesticides, DOM) and antibiotic drugs from runoffs/seepage from cattle and swine wastes and various land uses on water quality of selected Missouri streams. The approved project will explore ecological links between bioindicators of environmental health, i.e., the role of water quality, nutrient flow, and invasive species in determining species abundance of aquatic turtles and mussels.

**Improving Drinking Water Quality for Small Rural Community**

Elevated dissolved organic matter in drinking water source, due to operations in agricultural watershed, is a health and environmental thread because of toxic disinfection byproduct (DBP) formation in drinking water. This research is to develop cost-effective water treatment technology for reducing DBP formation for small water system, using advanced oxidation techniques.

**Health Assessment of Forestry Ecosystem**

This study is to use the remote sensing and geospatial technology for investigating tree mortality and health in Missouri forestry ecosystem and link tree health to weather conditions. The primary task is to locate and assemble relevant geospatial data on selected ecosystem consisting of various layers including digital elevation, land use/land cover, geology, soil, hydrology, wetlands, and remote sensing data (satellite and air photo) and validate remote sensing data by ground measurement.

**Air Quality Studies**

The atmospheric concentration of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O is ever increasing and a good deal of research has been conducted to estimate emissions of these greenhouse gases from soils. Although numerous measurements have been made, emissions from soils still show variability based on a number of controlling factors. In fact, differences in soil type, moisture, temperature, season, crop type, fertilization, and other agricultural practices apparently all play a part in emissions from soils.

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

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

#### Hydrologic Processes Controlling Stream Water Quality in Missourian Watersheds

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

#### Differentiation of Environmental E. coli from Enteric E. coli for Water Quality Assessment

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

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

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

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

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

#### Agriculture Social-Economics:

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

#### **Natural Resource Diversity Studies:**

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

## **2. 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 & 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**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	1331	1547	700	500

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

**Patent Applications Submitted**

Year: 2017  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	0	35	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

2017 Lincoln University of Missouri and University of Missouri Combined Research and Extension Annual Report of Accomplishments and Results

<b>Year</b>	<b>Actual</b>
2017	94

**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**

<b>Year</b>	<b>Actual</b>
2017	7

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Water contamination is causing serious environmental and health problems. The chemical and toxic leachates, pathogens and biological organisms can negatively impact public health,

**What has been done**

Stream water samples were collected from selected agricultural watersheds and water contaminants were determined. We identified potential land use controlling factors and increased our knowledge of contaminant behaviors and risks in the soil ecosystem.

**Results**

This project increased our understanding of greenhouse gas emissions from agricultural fields. Preliminary results showed that the hydrogen peroxide treatment effectively reduce DBP formation in drinking water, thus lowering the risks to human health. Extensive education was given to members of the target audience. This resulted in better management to improve water and soil quality.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
125	Agroforestry

134	Outdoor Recreation
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
205	Plant Management Systems
213	Weeds Affecting Plants
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
502	New and Improved Food Products
704	Nutrition and Hunger in the Population
723	Hazards to Human Health and Safety

**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
2017	5

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

There is a need to understand the source of water contamination from agricultural fields and to devise strategies to mitigate these contamination. 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**

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

### 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
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Water contamination from runoff associated with agriculture and CAFOs is a health risk for those who live in and near contaminated sites. Drinking water treatment methods are being developed and the public needs to be informed on this topic.

**What has been done**

Risk reduction of water and soil contamination was conducted. This helps restore water and soil to protect human from environmental contamination. Participants in field days, seminars and workshops were introduced to conservation practices.

**Results**

The health and ecological risks associated with water contamination were assessed. This research helps sustained natural resources and improved environmental quality and quality of life.

**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
125	Agroforestry
134	Outdoor Recreation
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
205	Plant Management Systems
213	Weeds Affecting Plants
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
502	New and Improved Food Products
704	Nutrition and Hunger in the Population
723	Hazards to Human Health and Safety

**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**

<b>Year</b>	<b>Actual</b>
2017	10

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

This research reduces the health and ecological risks associated with water and soil in agriculture watershed, 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. Research was conducted to evaluate water quality in agriculture ecosystem. Samples were taken from fields and 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 water quality. 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**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources

125	Agroforestry
134	Outdoor Recreation
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
205	Plant Management Systems
213	Weeds Affecting Plants
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
502	New and Improved Food Products
704	Nutrition and Hunger in the Population
723	Hazards to Human Health and Safety

#### **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**

The factors above 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

##### **Key Items of Evaluation**

No data

**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%
403	Waste Disposal, Recycling, and Reuse	0%	20%	0%	0%
503	Quality Maintenance in Storing and Marketing Food Products	0%	10%	0%	0%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%	30%	0%	50%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	30%	0%	25%
723	Hazards to Human Health and Safety	0%	10%	0%	0%
	<b>Total</b>	0%	100%	0%	100%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	2.0	0.0	4.0
<b>Actual Paid</b>	0.0	0.0	0.0	0.0
<b>Actual Volunteer</b>	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	156271	0	865014
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	79990
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**

1. 1. Develop micro- and nano-sensors for food contamination detection.
2. Develop biological control methods to reduce vegetable-borne pathogens
3. Present and publish experimental results in journals and scientific conference.
4. Conduct seminar and workshop to distribute information on nutrition and physical activity to clientele.

**2. Brief description of the target audience**

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

**3. How was eXtension used?**

eXtension was not used in this program

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	7178	1320	830	9800

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

**Patent Applications Submitted**

Year: 2017

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

<b>2017</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Actual</b>	0	10	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number of publication, presentations, workshops and contacts.

