

# 2009 Lincoln University of Missouri Combined Research and Extension Annual Report of Accomplishments and Results

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## I. Report Overview

### 1. Executive Summary

Missouri ranks second only to Texas in the number of farms. Of the almost 108,000 farms, in Missouri, approximately 82,000 are considered small farms. These traditional farms represent a way-of-life that Missourians and other rural citizens have taken for granted over much of the nations' history. However, prime farmland in Missouri, as well as in the remaining states, is being lost rapidly due to urban sprawl. A major reason for this loss is due to cities expanding into areas traditionally used by farmers. During encroachment, farmland becomes too valuable to farm and is purchased for commercial development. A major component of this modified land use is for housing developments.

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

Busby farm will be the focal point for this highly integrated research and extension unit at Lincoln University. Results from the research conducted at the farm will be transmitted to limited resource producers and families throughout the state of Missouri. This farm will complement our extension urban family and youth development programs in Jefferson City, Kansas City, St. Louis, Southwest Missouri, and the Bootheel. Families and or youth can be brought to campus for summer camps (they will be accommodated in our youth development camp). Youth will be exposed to agricultural practices at Busby and will be provided the opportunity to assist the manager. This will be a unique farm opportunity in Missouri and it is being developed with input from private individuals, area high school students, numerous agricultural organizations, and the University of Missouri.

Individual research projects will continue at Carver farm. These projects will allow investigators to examine specific issues of concern that cannot be readily incorporated into the integrated farming system. Projects that will be supported for continuing studies in cooperative research will include the USDA priority areas of Global Food Security and Hunter (animal and plant science), Climate Change (environmental science), Childhood Obesity (human nutrition), Food Safety and Sustainable Energy.

### **Global Food Security and Hunger**

#### Animal science

##### Ruminants:

The primary emphasis in animal science will continue to be with goat production systems, but will include grazing studies with sheep and cattle. These studies are highly integrated between research and extension ,and between Lincoln University and the University of Missouri.

Ruminant research at Lincoln University is currently in three primary areas: First, researchers are testing various herbal treatments for the impact on internal parasite load. Second, embryonic and fetal mortality are large sources of economic loss in the livestock industry. Although average ovulation rates are sufficient, a significant economic loss results from a large percentage of those oocytes not resulting in live offspring. A recently approved project will involve real-time ultrasonographic examination of pregnant does throughout gestation in order to discover how much embryonic and fetal loss occurs in goats and when these losses occur. Third, Lincoln is evaluating the feasibility of developing a real-time biosensor for LH using nanotechnology derived components.

The University of Missouri has no plans for expanding extension efforts into goat production and the above projects will allow Missouri residents to receive assistance without duplication of effort by the land-grant universities. It is planned that an investigator with training in pasture and forage production will be added with a split research and teaching component.

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

#### Aquaculture:

This is a relatively new research area at Lincoln University, and information from ongoing and future studies will be made available for use by extension personnel at Lincoln University and at the University of Missouri. 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. This program was initiated based upon strong support for starting aquaculture research for Missouri producers. Research is needed that is specific to Missouri because the state has such wide climatic variation.

#### Plant Science

This program is highly integrated with the Extension Small Farm Program. Studies continue to examine profitable and value added products and the marketing of new crops and other plants with particular interest in the needs of underserved farmers with limited resources. Additionally, horticulture is a profitable enterprise on many small farm operations.

#### **Climate Change**

#### Environmental Science

Integrated Risk Management of Impaired Environments in Missouri for Improving Quality of Life and Natural Resources Sustainability. A systematic study of our environment requires investigation of intersections of many disciplines. Studies in environmental science will focus on minimizing the impacts of agriculture on soil, water and air quality.

#### **Childhood Obesity, Food Safety**

#### Human Nutrition and Food Safety

Basic, as well as applied, studies will continue in this area examining the causes and impacts of obesity and hypertension in minority populations. A particular focus in this area are the causes and prevention of obesity, in both youth and adults.

Detection and identification of bacteria and food pathogen is an essential step in food safety inspection. A recently approved project in the area of food safety will develop a *novel* 3-dimensional (3-D) interdigitated microelectrode array (IDE) based impedance biosensor. This biosensor will be capable of rapid detection and selectively identifying *E. coli* O157:H7. This design is *unique* in the use of a 3-D IDE which increases the surface area compared to a single (2-D) IDE sensor. The increased surface area will enhance the sensitivity of impedance detection. Efforts are currently underway to hire an additional person in food safety that will have a split research and extension appointment.

#### **Sustainable Energy**

#### Sustainable Energy

Studies are being undertaken to develop alternative fuel sources that are feasible, economical, efficient, and environmentally friendly. Microalgae studies are designed to evaluate the mass cultivation of microalgal biomass as an alternative fuel source. Leaves are being studied to evaluate their potential use as a secondary fuel source, particularly in power plants, in lieu of or in conjunction with coal.

Leaves and other sources as power sources will be evaluated. Leaves from yards typically go to the landfill, however, these provide a substantial source of energy that is not utilized. We will evaluate their practical use for heating systems.

#### Programs without strong research counterparts

Extension efforts to improve the educational and economic opportunities for under-represented populations in Kansas City, St. Louis, Jefferson City, Southwest Missouri, and the Bootheel will continue. Expansion of programs in Kansas City will occur through acquisition of property and construction of a facility near the downtown area. Property has been purchased and an architectural firm chosen. Programs in all these areas will assist families, youth and the elderly, as well as, entire communities that have underserved and under-represented populations.

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	23.0	0.0	25.0
Actual	0.0	16.0	0.0	18.0

## 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

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

## III. 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.

Invitations and announcements were sent to radio stations, newspapers and to stakeholders by mail, telephone, and e-mail. Word of mouth was also used to extend invitations to non-traditional stakeholders. Special invitations were sent to minority stakeholders. When English was not their first language, invitations were sent in their native language. Invitations specified that the learning experience would be presented bi-lingually (English and Spanish).

Trainings and other events for traditional and non-traditional stakeholders were offered to the stakeholders.

For seminars targeting minorities: personal invitations were sent, churches were visited, advertisements were played on appropriate radio stations, bilingual newspapers were utilized, and community leaders were contacted. This provided an opportunity to arrange for discussions to address their specific needs at a date, time, and location that was convenient for them and their organizations.

**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
- Other (Face to face conversations, telephone conversations, responding to e-mail questions from individuals.)

**Brief explanation.**

Not all of the identified methods were used in every discipline. All of the programs used a combination of multiple methods, employing those that would more accurately identify interested individuals and groups.

Participants were identified by the program specialist during face-to-face conversations, interviews and telephone conversations; responses to e-mail 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 with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals

**Brief explanation.**

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**

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

#### **Brief explanation.**

The input was used to strengthen and focus efforts in needed areas. The input was also used to adjust Extension 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 will be expanded in response to information gathered.

Organized additional workshops to cover additional training. Requested information was used to submit a 2501 grant proposal. Passed information on to other agencies if they could not be helped.

#### **Brief Explanation of what you learned from your Stakeholders**

There was a high interest and strong desire for continuous learning in composting, health, dieting, landscaping, environment improvement, and landscaping with native plants.

