

2010 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 108,000 farms in Missouri, approximately 101,600 small farms. This is based on farms with gross annual sales less than \$250,000 excluding government payments (National Agriculture Statistics Service NASS). These traditional farms represent a way-of-life that Missourians and other rural citizens have taken for granted over much of the nations' history. However, prime farmland in Missouri, as well as in the remaining states, is being lost rapidly due to urban sprawl. This loss of farmland across the United States occurs at a rate of 50 acres every hour, which is one-half million acres per year. A major reason for this loss is because our increasing population results in cities expanding into areas traditionally used by farmers. During encroachment, farmland becomes too valuable to farm and is purchased for commercial development. A major component of this modified land use is for housing developments.

Incorporation of an integrated 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 experimental learning, energy use, and labor requirements.

Busby farm continues to 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 complements 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 are exposed to agricultural practices at Busby and provided the opportunity to assist the manager. This is a unique farm opportunity in Missouri and it is being developed with input from private individuals, area high school students, numerous agricultural organizations, and the University of Missouri.

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

Global Food Security and Hunger

Animal science

Ruminants:

The primary emphasis in animal science continue to be with goat production systems, but also includes 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 the United States during the outbreak of the West Nile virus in New York City and surrounding areas in 1999. In order to control populations of disease vectors and, in turn, control the disease agents they transmit, an extensive and thorough knowledge of the life cycle and ecology of these arthropods must exist. One project examines the biology of mosquitoes from the viewpoint of interactions between mosquito populations and their ecosystems. Through this project we can gain a better understanding of the role that environmental factors play in larval development, adult mosquito production and fitness, and population dynamics.

Aquaculture

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

Human Nutrition

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

Food Safety

Food Safety

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 the practical use of leaves for heating systems.

The application of biochar to soil is a novel approach to establish a long-term sink for atmospheric carbon dioxide in the terrestrial ecosystem. The application of biochar to soil has the potential to improve soil fertility and increase crop production. This study, started late in the fiscal year, will examine potential hazards associated with biochar applications.

Programs without strong research counterparts

Extension efforts to improve the educational and economic opportunities for under-represented populations in Kansas City, St. Louis, Jefferson City, Southwest Missouri, and the Bootheel will continue. 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: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	37.0	0.0	39.0
Actual	0.0	37.0	0.0	50.0

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 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

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals

Brief explanation.

A stakeholder survey was sent to all Regions in the state and over 3,000 responses were received. These results were entered into a database and currently there is an on-going evaluation

of the responses.

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 External Focus Groups
- Needs Assessments
- Use Surveys

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

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.

A stakeholder survey was utilized in all Regions in the state and over 3,000 responses were received. These results were entered into a database and currently there is an on-going evaluation of the responses.

3. A statement of how the input will be considered

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

Brief explanation.

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, environmental improvement, and landscaping with native plants.

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

A stakeholder survey was utilized in all Regions in the state and over 3,000 responses were received. These results were entered into a database and currently there is an on-going evaluation of the responses.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	3191020	0	3359503

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	3458151	0	3373352
Actual Matching	0	1524844	0	2367365
Actual All Other	0	0	0	0
Total Actual Expended	0	4982995	0	5740717

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

V. Planned Program Table of Content

S. No.	PROGRAM NAME
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

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

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890

Plan	0.0	1.5	0.0	4.0
Actual	0.0	4.6	0.0	12.4

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	1151705	0	2202518
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	640500	0	1218283
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

- 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.
- Workshops to develop marketing and production cooperatives for small farmers.
- A value-added Fiber program helped producers market fibers from sheep, goats, rabbits, llamas, and alpacas.
- Various other 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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5879	4595	866	610

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	5	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Projects completed, presentations and manuscripts

Year	Actual
2010	23

Output #2

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

Year	Actual
2010	2

Output #3

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	Actual
2010	105

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
2010	3575	1000

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. Workshops have reached approximately 1,000 potential fish farmers.

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 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	1530	400

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. Workshops and presentations have reached approximately 1,000 potential fish farmers.

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
2010	1530	930

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. Over 930 farmers participated in workshops and presentations.

Marketing workshops to eventually increase small farmer income.

