

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: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	2.0	0.0	16.0
Actual Paid Professional	0.0	2.0	0.0	14.8
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	59772	0	1714305
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	129426	0	420940
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:

1) To establish baseline data, evaluate practices at CAFOs identified sites, and quarterly determine the concentrations of E. Coli, nitrates, nitrites, ammonia, total nitrogen, phosphorus, and antibiotics in lagoon/holding tanks, during manure applications, in CAFOs runoffs, and in streams and compare data obtained with natural systems.

2) To evaluate rainfall events and possible water quality changes due to Escherichia Coli, nitrates, nitrites, ammonia, phosphorus, and antibiotic drugs in streams and leachates from identified CAFOs.

3) Relate farm operations on the partitioning and fate of phosphorus in streams and sediments.

4) Assess the occurrence of antibiotic drugs in native fish collected from streams near CAFO identified sites.

5) Apply analytical data obtained in water quality modeling to better predict water quality near a CAFOs site.

6) To provide BMPs that will assist in water quality improvements near identified CAFOs in Central Missouri.

7) Develop new methods for the accurate determination of the source and magnitude of fecal pollution in water.

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 database will play an integral role in designing field sampling strategies, plotting sample locations, conducting spatial analysis and modeling of analytical data. 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).

Air Quality Studies:

The specific objectives of this study are to investigate,

- 1) How soil pore space and thermal properties indices (pore tortuosity factor, relative gas diffusion coefficient and thermal conductivity, diffusivity and resistivity) relate to greenhouse gas fluxes from soils under agricultural fields, forest and pasture,
 - 2) How pore space indices vary in these soils with different vegetation types,
 - 3) How pore space indices, soil thermal properties (thermal diffusivity, conductivity and resistivity), greenhouse gas fluxes and other dynamic soil properties relate to static soil characteristics such as texture and bulk density in soils under agricultural fields, forest and pasture, and finally
 - 4) How the use of geo-spatial technologies (GPS, GIS and Geostatics) in our sampling strategies improve the estimation of greenhouse gas fluxes, static soil characteristics and dynamic soil properties.1)
- Examine how management, use, and restoration of grasslands affect their biological diversity,

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

The specific objectives of this study are:

1. Study the changes in soil microbial consortia as affected by different surfactants. Knowledge of the natural evolution of microorganisms in the soil will be crucial to successful study of the fate of these chemicals and possible bioremediation design schemes.
2. Determine the effect of different surfactants on plant nutrient uptake. This objective will investigate the possible interactions of surfactants with macro-and micronutrient uptake by plants.
3. Measure the activities of enzymes involved in the cycling of C, N, P and S in the presence of different surfactants. Surfactants can interact with microbial enzyme activity.

Natural Resource Diversity Studies

Objectives of the studies are to

- 1) Examine how management, use, and restoration of grasslands affect their biological diversity,
- 2) Develop recommendations for planting CRP fields which would increase their biological diversity,
- 3) Identify farm practices which would lead to conservation of biological diversity.
- 4) Examine application of Biochar to soil to improve soil fertility and crop production.

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.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1330	2332	499	480

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

Patent Applications Submitted

Year: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	10	10

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
2012	71

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
2012	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
2012	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
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
2012	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
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
403	Waste Disposal, Recycling, and Reuse
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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
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

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	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)

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