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

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

IV. Expenditure Summary

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	2995758	0	3132177

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
	<b>Extension</b>		<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	0	1915690	0	2595986
<b>Actual Matching</b>	0	1915692	0	3284302
<b>Actual All Other</b>	0	0	0	0
<b>Total Actual Expended</b>	0	3831382	0	5880288

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

**V. Planned Program Table of Content**

<b>S. No.</b>	<b>PROGRAM NAME</b>
1	Global Food Security and Hunger
2	Family and Youth Development
3	Community and Leadership Development
4	Climate Change
5	Childhood Obesity
6	Plant Science--This section reported under Global Food Security and Hunger
7	Food Safety
8	Sustainable Energy

**V(A). Planned Program (Summary)****Program # 1****1. Name of the Planned Program**

Global Food Security and Hunger

**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships		5%		8%
111	Conservation and Efficient Use of Water		5%		5%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants		2%		2%
204	Plant Product Quality and Utility (Preharvest)		5%		5%
205	Plant Management Systems		5%		7%
212	Pathogens and Nematodes Affecting Plants		2%		2%
216	Integrated Pest Management Systems		5%		5%
301	Reproductive Performance of Animals		5%		5%
302	Nutrient Utilization in Animals		5%		5%
303	Genetic Improvement of Animals		10%		10%
307	Animal Management Systems		15%		15%
311	Animal Diseases		6%		6%
313	Internal Parasites in Animals		5%		5%
405	Drainage and Irrigation Systems and Facilities		2%		2%
503	Quality Maintenance in Storing and Marketing Food Products		5%		0%
601	Economics of Agricultural Production and Farm Management		8%		8%
604	Marketing and Distribution Practices		5%		5%
721	Insects and Other Pests Affecting Humans		5%		5%
	<b>Total</b>		100%		100%

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	1.5	0.0	4.0
Actual	0.0	4.6	0.0	7.4

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 664536	<b>Hatch</b> 0	<b>Evans-Allen</b> 1338744
<b>1862 Matching</b> 0	<b>1890 Matching</b> 670263	<b>1862 Matching</b> 0	<b>1890 Matching</b> 1986128
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 0	<b>1890 All Other</b> 0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

- An evaluation of potential for the production of Sweet Potato and Watermelon, using alternative management practices.
- Use of scented geraniums as a potential source for insect control.
- Small scale hydroponic cropping of specialty vegetable and herbs.
- Develop bluegill for aquaculture as a food-fish.
- Explore embryonic and fetal losses in goats.
- Using herbs to control internal parasites in small ruminants.
- Non-traditional methods for improving ruminant production on small farms.
- Develop sunfish cultigens for distribution to the industry.
- Reduce mosquito population responsible for transmitting the causative agents for cattle and humans.
- Artificial insemination in large and small ruminants to improve the genetics of the herds.
- Various workshops, conferences, and other educational and informative programs.

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

Disadvantaged, low-income, limited resource farmers and ranchers, small farmers, farmers with unsuitable land for row-crop farming, gardeners, greenhouse growers, and horticultural and agricultural crop producers, Missouri aquaculture fish farmers.

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	2200	80000	400	2000
<b>Actual</b>	10000	5100	580	1100

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

Year: 2009

Plan: 0

Actual: 0

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
Plan	0	2	
Actual	0	2	2

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

**Output Target**

**Output #1**

**Output Measure**

- Research Projects Completed\* Year Aquaculture Small Ruminant Large Ruminant 2008 0 1 0 2009 4 1 0 2010 0 1 0 2011 2 1 1 2012 2 1 1 \*Projects reported only in year of completion Presentations Year Aquaculture Small Ruminant Large Ruminant 2008 6 2 0 2009 6 2 0 2010 6 2 0 2011 6 2 0 2012 6 2 0 Manuscripts Year Aquaculture Small Ruminant Large Ruminant 2008 4 1 0 2009 4 1 0 2010 4 1 0 2011 5 2 0 2012 5 2 0  
Not reporting on this Output for this Annual Report

**Output #2**

**Output Measure**

- Short term output measures are: Abstracts, Presentations, Training students, and Workshops. Intermediate output measures are publications. Long-term: Will be felt after five years

Year	Target	Actual
2009	{No Data Entered}	120

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Aquaculture- Define sunfish nutritional requirements. Develop a fast growing sunfish cultivar. Identify viable production systems for sunfishes. Make available a fish health protocol. Small Ruminants- Assess the use of herb cultivars for control of internal parasites. Investigate new cultivars of grasses and legumes for potential improvement of weight gains in lambs and kids. Develop optical or biosensor to determine optimum breeding time. Large Ruminants- Develop optical sensor or biosensor for determining optimum breeding time.
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	Develop educational programs to encourage minority youth to get involved in farming. : Increase the number of minority farmers by 200. Adoption of environmental sustainable crop production practices: Increase the number of farms adopting production practices by 150.
5	Improve small and minority farms income: Increase the average small farm gross income by \$5,000
6	Enhanced viability of rural communities. Enhanced profitability of Small Farms. 2010: Increase Farm growth income by \$5, 000 2011: Increase Farm retention rate by 4, 250

**Outcome #1****1. Outcome Measures**

Aquaculture- Define sunfish nutritional requirements. Develop a fast growing sunfish cultivar. Identify viable production systems for sunfishes. Make available a fish health protocol. Small Ruminants- Assess the use of herb cultivars for control of internal parasites. Investigate new cultivars of grasses and legumes for potential improvement of weight gains in lambs and kids. Develop optical or biosensor to determine optimum breeding time. Large Ruminants- Develop optical sensor or biosensor for determining optimum breeding time.

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	3064	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Small limited resource farmers to improve production and increase profits. Commercial fish farmers.

**What has been done**

Aquaculture-Application of research diets, verification of cage studies for food sized sunfish.

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

Conversion of empty swine facilities to aquaculture farming, raising food fish. Transfer new technologies for sunfish, small and large ruminant production for farmers. Refining re-cycle aquaculture systems to be sustainable on small farms.

**Results**

Several novel bluegill crosses have been created with considerable variation in terms of their performance. Data indicates that higher protein and lipid feeds resulted in greater growth and fillet yields in bluegill sunfish. Even though the data is not completely analyzed the higher cost (Higher protein, higher lipid) feeds appear to produce a lower cost of fish produced per pound of feed.

Survival of hybrid sunfish in the laboratory was excellent. Survival of cold shocked fish was higher than expected.

These fish are currently being grown to a stage where ploidy can be determined with the Coulter Counter.

Success was attained in reducing the larval brine shrimp feeding time to 7 days. Survival of the fish tested on the new larval feed was near 99%.

**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
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.

**2. Associated Institution Types**

- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1420	0

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

**Issue (Who cares and Why)**

Commercial fish farmers.  
Small farmers interested in fish farming.

**What has been done**

Taught 4H youth quality assurance and proper techniques used in livestock care.  
Educated producers about disease transmission and control.  
Programs delivered included Goat and Sheep disease update, goat meat updates, Animal Agriculture Emergency Response and Emergency Preparedness for Livestock Specialists. Current LU Small Ruminant research was presented.

**Results**

Awareness of disease transmission between animals and between humans and animals, how easily it can happen and what producers can do to control transmission. Producers learned how to recognize specific diseases and are now better able to detect and prevent economic losses.

**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
311	Animal Diseases
313	Internal Parasites in Animals

**Outcome #3**

**1. Outcome Measures**

Farmers adopt new technologies for increased and sustainable production.

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1420	0

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

**Issue (Who cares and Why)**

Increased and sustainable production. Farmers should adopt new technologies

**What has been done**

Through clinics and workshops, introduced new philosophies and methods in controlling internal parasitism in small ruminants such as non-chemical control, sustainable management and control measures that small ruminant producers would be able to utilize.

**Results**

30% of the 50 producers who participated stated they would be willing to change management practices and try new ideas.

**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
311	Animal Diseases
313	Internal Parasites in Animals

**Outcome #4****1. Outcome Measures**

Develop educational programs to encourage minority youth to get involved in farming. : Increase the number of minority farmers by 200. Adoption of environmental sustainable crop production practices: Increase the number of farms adopting production practices by 150.

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	360

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Farmers need additional income.

Because of the increasing number of older farmers, the state of Missouri is losing minority small farmers and ranchers at an alarming rate due to retirement and death.