Results

A large percentage of the producers who participated stated they would be willing to change management practices and try new ideas, including different marketing strategies.

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
2010	{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 central Missouri, and assessing the economic implications of these practices. The value-added fiber program helped producers market fiber and hopefully increase overall small farm income.

Results

More small farmers have learned seasonal extension techniques with high-tunnels. More educators have learned 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. The name of the cooperative has been selected. Market contracts have been signed with large chain stores.

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
2010	{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.
About 30 younger farmers were recruited to begin farming.
Hispanic producers and workers were recruited for the first time. The workers assisted in harvesting the produce.

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
2010	{No Data Entered}	50

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 1.23mS/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 and use, 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.

Missouri Agricultural Products Cooperative was established.

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)

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 plays a significant role in the evaluation.
- the last, and not 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%
	Total		100%		0%

V(C). Planned Program (Inputs)

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

Year: 2010	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	1229775	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	795037	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.
- Leadership Retreat, for youth to develop good decision making skills.

The Hip Hop Camp is designed to empower the youth to take an active role in becoming the leaders of tomorrow. Our program is also based on the belief that the youth themselves can become a potent force in combating social issues.

Activities that have been implemented in all four Regions include:

Black History Programs for youth (K-12) in the school districts. This is an educational program on the accomplishments and struggles of African-Americans.

Not on my Watch Program for parents and youth to address the issue of Childhood Obesity.

Financial Management and Youth Program, which is designed to teach youth about basic financial management in order to help them make better economic and life decisions.

Dare to be King conference develops skills for making healthy choices when dealing with oppressive issues. By providing youth with positive mentors and role models, the issue of increased high school drop out rate is addressed and children are more likely to complete high school and attend college. By providing the youth with positive mentors and role models we are also aiding suicide prevention and combating in lowering suicide attempts.

Show Me The Ropes Statewide Double Dutch Competition. Conduct the statewide Double Dutch competition and provide the opportunity for youth to demonstrate skills developed throughout the program. Skill development included (1) Single rope jumping: Skills that are executed by one person with an individual rope; foot movement (basic jumping) and hand position (turning the rope). (2) Partner Jumping: Skills where two or more people share one jump rope. (3) Double Dutch: skills where two long ropes are turned so that they overlap while essentially parallel to each other. (4) Group Jumping: Skills where three or more people share one or two jump ropes.

The critical issue is the percentage of childhood obesity in our society due to the amount of time spent on non physical activities and the lack of knowledge about what's considered to be healthy food. We have addressed these issue by planning and directing fun physical activities and provide a professional dietitian to speak about the importance of health.

2. Brief description of the target audience

The target audience also includes small under served rural communities as well as older adults.

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

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2539	3720	11164	4982

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year	Actual
2010	336

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
2010	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
2010	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
2010	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
903	Communication, Education, and Information Delivery

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)

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
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%
	Total		100%		0%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
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)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	180111	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	51684	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

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2544	5225	3108	2496

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

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

Year Actual

2010

80

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Community decision makers will increase inclusivity when seeking stakeholder input. Stakeholders will be empowered and concerned about improving the quality of life in their community. Community decision makers will seek extramural funds to make improvements. Community decision makers will review, and update ordinances to make operation more efficient.
2	Increased knowledge and understanding of community development planning. Increased partnerships and resources for the community. Increased civic engagement in deliberating community issues.
3	Evidence of community goal attainment * Increased capacity to deal with future issues *Change in community practice *Improved community fiscal and economic performance * Those participating in local government are more representative of the population of the community * Sustained capacity for informed local decision making

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	75	150

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

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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

Outcome #3

1. Outcome Measures

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

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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)

Evaluation Results

A survey of statewide regions resulted in a response from over 3,000 stakeholders. These results were entered into a database for evaluation. That evaluation is currently in progress. We hope to compare the various regions on what programs were effective, what were some regions doing well, that did not work in other regions, and the overall status of programs throughout the state.

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
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%
	Total		100%		100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	0.0	7.0
Actual	0.0	1.1	0.0	17.5

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	44162	0	604865
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	37623	0	933186
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 atmospheric concentration of CO₂, CH₄ and N₂O 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 H₃PO₄ 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 presentations through Extension, such as; the third annual In Touch of Nature Field Day, Nature and Agriculture in the City, Horticulture and Nutrition Programs, and Native Plants and Native Pollinators workshop have educated farmers about techniques and market strategies to increase production and thus, increase income.