<b>Year</b>	<b>Actual</b>
2017	35

**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**

<b>Year</b>	<b>Actual</b>
2017	7

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

All families that prepare food want to know that the food safety and nutrition they purchase and prepare is free of bacteria and other pathogens.

**What has been done**

The sensors for detecting food contamination were developed and tested, and biological methods to control vegetable pathogens studied. Workshops and presentations were made to community groups, schools and students to stress the importance of food safety and nutritious, fully cooked food.

**Results**

We expect an 80% positive response of those contacted. Some of the research findings were presented in conferences and published in journals.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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**

<b>Year</b>	<b>Actual</b>
2017	5

### **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.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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**

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

#### **V(I). Planned Program (Evaluation Studies)**

##### **Evaluation Results**

Effectiveness of the detection sensors and biological method is the key to evaluate the results. The positive feedback from contacts is essential.

##### **Key Items of Evaluation**

This project will decrease the evaluation time to detect E. coli and other bacteria and reduce 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 and 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%
402	Engineering Systems and Equipment	0%	0%	0%	5%
403	Waste Disposal, Recycling, and Reuse	0%	0%	0%	10%
404	Instrumentation and Control Systems	0%	0%	0%	5%
511	New and Improved Non-Food Products and Processes	0%	0%	0%	5%
	<b>Total</b>	0%	0%	0%	100%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	1.0	0.0	2.0
<b>Actual Paid</b>	0.0	0.0	0.0	5.0
<b>Actual Volunteer</b>	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	150162
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**

The objective of the project is to maximize the bioenergy (biomethane, and bio-oil) production from switchgrass with producing biochar as a valuable soil amendment. To achieve this objective, 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.

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

**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**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	530	5100	0	0

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

**Patent Applications Submitted**

Year: 2017

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
Actual	0	5	0

**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
2017	20

**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.

**2. Associated Institution Types**

- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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



**Outcome #2**

**1. Outcome Measures**

Develop commercial cultivation system for mass production of algal biomass

**2. Associated Institution Types**

- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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

**Outcome #3**

**1. Outcome Measures**

Educate stakeholders on research status for environmental solutions

**2. Associated Institution Types**

- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

**What has been done**

**Results**

**4. Associated Knowledge Areas**

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

**Outcome #4**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2017	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**

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

**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
2017	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
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**

{No Data Entered}

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}

**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%	20%
701	Nutrient Composition of Food	0%	20%	0%	20%
702	Requirements and Function of Nutrients and Other Food Components	0%	20%	0%	10%
703	Nutrition Education and Behavior	0%	20%	0%	20%
704	Nutrition and Hunger in the Population	0%	10%	0%	10%
724	Healthy Lifestyle	0%	10%	0%	20%
	<b>Total</b>	0%	100%	0%	100%

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2017	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	1.0	0.0	2.0
<b>Actual Paid</b>	0.0	0.5	0.0	3.0
<b>Actual Volunteer</b>	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	14959	0	0
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	114344	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.
- Double Dutch/Stepping/Dancing Obesity Reduction Programs.

**2. Brief description of the target audience**

Ethnic minorities, low-income families and other under-represented 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**

2017	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	1684	2000	2696	65000

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

**Patent Applications Submitted**

Year: 2017

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2017	Extension	Research	Total
<b>Actual</b>	0	1	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

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

<b>Year</b>	<b>Actual</b>
2017	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.

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2017	500

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Many children in the target population experience hunger and poor nutrition at a higher rate than adults.

There is a lack of positive and safe spaces for youth to participate in structured physical activities.

Transportation and cost create barriers for youth to access nutritious food and safe play spaces.

**What has been done**

Each LUCE program provides breakfast and lunch in the summer through the USDA food program. After school programs include structured physical activities in the form of dance, stepping and Double Dutch jump roping. Community gardening is taught and encouraged. Young people grow vegetables for their families. Through a partnership with the YMCA young people have the opportunity to swim.

**Results**

Every child participating in Extension program has increased activity during the day. About 50 percent of youth have agreed to making healthier choices when eating.

**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
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

**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 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2017	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

{No Data Entered}

**What has been done**

{No Data Entered}

**Results**

{No Data Entered}

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
607	Consumer Economics
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

#### **V(H). Planned Program (External Factors)**

##### **External factors which affected outcomes**

- Economy
- Appropriations changes

##### **Brief Explanation**

Youth navigating in unsafe environments.  
Limited resource families are not able to avail themselves costly resources.

#### **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. Youth leave programs with basic knowledge about healthy foods, food safety and the benefits of increased activities.

##### **Key Items of Evaluation**

## VI. National Outcomes and Indicators

### 1. NIFA Selected Outcomes and Indicators

<b>Childhood Obesity (Outcome 1, Indicator 1.c)</b>	
60	Number of children and youth who reported eating more of healthy foods.
<b>Climate Change (Outcome 1, Indicator 4)</b>	
5	Number of new crop varieties, animal breeds, and genotypes with climate adaptive traits.
<b>Global Food Security and Hunger (Outcome 1, Indicator 4.a)</b>	
1150	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
<b>Global Food Security and Hunger (Outcome 2, Indicator 1)</b>	
0	Number of new or improved innovations developed for food enterprises.
<b>Food Safety (Outcome 1, Indicator 1)</b>	
5	Number of viable technologies developed or modified for the detection and
<b>Sustainable Energy (Outcome 3, Indicator 2)</b>	
150	Number of farmers who adopted a dedicated bioenergy crop
<b>Sustainable Energy (Outcome 3, Indicator 4)</b>	
5	Tons of feedstocks delivered.