Horticultural crops are most attractive to the small-scale producer because they produce high returns per unit land area.

**What has been done**

Pre- and Post-activity surveys showed the knowledge or techniques were well received by participants. On-farm visits for questions and answers to some commercial vegetable growers; community gardening and high-tunnel greenhouse vegetable production trainings; and launching of the Innovative Small Farms' Outreach Program(ISFOP). Brochures, publications and handouts. Meetings and conferences were held, online journal publications, abstracts and articles were published in a referred hard bound journal. Starting a local farmers cooperative.

Development of cultural and management systems to improve the adaptation of sweet potato and watermelon in

**Results**

More small farmers have learned seasonal extension techniques with high-tunnels. More educators have learned on how to organize and manage community gardens. Positions for the ISFOP were advertised.

Individuals redirected their production and marketing practices. Businesses and government adjusted their policies as a result of publications, journals and abstracts. More than 1,800 people were contacted through publications.

Twenty younger farmers have joined the cooperative.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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
216	Integrated Pest Management Systems
405	Drainage and Irrigation Systems and Facilities
503	Quality Maintenance in Storing and Marketing Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

**Outcome #5**

**1. Outcome Measures**

Improve small and minority farms income: Increase the average small farm gross income by \$5,000

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	4000

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

**Issue (Who cares and Why)**

Small farmers need new technologies to increase farm income.  
Alarming poverty rates among farmers, ranchers and residents in Southeast Missouri.

**What has been done**

More high-tunnel greenhouses were built by small farmers. More community gardens were planned by community leaders for next year.  
Conducted meeting and conferences to discuss marketing opportunities for minority farmers and ranchers.  
Presented the development of business and market plans to the audiences identified above.  
Organized computer literacy training to assist the audience in good farm record keeping.  
Buyers have been brought in to discuss bulk purchases.

**Results**

Increased/extended supply of freshly produced vegetables and small fruits.  
Farmers' income increased by approximately \$4,000 to 6,000 annual rate.  
Farmers gained invaluable knowledge of computers for purposes other than record keeping.  
Younger farmers were recruited to begin farming.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water

203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
405	Drainage and Irrigation Systems and Facilities
503	Quality Maintenance in Storing and Marketing Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
721	Insects and Other Pests Affecting Humans

**Outcome #6**

**1. Outcome Measures**

Enhanced viability of rural communities. Enhanced profitability of Small Farms. 2010: Increase Farm growth income by \$5, 000 2011: Increase Farm retention rate by 4, 250

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Small Farmers/growers who do not stay on the farm because of lack of quality of life from farming. There is no change in their economic well being as a result of continued farming participation. Need to improve nutrient level in soil.

**What has been done**

The two fertilizer treatments consisted of 1) optimum N (200 mg N/liter), and 2) low N (100 mg N/liter). While the pH of the recirculating nutrient solution for both treatments was maintained at about 6.0, mean electrical conductivity (EC) was 2.29 mS/cm at optimum N compared with 1.23 mS/cm at low N (Table 2). Average day/night ambient temperature was 39.1 oC and 32.8 oC, with a mean of 30.5 oC, and day/night relative humidity (RH) was 81.3 % and 55.0 %, respectively. Two-week old lettuce seedlings transferred into NFT troughs (Figs. 1a and 1b) at the first true-leaf stage were harvested 30 days later. Recruited more younger farmers and provided education about the process of production and marketing.

**Results**

Marketable yield (mean fresh weight [g/head of lettuce]) decreased by 30.5 % at low N compared with optimum N, consistent with 43.5 % and 17.5 % decrease in dry weight and dry weight ratio (dry weight/fresh weight), respectively. These findings improve grower knowledge about hydroponic nutrient solution composition

which represents the greatest challenge to all hydroponic/soilless growers. A soundly based understanding of nutrient solution management, on which literature information is most limited, is as important to successful hydroponic culture as the lists of nutrient formulas, preferred reagent sources and the weights and measures often published in textbooks. Better plant nutrient management through the supply of optimum rather than excess or suboptimum levels in NFT systems can improve profitability through 1) increased lettuce yield and quality 2) reduction of plant nutrient costs, and 3) reduction in losses by enhancing root nutrient uptake, which can also minimize environmental pollution. Improved marketing of produce and specialty crops. Improved farm income for small and limited resource farmers.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
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
721	Insects and Other Pests Affecting Humans

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

##### External factors which affected outcomes

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

##### Brief Explanation

Extreme weather conditions had an affect on some of the outcomes. There was flooding in the Southeast portion of Missouri, where a majority of our Extension efforts are concentrated. The biggest challenges were financial and attributed to funding costs. The downturn in the economy affected most of these poor areas. Joblessness became worse and funds for other assistance dried up.

#### V(I). Planned Program (Evaluation Studies and Data Collection)

##### 1. Evaluation Studies Planned

- After Only (post program)
- During (during program)
- Case Study

## **Evaluation Results**

We found that if the program is maintained and enhanced, profitability of farmers will increase. The quality of life of farm families will improve. Rural communities will become vibrant and attractive to live in.

### **Key Items of Evaluation**

- Evaluation was based on current and previous performances of farmers in the region.
- It was also based on market discovery for farmers to profitably sell their produce.
- Recruitment of young farmers played a role in the evaluation.
- The willingness of older farmers to educate the young on the process of farming play a significant role in the evaluation.
- the last, and not the least was on farming participation rate.

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

**Program # 2**

**1. Name of the Planned Program**

Family and Youth Development

**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		5%		0%
801	Individual and Family Resource Management		10%		0%
802	Human Development and Family Well-Being		15%		0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities		5%		0%
805	Community Institutions, Health, and Social Services		10%		0%
806	Youth Development		35%		0%
901	Program and Project Design, and Statistics		10%		0%
903	Communication, Education, and Information Delivery		10%		0%
<b>Total</b>			100%		0%

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	22.0	0.0	0.0
Actual	0.0	6.0	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	976950	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	1117527	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 areas of the state; Kansas City, St. Louis, Central Region, and the Southeast region all have similarities and differences. However, all have been developed to design, implement, and evaluate educational programs for youth-at-risk. Program implementation includes 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 meetings that address topics related to self esteem, nutrition, fitness, computer skills, relationships and parenting.
- Afterschool Tutoring Program: Programs assist students K-8 with homework, tutoring, computer classes, reading and math labs, life skills, arts, crafts and recreation. Collaboration with the National Book Bank provides book donations to non-profit organizations.
- Fitness Program: LUCE currently offers 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 Teen Talk Abstinence Program, for girls to learn the advantages of remaining abstinent.

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

- Teen Drop In: This program has open enrollment for neighborhood youth providing 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 are not limited to homework assistance, open-microphones to develop their skills in public speaking, teen talk to discuss youth community issues and concerns, and educational games, as well as activities that teach life skills. These programs are offered throughout the school year.
- North Side After School Neighborhood Initiative: This is a partnership between Lincoln University Urban Impact Center of St. Louis, community volunteers and two St. Louis Public grade schools. This initiative is to provide a power-hour implementing homework assistance for youth after school, provide life skills activities that stress communication skills, drug and alcohol prevention, conflict resolution etc, as well as health and nutrition via snacks and physical activity in the school gymnasiums. This program offers open enrollment to youth participants and uses 10 community volunteers.
- Urban Garden Beautification Project collaborative effort with the St. Louis Neighborhood Stabilization Office and community leaders to continue transforming a weed infested vacant lot into a neighborhood asset that will assist in stabilizing the neighborhood and revitalize the community. The lot is located in the Baden area of St. Louis, called the Baden Triumph Garden. Plans are being implemented and resources are being sought for this location.

