

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Climate Change

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships		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 FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	2.0	0.0	16.0
Actual Paid	0.0	2.0	0.0	16.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	17594	0	899999
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	149280	0	428063
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

Water Quality Studies:

Missouri region is one of several areas in the United States having confined animal feeding operations (CAFOs) under various animal units' classifications. Water quality of streams near CAFOs may deteriorate due to inputs of Escherichia Coli (E. coli), nitrogen (N), phosphorus (P), and antibiotic drugs from animal wastes. In addition, landuse and management practices in various watersheds may also impact surface water quality. Also understanding the distribution and fate of pollutants from animal wastes in environmental media (soil, sediment, surface and groundwater) and the potential public health risks are necessary. Protection of water resources is important for human, aquatic and environmental health. The hypothesis to test is that there are significant contributions of N, P, E. coli, metals, pesticides and antibiotic drugs from runoffs/seepage from cattle and swine wastes and various landuses on water quality of selected Missouri streams. A recently approved project will explore ecological links between bioindicators of environmental health, i.e., the role of water quality, nutrient flow, and invasive species in determining species abundance of Aquatic turtles and mussels.

Risk Reductions and Remediation of metal-Contaminated Mining Wastes in Missouri :

Characterize the physical/chemical properties of the tailings and determine the spatial variability of metal contamination in the areas. This objective will focus on the collection of soil and water samples within the study site, the analyses of metal concentration and metal species in samples, and the determination of the extent or degree of the contamination and spatial distribution of contaminants. This study will provide base information of the site for selecting in situ treatment.

Watershed Based Studies:

The specific objective of the geospatial studies is to create a geospatial digital database for the Lake of the Ozarks, Lamine, Lower Missouri-Moreau, and Osage watersheds. The primary task is to locate and assemble relevant geospatial data from the various state and federal agencies. The database will consist of various layers including digital elevation models, land use/land cover, geology, soil, hydrology, mine locations, wetlands, floodplains, and remote sensing data (satellite and air photo).

Stream water contamination by soil applied herbicides and nutrients continues to be a major water quality problem in Missouri watersheds. One project is aimed at improving our understanding of the controls of stream water quality. The research objectives are to understand the hydrologic pathways controlling stream flow under storm event and base flow conditions, and to evaluate the factors controlling nutrient and herbicide transport to stream water.

Air Quality Studies:

The atmospheric concentration of CO₂, CH₄ and N₂O is ever increasing and good deal of research has been conducted to estimate emissions of these greenhouse gases from soils. Although numerous measurements have been made, emissions from soils still show variability based on a number of controlling factors. In fact, differences in soil type, moisture, temperature, season, crop type, fertilization, and other agricultural practices apparently all play a part in emissions from soils.

Behavior of Select Surfactants in Soil: Interactions with Physicochemical and Microbial Properties

Enhanced In Situ Biodegradation of Pesticides Under Modified Soil Conditions

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

Hydrologic Processes Controlling Stream Water Quality in Missourian Watersheds

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

Bacterium Faecalibacterium for Tracking Agricultural Sources of Fecal Pollution in Water"

The objective of this project is to use the anaerobic fecal bacterium Faecalibacterium as an alternative fecal indicator for the accurate determination of agricultural sources of fecal pollution in water. Genetic markers of the bacterium, which are unique to feces of cattle, swine, or poultry, will be identified and used to develop PCR-based methods for identification of the sources of fecal pollution in water.

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

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

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

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

Agriculture Economic/Business:

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

Natural Resource Diversity Studies:

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

2. Brief description of the target audience

- (a) Farmers
- (b) Engineers
- (c) Policy makers
- (d) Students
- (e) Community leaders
- (f) Local citizens
- (g) Extension workers
- (h) Scientists & other Researchers
- (i) Regulatory Agencies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	577	825	0	0

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

Patent Applications Submitted

Year: 2014
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	0	19	19

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Short term output measures are: Abstracts(16), Presentations (20), Training students (10),and Workshops (4). Intermediate output measures are publications. Long-term: After five years

Year	Actual
2014	92

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	Actual
2014	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
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	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 LU-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
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Environmental sustainability; Improved quality of life

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	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 outdoor laboratories and demonstration 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
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2014 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

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.

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
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
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
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	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

Various native plant and native pollinators workshops have introduced the idea of using native plants as habitat for beneficial insects. A poster about pollinators and native plants is available online. Native seed is being collected from natural areas to develop gardens for pollinators.

Results

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

4. Associated Knowledge Areas

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

Evaluation Results

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.

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. Participants were excited about the idea of using native plants for pollinators and a special crop subsidy.