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	717	511	247	165

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Short term output measures are: Abstracts, presentations, Training students and Workshops. Intermediate output measures are publications. Long-term: After five years

Year	Actual
2010	53

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 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	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 H3PO4 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
511	New and Improved Non-Food Products and Processes
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
2010	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, Native Pollinator Program, and the restoration of warm season grasses, but they are too hard to measure at this time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
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
511	New and Improved Non-Food Products and Processes
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
2010	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
2010	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
511	New and Improved Non-Food Products and Processes
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
2010	{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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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 that will report illegal immigrants to authorities.

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

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

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
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%
	Total		100%		100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.5	0.0	2.5
Actual	0.0	1.0	0.0	2.0

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	852398	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3364	1295	9560	2747

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of publication, presentations, workshops and contacts.

Year	Actual
2010	661

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase knowledge of good nutrition measured by surveys pre- and post-nutrition education. Increased awareness about relationship between nutrition and physical activity and chronic diseases measured by periodic surveys 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	-Number of citations of publications by other scientists in scientific papers. -Use of research results by nutrition extension and health care specialists. I-mprovement of eating behavior and physical activities. -Decrease in percentage of overweight and obesity in research and extension participants. Medium-term: 2010 - measurable weight reduction (1-5%) in overweight and obese subjects and clientel. Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). measurable weight reduction (1-5%) in overweight and obese subjects and clientele 2011 - Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). 2012 - Same as 2011. 2013 - Same as 2012 and number of citations of publications = 10 2014 - Same as 2013 and number of citations of publications = 15
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
2010	700	2500

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. I-mprovement of eating behavior and physical activities. -Decrease in percentage of overweight and obesity in research and extension participants. Medium-term: 2010 - measurable weight reduction (1-5%) in overweight and obese subjects and clientel. Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). measurable weight reduction (1-5%) in overweight and obese subjects and clientele 2011 - Utilization of research outcomes by the extension specialist (2-3 good nutrition guides). 2012 - Same as 2011. 2013 - Same as 2012 and number of citations of publications = 10 2014 - Same as 2013 and number of citations of publications = 15

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	3	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Address obesity, espically 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
2010	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 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{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
2010	{No Data Entered}	0

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
2010	{No Data Entered}	0

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. Precise long-term graduation rate increases have not yet been determined.

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

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

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)

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				
	Total				

V(C). Planned Program (Inputs)

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

Year: 2010	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

{No Data Entered}

2. Brief description of the target audience

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	{NO DATA}	{NO DATA}	{NO DATA}	{NO DATA}

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

Patent Applications Submitted

Year: 2010

Actual: {No Data}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	{No Data Entered}	{No Data Entered}	{No Data Entered}

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed publications

Year	Actual
2010	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.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	150	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

{No Data Entered}

What has been done

{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

Outcome #2

1. Outcome Measures

Improve small and minority farms income 2009: 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
2010	5000	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

{No Data Entered}

What has been done

{No Data Entered}

Results

{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	5000	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

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

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	0.0	0.0	3.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	0	200142
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	215896
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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2053	180	76	15

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

Patent Applications Submitted

Year: 2010

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	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

Year	Actual
2010	19

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
2010	{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. Early experiments indicate that the testing device is very sensitive with positive results so far

Results

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

4. Associated Knowledge Areas

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

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
2010	{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

- Natural Disasters (drought, weather extremes, etc.)
- 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)

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%
	Total		100%		100%

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	1.0	0.0	2.3

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	365827
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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. Biochar studies have been initiated to evaluate this soil additive to possibly increase soil productivity.

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

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2601	756	247	175

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

Patent Applications Submitted

Year: 2010

Actual: 1

Patents listed

Microalgae harvesting by Flocculation with Polymer-Coated Magnetite Particles.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Abstracts, publications, workshops, and presentations.

Year	Actual
2010	275

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
2010	{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
2010	{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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{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
2010	{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)

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. Biochar studies have just been started and more information is needed to present an in-depth evaluation.

Key Items of Evaluation

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