### **Specific examples of activities in the Southeast region include:**

- Health and Fitness Classes
- Health fair designed to educate youth on nutrition, fitness, and the dangers of alcohol, tobacco and other drugs.
- Field Day - a culmination of educational workshops on a variety of topics,
- Fall into Fall, a back-to-school rally to prepare students for the upcoming school year.
- HIV/AIDS/STD Awareness Day
- Summer Camp, a partnership with YMCA, Mission Missouri, Weed & Seed, and DAEOC to provide fitness and health, character development, arts and crafts, self-esteem building, recreation, and field trips for 5 weeks.
- Women's Wellness Conference
- Teen Talk/Young Scholars is a weekly program that allows teenagers to express themselves freely on different topics.

### **Specific activities in the Central Region include:**

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



2009

120

634

**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 5) increased 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, 4) Better social standards, 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 5) increased life skills.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	300	0

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

**Issue (Who cares and Why)**

Lack of availability of services and resources to underserved and minority populations to reduce health disparities and inequities in access to health-related care and literacy. Limited resource and underserved minority youth and families are in need of supplemental education to increase academic achievement and school success.

**What has been done**

Provide culturally and educationally appropriate information on health management and established collaborations with other health entities and interested health professionals; including conducting focus groups, educational workshops, afterschool programs, volunteer and leadership training.

**Results**

Many participants reported feeling that the educational presentations extended their knowledge of health issues, as well as resources available for adults, especially the older clientele. In particular, 98% of participants reported that the content of the Missouri Institute on Minority Aging provided helpful health/resource information to them professionally and personally. Increased knowledge and skills, and enhanced academic productivity. Youth participants in afterschool reading programs have increased their scores by two grade levels, as evidenced by test scores. Youth are more knowledgeable, making better life decisions, and showing more leadership skills.

**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
806	Youth Development
901	Program and Project Design, and Statistics
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, 4) Better social standards, and 5) Better life choices.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	300	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Lack of availability of services and resources to underserved and minority populations to reduce health disparities and inequities in access to health-related care and literacy. Limited resource and underserved minority youth and families are in need of supplemental education to increase academic achievement and school success.

**What has been done**

Information was compiled from monthly health educational sessions, health screenings, face-to-face interviews, and testimonies from program participants via in-person and/or small group settings.

Afterschool tutoring, summer enrichment, EFNEP, computer literacy program, and college preparatory classes. Workshops and seminars focused on leaderships skills, health education, making better choices, and nutrition

**Results**

Participants indicated adopting one health behavior (eg. decreased sodium and sugar consumption) that aided in better blood pressure and glucose monitoring of hypertension and diabetes, respectively.

Completion of current grade and promotion to next, increased graduation rate, increased self-esteem, better life decisions, and increased interest in attending college. Students who were identified as high risk youth were provided additional education, social, and emotional support. Those identified youth were able to achieve academic improvement and graduated to the next grade level. Teenage parents are making positive changes in the way they parent at home. Youth are learning to set goals with new aspirations.

**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
806	Youth Development
901	Program and Project Design, and Statistics

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	Quantitative Target	Actual
2009	300	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Lack of availability of services and resources to underserved and minority populations to reduce health disparities and inequities in access to health-related care and literacy. Limited resource and underserved minority youth and families are in need of supplemental education to increase academic achievement and school success.

**What has been done**

Survey results of participants indicated a change in better health management and knowledge based on health educational sessions. There was qualitative and quantitative analysis using pre-post test, testimonials and survey evaluations.

Workshops on college prep, financial aid completion for college, volunteer and leadership training, summer enrichment programs, and EFNEP.

**Results**

Participants plan to have more health screenings, especially for blood pressure and diabetes. Expected outcomes and impacts were described through monthly, quarterly and annual reports.

Improved life decisions, healthier and more fit individuals, and improved quality of life.

Students who were identified as not being able to complete grades 11 and 12 were given academic and emotional support, and completed grades 11 and 12, and subsequently graduated high school.

**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
806	Youth Development
901	Program and Project Design, and Statistics

**V(H). Planned Program (External Factors)****External factors which affected outcomes**

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

**Brief Explanation**

A funding decrease resulted in the elimination of two positions. Extreme weather conditions in Southeast Missouri increased the joblessness situation in an already hard hit area. Overall, the economic situation has made it more difficult on families in underserved areas. State budget cuts have had a huge impact in some areas, resulting in more stress and tension in families and communities.

**V(I). Planned Program (Evaluation Studies and Data Collection)**

## 1. Evaluation Studies Planned

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Comparisons between program participants (individuals, group, organizations) and non-participants

**Evaluation Results**

- Participants have made family and friends aware of the importance of adopting a healthy lifestyle.
- Participants utilized health literature as resource information on culturally appropriate healthcare, regional health and aging programs, health issues and concerns.
  - An assessment identified an initial set of issues facing Callaway County, which was identified by partners through community organization and with additional input from individuals in the county.
    - More youth are graduating from high school with an improved quality of life.
    - Youth are making better grades in school, learning leadership skills, and serving less suspensions.
    - Youth are eating healthier and are more active.
    - Individuals completing evaluations indicated they learned helpful information and will share it with friends and families.
      - Communities are excited about continued participation with Lincoln University Extension.
      - Returning participants brought siblings along for enrollment in programs and workshops.

**Key Items of Evaluation**

- It is important that varying degrees of flexibility and uniqueness be reasonably allowed for the maximization of program delivery and participation.
  - Some issues are still a concern: increased high school dropout rate in urban areas, the non-parental presence and support in the lives of urban youth, the increasing number of young African-Americans affected by HIV/AIDS, and a high teenage pregnancy rate in urban schools.

**V(A). Planned Program (Summary)****Program # 3****1. Name of the Planned Program**

Community and Leadership Development

**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
608	Community Resource Planning and Development		60%		0%
802	Human Development and Family Well-Being		10%		0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities		20%		0%
805	Community Institutions, Health, and Social Services		10%		0%
	<b>Total</b>		100%		0%

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

## 1. Actual amount of professional FTE/SYs expended this Program

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	2.0	0.0	0.0
Actual	0.0	2.0	0.0	0.0

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	99246	0	0
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	65784	0	0
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

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

## 1. Brief description of the Activity

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, and thinking strategically, basic leadership skills, work planning and goal setting, customer/resident relations, effective communication skills, budgeting, funding accounting and grant administrations, managing "troubled" and "problem" employees, and negotiations.

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

Small towns, community organizations and agencies. Low-income limited resource communities and families.

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	100	100	70	70
<b>Actual</b>	300	1500	200	100

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 0  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	0	
<b>Actual</b>	0	0	0

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

**Output Target**

**Output #1**

**Output Measure**

- # # # of informational sessions # of workshops # of presentations # of participants Evaluation forms  
 Anecdotal responses Changed behavior and procedures of participants and organizations

Year	Target	Actual
2009	75	200

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Communities will increase inclusivity when seeking stakeholder input. Stakeholders will be empowered and concerned about improving the quality of life for all people living in the community. Communities will seek extramural funds to make improvements Communities will review, and where necessary, update and develop new city ordinances to make operation more efficient.
2	Increased partnerships and resources Plan/project implementation Local officials take actions that increase citizen participation. Increased civic engagement in deliberating public issues Increased knowledge, understanding & skills
3	Evidence of community goal attainment Increased capacity to deal with future issues Change in community practice Improved community fiscal and economic performance Citizens of varying cultures increase their participation and engagement in local government and in the community Sustained capacity for informed local decision making Group or organizational sustainability

**Outcome #1**

**1. Outcome Measures**

Communities will increase inclusivity when seeking stakeholder input. Stakeholders will be empowered and concerned about improving the quality of life for all people living in the community. Communities will seek extramural funds to make improvements Communities will review, and where necessary, update and develop new city ordinances to make operation more efficient.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	75	125

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

**Issue (Who cares and Why)**

Community stakeholders lacked understanding of how to be effective when planning for the community's future. Issues of improving the quality of life for youth and future generations. The community stakeholders care and are very concerned about the quality of life in the community where they live.

**What has been done**

Training and workshops have been facilitated for strengthening leadership and management skills for small towns, communities, and organizations.

**Results**

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

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services

## Outcome #2

### 1. Outcome Measures

Increased partnerships and resources Plan/project implementation Local officials take actions that increase citizen participation. Increased civic engagement in deliberating public issues Increased knowledge, understanding & skills

### 2. Associated Institution Types

- 1890 Extension

### 3a. Outcome Type:

Change in Action Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	75	200

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Community stakeholders lacked understanding of how to be effective when planning for the community's future. Issues of improving the quality of life for youth and future generations. The community stakeholders care and are very concerned about the quality of life in the community where they live.

#### What has been done

Training and workshops have been facilitated for strengthening leadership and management skills for small towns, communities, and organizations.

#### Results

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

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services

## 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 Citizens of varying cultures increase their participation and engagement in local government and in the community Sustained capacity for informed local decision making Group or organizational sustainability

Not Reporting on this Outcome Measure

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

**External factors which affected outcomes**

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

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

1. Evaluation Studies Planned

- Comparison between locales where the program operates and sites without program intervention

**Evaluation Results**

**Key Items of Evaluation**

**V(A). Planned Program (Summary)****Program # 4****1. Name of the Planned Program**

Climate Change

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
102	Soil, Plant, Water, Nutrient Relationships		25%		25%
112	Watershed Protection and Management		20%		10%
123	Management and Sustainability of Forest Resources		5%		5%
136	Conservation of Biological Diversity		10%		10%
141	Air Resource Protection and Management		10%		10%
215	Biological Control of Pests Affecting Plants		5%		5%
216	Integrated Pest Management Systems		5%		5%
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals		10%		10%
403	Waste Disposal, Recycling, and Reuse		5%		5%
511	New and Improved Non-Food Products and Processes		0%		10%
723	Hazards to Human Health and Safety		5%		5%
	<b>Total</b>		100%		100%

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.0	0.0	9.0
Actual	0.0	1.1	0.0	8.5

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

<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
0	30708	0	1025699
<b>1862 Matching</b>	<b>1890 Matching</b>	<b>1862 Matching</b>	<b>1890 Matching</b>
0	62118	0	910973
<b>1862 All Other</b>	<b>1890 All Other</b>	<b>1862 All Other</b>	<b>1890 All Other</b>
0	0	0	0

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

### 1. Brief description of the Activity

The atmospheric concentration of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O is ever increasing and research is needed to identify potential controlling factors and devise mitigation strategies. This project seeks to clarify the relationship between soil properties and gases fluxes, develop as soil quality index for assessing this relationship, and improve methods to measure and predict greenhouse gas fluxes and soil properties in a corn and soybean fields, pasture and forest.

A watershed-based study that integrates hydrology, geochemistry, geology, and geospatial fields is being conducted in the Central Missouri Mining District to assess the impact of the abandoned mines on the water quality and ecosystem. The Central Mining District which was active from 1820 to 1950's had numerous small deposits of barite, pyrite, galena, and sphalerite. The Central Missouri Mining District lies in a number of counties including Cole, Miller, Moniteau, and Morgan and occupies about 2,000 square miles. They are spread over four watersheds, namely Lake of the Ozarks, Lamine, Lower Missouri-Moreau, and Lower Osage. To date no significant work has been conducted to investigate the level of environmental disturbance and contamination that may have resulted from these abandoned mines. The goal of the project is to generate scientific data that characterizes the nature and magnitude of contamination and the level of environmental disturbance that may have resulted from the historic mining activity.

Lead (Pb) contamination in soils and lands from abandoned mining and smelting areas in Missouri, has been identified as a human health and ecological threat. *In situ* phosphate treatment that immobilizes soil Pb and reduces its bioavailability is emerging as a potential cost-effective remedial alternative for safeguarding human and environment from Pb-contamination. The phosphate-based treatments have been evaluated in smelter-contaminated urban soil for reducing the Pb human health and ecological risks. Preliminary results showed that the H<sub>3</sub>PO<sub>4</sub> treatment effectively immobilized soil Pb by transforming Pb from labile species to non-bioaccessible forms, thus lowering the risks to human health and ecosystems. However, the efficacy of soil treatment using phosphate-based materials on mine tailings is largely unknown and little studied.

Remediation and restoration of Pb-contaminated lands for reducing the human exposure is a national priority. In order for a large-scale implementation of phosphate remedial technology in mining-contaminated site, a site-specific or mining waste-specific assessment of *in situ* phosphate treatment is needed. The proposed study is designed to substantiate the hypothesis that *in situ* soil treatments using phosphate-based amendments could effectively reduce Pb bioavailability and mobility in the tailing-contaminated areas, which help re-establish vegetation cover and protects human and environment from contamination. If successful, results from this project will provide a site-specific assessment of phosphate treatment effectiveness on tailing remediation and scientific evidence that can support large-scale remediation efforts using phosphate-based treatments in similar contaminated sites nationwide.

Various programs and presentation through Extension, such as; the second annual In Touch of Nature Field Day, Nature and Agriculture in the City, Horticulture and Nutrition Programs, and Native Plants and Native Pollinators workshop

### 2. Brief description of the target audience

The target audience includes activists, teachers, researchers, policy makers, and professionals in environment related areas. The general public target audience includes farmers, students, and residents living in contaminated mining sites. Part of the specific target audience includes residents of rural communities in Central Missouri, i.e., residents of Cole, Miller, Morgan, and Moniteau Counties.

The Extension programs targeted a diverse population, including Hispanic, African-American, women, children, and youth. The presentations averaged about 50% minority and 50% white.

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

### 1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	25	60	15	30
<b>Actual</b>	150	200	25	400

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 0  
 Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>	0	6	
<b>Actual</b>	0	18	18

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

**Output Target**

**Output #1**

**Output Measure**

- Short term output measures are: Abstracts (7), presentation (7), Training students (10) and Workshop (1)  
 Intermediate output measures are publications (7) Long-term: Will be felt after five years

Year	Target	Actual
2009	42	83

**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.
5	Increase knowledge about using native plants for conservation practices, such as providing habitat for pollinators and other beneficial wildlife.

**Outcome #1****1. Outcome Measures**

Chemical and biological characterization of the ecosystems.

**2. Associated Institution Types**

- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	4	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Lead contamination in soil, which is causing serious health problems for children. The chemical and toxic leachates, pathogens, biological organisms can negatively impact public health, ground water, and streams. Water runoff from CAFOs contaminating water quality of streams near CAFOs.

**What has been done**

Started mapping and analyzing rock, mineral, and water samples from seven abandoned mines. Identified potential soil controlling factors for greenhouse emissions from soil. Increased knowledge of Pb behaviors and risks in soil ecosystem. Collected water samples near CAFOs, to evaluate levels of E. coli, nitrogen, phosphorous and antibiotic drugs from animal waste.

**Results**

Increased understanding of greenhouse gas emissions from agricultural fields. Preliminary results showed that the H<sub>3</sub>PO<sub>4</sub> treatment effectively immobilized soil PB, thus lowering the risks to human health, however more studies are needed. Extensive education given to members of the target audience. Better management to improve water quality.

**4. Associated Knowledge Areas**

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

**Outcome #2****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	3	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Understanding greenhouse gas emissions from agricultural fields and devising strategies to mitigate these gases. Deterioration of water quality due to runoff from CAFOs. Conservation and protection of native plants and other natural resources help to protect watersheds, which results in cleaner water, air, soil, and healthier and safer environments

**What has been done**

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

**Results**

Better understanding of greenhouse gas emissions and a new approach to measure these emissions from fields, pastures, and forests. Education for stakeholders to alter agricultural practices to reduce emissions from agricultural fields. Better management practices to improve water quality.

There are positive changes associated with the Native Plants Program, but they are too hard to measure at this time.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems

314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

**Outcome #3**

**1. Outcome Measures**

Environmental sustainability; Improved quality of life

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	1	0

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

**Issue (Who cares and Why)**

Lead contaminated soil and contamination from runoff associated with abandoned mines and CAFOs. This is a health risk for those who live in and near contaminated sites. Participants in field days, seminars, and workshops were introduced to conservation practices.

**What has been done**

Risk reduction of lead (Pb) contamination in soils and lands through in situ phosphate treatment of contaminated soil. This helps re-establish vegetation cover to protect human and environmental contamination. Water samples from streams near CAFOs. Native Plant gardens are under development for education and to provide a relaxing atmosphere to improve quality of life. Also these plants could provide a specialty crop for small farmers or producers.

**Results**

Reducing the health and ecological risks associated with Pb in soil ecosystem. Sustaining natural resources and improving environmental quality and quality of life. Better management practices.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
136	Conservation of Biological Diversity
141	Air Resource Protection and Management
215	Biological Control of Pests Affecting Plants

216	Integrated Pest Management Systems
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

**Outcome #4**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	4	0

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

**Issue (Who cares and Why)**

Educating stakeholders and target audience about the relationship between soils and soil properties to reduce greenhouse gas emissions. Contamination of soil, groundwater, and streams by lead concentrations, abandoned mining operations, and runoff from CAFOs.

**What has been done**

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

**Results**

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

**4. Associated Knowledge Areas**

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

141	Air Resource Protection and Management
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

**Outcome #5**

**1. Outcome Measures**

Increase knowledge about using native plants for conservation practices, such as providing habitat for pollinators and other beneficial wildlife.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Extension specialists work with small farmers, producers, and landowners. Along with educators such as Master Gardeners, Master Naturalists, and teachers interested in ecology, biology, and conservation.

**What has been done**

Native plant and native pollinators workshop introduced the idea of using native plants as habitat for beneficial insects.

**Results**

Several participants have offered workshops about native pollinators in their own regions. Awareness about native pollinators has been increasing steadily. Partnerships between Lincoln University and other organizations have occurred as a result of this workshop. Additional workshops of this nature are planned.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
136	Conservation of Biological Diversity

## **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
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

These factors could have impacted outcomes, but in the past year there were few external factors that did hinder the projects. The economy is always an issue, as joblessness, in certain areas is more prevalent and creates anxiety and tension among families and communities.

There were some problems to reach out to Hispanic audiences because of immigration issues, as many people either do not have legal documents or have relatives who are illegal. There is a false idea that Universities are governmental organizations.

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)
- Comparisons between program participants (individuals, group, organizations) and non-participants

### **Evaluation Results**

Progress is being made in the areas of greenhouse gas emissions , along with testing and evaluating lead contaminated soils and runoff from abandoned mining operations and the potential for ground water contamination from CAFO runoff.

There is extensive interest in using native plants as pollinators for beneficial insects. Farmers and horticulturists recognize the benefits of using native plants both as pollinators and as a special crop subsidy.

### **Key Items of Evaluation**

Overall, the stakeholders were very receptive to the studies that are designed to provide healthier living conditions for their families. People are aware of the environment and understand the need to study and document runoff from abandoned mines and CAFOs.

**V(A). Planned Program (Summary)****Program # 5****1. Name of the Planned Program**

Childhood Obesity

**V(B). Program Knowledge Area(s)****1. Program Knowledge Areas and Percentage**

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
701	Nutrient Composition of Food		0%		25%
702	Requirements and Function of Nutrients and Other Food Components		0%		25%
703	Nutrition Education and Behavior		0%		25%
704	Nutrition and Hunger in the Population		5%		0%
724	Healthy Lifestyle		15%		25%
801	Individual and Family Resource Management		5%		0%
802	Human Development and Family Well-Being		10%		0%
803	Sociological and Technological Change Affecting Individuals, Families, and Communities		5%		0%
805	Community Institutions, Health, and Social Services		5%		0%
806	Youth Development		30%		0%
901	Program and Project Design, and Statistics		15%		0%
903	Communication, Education, and Information Delivery		10%		0%
	<b>Total</b>		100%		100%

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

<b>Year: 2009</b>	<b>Extension</b>		<b>Research</b>	
	<b>1862</b>	<b>1890</b>	<b>1862</b>	<b>1890</b>
Plan	0.0	0.5	0.0	2.5
Actual	0.0	1.0	0.0	1.0

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

Extension		Research	
<b>Smith-Lever 3b &amp; 3c</b> 0	<b>1890 Extension</b> 144053	<b>Hatch</b> 0	<b>Evans-Allen</b> 0
<b>1862 Matching</b> 0	<b>1890 Matching</b> 0	<b>1862 Matching</b> 0	<b>1890 Matching</b> 0
<b>1862 All Other</b> 0	<b>1890 All Other</b> 0	<b>1862 All Other</b> 0	<b>1890 All Other</b> 0

**V(D). Planned Program (Activity)****1. Brief description of the Activity**

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

Specific areas of focus include the role of diet and exercise on the development of obesity, hypertension and type 2 diabetes and their subsequent contribution to development of cardiovascular diseases. Focus is also placed on education of public for prevention of these chronic diseases by life-style modification (healthy eating and increased physical activity). There are plans to study the biochemical and physiological basis for regulation of body weight and body fat distribution using a diet-induced obese animal model. While this research is relevant for all people, emphasis is primarily on specific subpopulations including African-Americans, low-income populations and other under represented groups.

Lincoln University Encore Steppers (LUES) is a teen leadership, team building fitness program designed to teach team skills, good decision making skills, and to stay physically fit. The statewide "Show me the Ropes" obesity reduction /double dutch competition was initiated. This is an 8-week nutrition and fitness program combined with the activity of jumping rope for health. Other workshops, conferences, and afterschool programs focused on nutrition, staying fit, and making healthy choices.

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

African-Americans, low-income families and other under-represented groups in St. Louis, Kansas City, Bootheel, and Jefferson City areas in the State of Missouri. Minority youth, specifically students in the 9-18 age bracket.

**V(E). Planned Program (Outputs)****1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	200	500	100	200
<b>Actual</b>	900	1700	1900	1500

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

Year: 2009

Plan: 0

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

<b>2009</b>	<b>Extension</b>	<b>Research</b>	<b>Total</b>
<b>Plan</b>	0	0	
<b>Actual</b>	0	0	0

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

**Output Target**

**Output #1**

**Output Measure**

- 1) Number of publication 2) Number of presentation 3) Number of workshops 4) Number of contacts 2007: number of presentation: 2 number of workshops: 6 number of contacts (direct & indirect): 1,000 2008: Number of publication:1 Number of presentation, workshops and contacts : Same as in 2007 2009: Same as in 2008 2010: Same as in 2008 2011: Same as in 2008

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	1007	130

## V(G). State Defined Outcomes

### V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	<p>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 in research subjects and other clientele.</p> <p>increase nutrition knowledge and awareness of importance of nutrition for prevention of chronic diseases by 90% of participants in direct contacts and 70% of indirect contacts.</p>
2	<p>-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.</p> <p>Medium-term: 2007 - 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</p> <p>2008 - Utilization of research outcomes by the extension specialist (2-3 good nutrition guides).</p> <p>2009 - Same as 2008.</p> <p>2010 - Same as 2008 and number of citations of publications = 10</p> <p>2011 - Same as 2008 and number of citations of publications = 15</p>
3	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.
4	Study the association between dietary factors and exercise and development and prevention of obesity and cardiovascular disease.
5	Short term: Enhanced academic productivity, improved rate of community volunteerism, development of leadership skills, increased knowledge, and increased life skills.
6	Medium Term: Completion of current grade and promotion to the next, increased graduation rates from high school, reduced probability of acts of crime, increases self esteem, better social standards, and better life choices.
7	Long Term: Improved education levels, Increased standard of living, and improved quality of life

**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 in research subjects and other clientele. increase nutrition knowledge and awareness of importance of nutrition for prevention of chronic diseases by 90% of participants in direct contacts and 70% of indirect contacts.

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	700	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

The prevalence of high blood pressure, diabetes, and obesity in the minority and limited resource audiences (both children and adults) served by LU Extension.

**What has been done**

Classes were provided for children and parents. Creative methods to increase activity for children were provided. Double Dutch Jumping competitions were held. All competitors were involved in health and nutrition classes.

**Results**

Over a majority of the people surveyed indicated that they have made at least one positive change in their eating or exercise experience.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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: 2007 - 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 2008 - Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). 2009 - Same as 2008. 2010 - Same as 2008 and number of citations of publications = 10 2011 - Same as 2008 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	Quantitative Target	Actual
2009	3	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Address obesity, especially childhood, in the minority and limited resource population served by LU extension.

**What has been done**

Project studying obesity using a diet induced animal model was terminated effective 3/31/10, six months earlier than expected.

**Results****4. Associated Knowledge Areas**

KA Code	Knowledge Area
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 #3****1. Outcome Measures**

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

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	0	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Obesity is a serious nutritional problem in the United States. The prevalence of obesity is currently estimated at over 20% of the population.

**What has been done**

Numerous workshops and presentations were given to school age children and adults.

**Results**

The vast majority of the participants recognized the need to live healthier and to eat healthier and to get regular exercise. People are generally very receptive to new ideas on food and exercise.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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 #4****1. Outcome Measures**

Study the association between dietary factors and exercise and development and prevention of obesity and cardiovascular disease.

**2. Associated Institution Types**

- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Adults and children who are at risk of developing overweight or obesity associated health problems. Particularly African-American women.

**What has been done**

Produced information on healthful dietary recommendations using a diet-induced animal model. Project was terminated effective 3/31/10, six months earlier than expected.

**Results**

Successfully established a rat obese model gaining 30% more weight by feeding a high fat, high energy diet. Found that dietary fish oil supplementation is useful to alleviate the weight gain in obese animals and reduce the plasma cholesterol and triglyceride levels in obese animals. This project was terminated on 3/31/2010.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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 #5****1. Outcome Measures**

Short term: Enhanced academic productivity, improved rate of community volunteerism, development of leadership skills, increased knowledge, and increased life skills.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	500

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

**Issue (Who cares and Why)**

Childhood obesity has become a growing problem in the U.S. Young people continue to face challenges with their overall health and activity levels.

**What has been done**

The Show me the Ropes program has cultivated a positive atmosphere where young people are taught the basics of healthy eating choices and nutrition. EFNEP offers individual and family nutrition education, recreational and fitness programs. LUES students are taught healthy lifestyles and leadership skills while being active.

**Results**

Participants have learned basic and advanced skills in a health activity which promotes longer life by increasing cardio vascular efficiency, muscle tone, endurance, and agility.

**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
806	Youth Development
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery

**Outcome #6**

**1. Outcome Measures**

Medium Term: Completion of current grade and promotion to the next, increased graduation rates from high school, reduced probability of acts of crime, increases self esteem, better social standards, and better life choices.

**2. Associated Institution Types**

- 1890 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	200

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

**Issue (Who cares and Why)**

Young people around the State of Missouri continue to face challenges with their overall health and activity levels. Unhealthy lifestyles and behavioral choices have continues to cause an increased mortality rate, propensity toward criminal activity, and addictive/destructive behaviors.

**What has been done**

Participants have learned basic and advanced skills in a health activity, which promotes long life by increasing cardio vascular efficiency, muscle tone, endurance, and agility.

**Results**

Most participants were inspired and setting personal goals that would incorporate healthy choices, nutrition, and overall better health.

**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
806	Youth Development
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery

**Outcome #7**

**1. Outcome Measures**

Long Term: Improved education levels, Increased standard of living, and improved quality of life

Not Reporting on this Outcome Measure

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

**External factors which affected outcomes**

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

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies and Data Collection)**

1. Evaluation Studies Planned

- During (during program)
- Comparison between locales where the program operates and sites without program intervention

**Evaluation Results**

**Key Items of Evaluation**

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

**Program # 6**

**1. Name of the Planned Program**

Plant Science--This section reported under Global Food Security and Hunger

**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				
111	Conservation and Efficient Use of Water				
132	Weather and Climate				
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants				
204	Plant Product Quality and Utility (Preharvest)				
216	Integrated Pest Management Systems				
405	Drainage and Irrigation Systems and Facilities				
503	Quality Maintenance in Storing and Marketing Food Products				
601	Economics of Agricultural Production and Farm Management				
604	Marketing and Distribution Practices				
	<b>Total</b>				

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	4.5	0.0	4.0
Actual	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

**1. Brief description of the Activity**

Activities for this Planned Program have been included in the Global Food Security and Hunger priority section.

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

A full description of the target audience, for plant science has been included in the Global Food Security and Hunger priority section.

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	1000	3000	100	300
Actual	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

**Patent Applications Submitted**

Year: 2009  
 Plan: 0  
 Actual: {No Data Entered}

**Patents listed**

{No Data Entered}

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
Plan	0	0	
Actual	{No Data Entered}	{No Data Entered}	{No Data Entered}

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

**Output Target**

**Output #1**

**Output Measure**

- Publications Abstracts Refereed Journals Bulletins Years 2007-2088 primarily abstracts and bulletins Year 2009 transition year and years 2010-2011 primarily scientific manuscripts

Year	Target	Actual
2009	6	0

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Develop educational programs to encourage minority youth to get involved in farming. 2007: Increase the number of minority farmers by 200. Adoption of environmental sustainable crop production practices. 2008: Increase the number of farms adopting production practices by 150.
2	Improve small and minority farms income 2009: Increase the average small farm gross income by \$5, 000
3	Enhanced viability of rural communities. Enhanced profitability of Small Farms. 2010: Increase Farm growth income by \$5, 000 2011: Increase Farm retention rate by 4, 250

## **Outcome #1**

### **1. Outcome Measures**

Develop educational programs to encourage minority youth to get involved in farming. 2007: Increase the number of minority farmers by 200. Adoption of environmental sustainable crop production practices. 2008: Increase the number of farms adopting production practices by 150.

Not Reporting on this Outcome Measure

## **Outcome #2**

### **1. Outcome Measures**

Improve small and minority farms income 2009: Increase the average small farm gross income by \$5, 000

Not Reporting on this Outcome Measure

## **Outcome #3**

### **1. Outcome Measures**

Enhanced viability of rural communities. Enhanced profitability of Small Farms. 2010: Increase Farm growth income by \$5, 000 2011: Increase Farm retention rate by 4, 250

Not Reporting on this Outcome Measure

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

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

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

### **Brief Explanation**

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)

## **Evaluation Results**

## **Key Items of Evaluation**



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

**Program # 7**

**1. Name of the Planned Program**

Food Safety

**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

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

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	0.0	0.0	1.0

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	197	0	231543
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	175134
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

Escherichia coli O157:H7 is clearly one of the deadliest food borne pathogenic bacteria. It causes an estimated 73,000 cases of infection and 61 human deaths in the United States each year (Centers for Disease Control and Prevention, 2006). This bacterium has been linked to hemolytic uremic syndrome and hemorrhagic colitis. These illnesses may cause diarrhea, seizure, stroke, kidney failure and even death (Food and Drug Administration, 2008). They are often misdiagnosed, resulting in expensive medical testing before they are correctly diagnosed. In addition, E- coli has the potential to cause enormous national and international economical devastation due to medical costs and product recalls, as recently occurred with the recall of tomatoes

due to E. coli O157:H7 contamination. It can also be found in vegetables, unpasteurized milk, juice and unchlorinated water. Contamination can have a significant impact on businesses such as the beef -industry. E. coli O157:H7 can be found on most cattle farms and can live in the intestines of healthy cattle. Thus, the meat can become contaminated with E. coli O157:H7 during slaughter. Testing for the bacteria requires extensive analysis which has to meet certain challenging criteria. Sensitivity and response time for the analysis are imperative factors related to the usefulness of microbiological testing. An extremely selective detection methodology is also required because low numbers of pathogenic bacteria are often present in a complex biological environment along with many other nonpathogenic organisms. Traditional methods for the detection of bacteria are not available in the time scale desired in a clinical laboratory. In response to this problem, a number of instruments have been developed using various principles of detection, such as flow cytometry polymerase chain reaction, immunomagnetic separations, bioluminescence and mass spectrometry. These methods, however, are still time consuming and expensive. The proposed project will develop a novel 3-dimensional (3-D) interdigitated microelectrode array (IDE) based impedance biosensor. This biosensor will be capable of rapid detection and selective for accurate identification of E. coli O157:H7. This design is unique in the use of a 3-D IDE which increases the surface area compared to a single (2-D) IDE sensor. The increased surface area will enhance the sensitivity of impedance detection. Each IDE biosensor consists of 100 pairs of gold electrode "fingers" with a length of 0.5 mm. The IDE array will be designed with spaces between the interdigitated electrodes nearly the size of the bacteria in order to detect a single or a few bacteria cells.

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

USDA-Food Safety, The Food Safety and Inspection Service (FSIS), food processors and handlers. Also targeted are African-Americans, low-income families, and other under represented groups.

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2009

Plan:

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>			
<b>Actual</b>	0	0	0

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

**Output Target**

**Output #1**

**Output Measure**

- Short term measures are Abstracts, presentations, training students, and workshops. Intermediate output measures are publications. Long Term: Will be felt after five years

<b>Year</b>	<b>Target</b>	<b>Actual</b>
2009	{No Data Entered}	2

**V(G). State Defined Outcomes****V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	This project is providing valuable design that can be extended to detect other bacteria, for example, Salmonella, in a more timely manner.
2	Improvements to public health and reduction in health care costs for specific population such as African-Americans, low-income families, and other under represented groups.

## Outcome #1

### 1. Outcome Measures

This project is providing valuable design that can be extended to detect other bacteria, for example, Salmonella, in a more timely manner.

### 2. Associated Institution Types

- 1890 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Health officials, food processors and handlers. Low-income and under served populations. Safe, clean food is necessary to help prevent illnesses, and lower health care costs.

#### What has been done

Early testing of sensor to more readily identify bacteria and other food pathogens.

#### Results

Early elimination of contaminated food to prevent human illnesses and costly market recalls.

### 4. Associated Knowledge Areas

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

## Outcome #2

### 1. Outcome Measures

Improvements to public health and reduction in health care costs for specific population such as African-Americans, low-income families, and other under represented groups.

### 2. Associated Institution Types

- 1890 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

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

**What has been done**

Workshops and presentations to community groups, schools, and students to stress the importance of nutritious, fully cooked food.

**Results**

Expect an 80% positive response of those contacted.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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
- Public Policy changes
- Government Regulations

**Brief Explanation**

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

**V(I). Planned Program (Evaluation Studies and Data Collection)**

**1. Evaluation Studies Planned**

- Before-After (before and after program)
- Comparisons between program participants (individuals, group, organizations) and non-participants

### **Evaluation Results**

To be determined.

### **Key Items of Evaluation**

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

Positive response from those contacted in regards to keeping food clean of bacteria and proper cooking methods.

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

**Program # 8**

**1. Name of the Planned Program**

Sustainable Energy

**V(B). Program Knowledge Area(s)**

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships		0%		10%
111	Conservation and Efficient Use of Water		0%		10%
131	Alternative Uses of Land		0%		5%
132	Weather and Climate		20%		5%
133	Pollution Prevention and Mitigation		20%		10%
141	Air Resource Protection and Management		10%		0%
402	Engineering Systems and Equipment		20%		0%
403	Waste Disposal, Recycling, and Reuse		20%		5%
404	Instrumentation and Control Systems		10%		0%
511	New and Improved Non-Food Products and Processes		0%		55%
<b>Total</b>			100%		100%

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

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

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	1.0	0.0	0.3

Actual	0.0	1.0	0.0	0.3
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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
0	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	212067
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**

Studies are being undertaken to develop alternative fuel sources that are feasible, economical, efficient, and environmentally friendly. Microalgae studies are designed to evaluate the mass cultivation of microalgal biomass as an alternative fuel source. Leaves are being studied to evaluate their potential use as a secondary fuel source, particularly in power plants, in lieu of ,or in conjunction with ,coal.

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

Undergraduate/graduate students majoring in Science and Engineering-Bioenergy technology. Small farmers interested in producing value added renewable energy crops. Local electric cooperatives. Scientists and other researchers, extension workers, policy makers, regulatory agencies, local citizens, and community leaders.

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

**1. Standard output measures**

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
<b>Actual</b>	0	0	0	0

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

**Patent Applications Submitted**

Year: 2009

Plan:

Actual: 0

**Patents listed**

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

**Number of Peer Reviewed Publications**

2009	Extension	Research	Total
<b>Plan</b>			
<b>Actual</b>	0	2	2

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

**Output Target**

**Output #1**

**Output Measure**

- Abstracts, publications, workshops, and presentations

Year	Target	Actual
2009	{No Data Entered}	19

**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	Develop economical and efficient methods to collect, store, transport, and transform leaves into a useable fuel source.

**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**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Small farmers, electric cooperatives, community leaders, citizens all have a vested interest in evaluating alternative fuel sources.

**What has been done**

Collection of many micro-algal species, specifically native species that adapt well, has been established.

**Results**

Two private companies have already shown an interest in the test evaluations of their proprietary processes using selected algae species. The project has been expanded to develop a microalgae cultivation system that can utilize carbon dioxide in the flue gas from the fossil-fuel power plant.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
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**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

Small farmers, Community leaders, Electric cooperatives.

**What has been done**

Working on the new transesterification method for the economical production of biodiesel from oil-bearing crops, including microalgae.

**Results**

Two private companies have shown an interest in the test evaluations.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
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 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

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

**Issue (Who cares and Why)**

All stakeholders have an interest in finding viable environmental solutions.

**What has been done**

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

**Results**

A more informed and interested stakeholder audience.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
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**

Develop economical and efficient methods to collect, store, transport, and transform leaves into a useable fuel source.

**2. Associated Institution Types**

- 1890 Extension
- 1890 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Quantitative Target	Actual
2009	{No Data Entered}	0

**3c. Qualitative Outcome or Impact Statement****Issue (Who cares and Why)**

Stakeholders, community leaders, citizens, who are interested in new methods to address environmental issues.

**What has been done**

Presentations and workshops given to provide updated knowledge about the research. On-going testing of leaves, collection methods, transportation and storage concerns, and the transformation process.

**Results**

Continued interest in leaves as an alternative fuel source from various Environmental companies in the Midwest.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
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

## **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

### **Brief Explanation**

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

## **V(I). Planned Program (Evaluation Studies and Data Collection)**

### **1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)
- Time series (multiple points before and after program)

### **Evaluation Results**

More testing is still needed with both the micro-algal studies and the leaves for fuel initiative. Private companies do show an interest, but more information needs to be evaluated to determine the economic feasibility of both projects.

### **Key Items of Evaluation**

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