

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

**Program # 3**

**1. Name of the Planned Program**

Natural Resources and Environmental Management

Reporting on this Program

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

**1. Program Knowledge Areas and Percentage**

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	12%		12%	
104	Protect Soil from Harmful Effects of Natural Elements	13%		8%	
111	Conservation and Efficient Use of Water	19%		15%	
112	Watershed Protection and Management	10%		7%	
121	Management of Range Resources	5%		7%	
132	Weather and Climate	2%		7%	
141	Air Resource Protection and Management	3%		5%	
205	Plant Management Systems	8%		8%	
511	New and Improved Non-Food Products and Processes	15%		12%	
601	Economics of Agricultural Production and Farm Management	3%		3%	
603	Market Economics	7%		3%	
605	Natural Resource and Environmental Economics	3%		13%	
	<b>Total</b>	100%		100%	

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

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

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	55.0	0.0	23.0	0.0
<b>Actual Paid</b>	50.0	0.0	65.0	0.0
<b>Actual Volunteer</b>	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
967789	0	1426750	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
3295238	0	8136570	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1375170	0	1825915	0

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

### 1. Brief description of the Activity

- Understand the sources, fate, and transport of important water contaminants (i.e., fecal coliform bacteria, nutrients, sediment, and pesticides [especially atrazine herbicide]), and develop and determine the environmental and economic effectiveness of best management practices for these potential contaminants.

- Quantify the environmental and economic effectiveness of best management practices for improving water quality at the watershed level.

- Disseminate science-based information through environmental education programs for both youth and adults, and deliver extension programs aimed at stakeholders that focuses on adoption of best management practices in targeted areas for water quality improvement.

- Develop and test new crop, livestock, bioenergy, and riparian forest systems that will reduce water use while optimizing productivity, environmental quality, and profitability, including water saving technologies for concentrated animal feeding operations (CAFOs) and industries that process agricultural commodities.

- Develop an information and education program for policy makers, producers, water professionals, and youth audiences with respect to the Ogallala Aquifer, including assessment of the potential impacts of climate change on this important water resource.

- Develop an understanding of air quality impacts of rangeland burning, including extent and timing of burn events, influence of fuel load on emissions, modeling the downwind transport of particulate matter, and developing a climatology of extreme events.

- Disseminate science-based information and transfer technologies to stakeholders, and implement youth education programs focused on air quality.

- Disseminate science-based information regarding the sustainability of biofuel production and processing.

- Develop new processes to modify agricultural-based materials into higher value products.

- Develop resources and pathways to increase climate literacy.

- Provide decision tools for adaptive best management practices that address the effects of climate change.

### 2. Brief description of the target audience

- Agricultural producers, youths, policymakers/regulators, crop and livestock consultants.
- Growing industry based on bioprocessing and bioconversion, including the existing ethanol and biofuels industry.
- International grain processors.

- Industrial products manufacturers: adhesives, composites, bio-based chemicals, solvents and lubricants.
- Entrepreneurs and investors seeking to enter this industry.
- Audiences whose production systems will be influenced by climate change, as well as those who consult or influence the decision-makers of these producers. Secondary audiences will be decision-makers and leaders responsible for preparing communities for change (e.g., state and local elected officials, environmental groups).

**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
<b>Actual</b>	13650	0	1785	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
<b>Actual</b>	16	12	28

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

**Output Target**

**Output #1**

**Output Measure**

- Number of educational programs delivered

<b>Year</b>	<b>Actual</b>
2014	420

**Output #2**

**Output Measure**

- Number participating in educational programs

<b>Year</b>	<b>Actual</b>
2014	12500

**Output #3**

**Output Measure**

- Number of refereed research publications

<b>Year</b>	<b>Actual</b>
2014	20

**Output #4**

**Output Measure**

- Number of presentations at national and international conferences

<b>Year</b>	<b>Actual</b>
2014	16

**Output #5**

**Output Measure**

- Number of workshops, web-based curricula, and field days/tours related to climate change  
Not reporting on this Output for this Annual Report

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Producers adopt BMPs that protect environmental quality (measured by number adopting BMPs)
2	Producers adopt BMPs for atrazine and soil erosion (measured by number of acres)
3	Measurable improvement in water quality (percent reduction atrazine) in Little Arkansas River Watershed
4	Improve utilization of biological raw materials as bioconversion substrates (measured by number of new processes developed).
5	An enhanced or improved economy as a result of bioenergy development (measured by number of new bio-based businesses created)
6	Improved environmental conditions through sustainable biofuel production and utilization (measured by: gallons biofuel; gallons of cellulosic ethanol; gallons of biodiesel . . . produced in KS)
7	Improved environmental conditions through sustainable biofuel production and utilization (measured by: PPM OF CO2 in atmosphere; water quality; average temperature during year)
8	Agricultural/natural resource producers, and/or business representatives modify existing practices or technologies and/or adopt new practices to protect/enhance natural resources and/or enhance biodiversity (Measured by # documented)
9	Development of new knowledge and technologies (Measured by percentage of participants who increase knowledge of management practices under climate variability and change)
10	Improve climate mitigation strategies and their adoption (Measured by number of farms and landowners reducing carbon and energy footprints)

**Outcome #1**

**1. Outcome Measures**

Producers adopt BMPs that protect environmental quality (measured by number adopting BMPs)

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2014	78

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

**Issue (Who cares and Why)**

Kansas ranks first in the nation in grain sorghum production for grain and second in sorghum silage production. Since 2010, grain sorghum acreage has increased 33 percent.

**What has been done**

Programs at four in-depth sorghum schools across the state in February 2014 focused on the latest sorghum grain and forage production research and resulted in an eight-page extension publication, Kansas Sorghum Management 2014 (MF3046).

**Results**

Conservative estimates indicate that program attendees represented management of greater than 200,000 acres. Eighty-two percent indicated the information they received would influence their management decisions. The sorghum schools provided education for a diverse group. One irrigator said he gained valuable information about water application timing.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
141	Air Resource Protection and Management

## **Outcome #2**

### **1. Outcome Measures**

Producers adopt BMPs for atrazine and soil erosion (measured by number of acres)

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

- 1862 Extension
- 1862 Research

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

Change in Action Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	17984

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

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

The project goal is to assist farmers to voluntarily implement atrazine herbicide best management practices (BMPs) to meet surface water quality standards of 3 µg/L, with no seasonal spikes. A decision was made to target specific sub-watersheds within the Little Arkansas River watershed in order to document water quality improvements.

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

Four watersheds within the Little Arkansas River watershed were targeted for implementation of BMPs for atrazine herbicide. Atrazine runoff vulnerable fields outside of the four targeted watersheds were also made eligible for incentive payments. Corn and grain sorghum fields were targeted.

#### **Results**

Farmers committed to implementing atrazine BMPs on 17,984 acres of corn and grain sorghum.

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

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

141 Air Resource Protection and Management

### **Outcome #3**

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

Measurable improvement in water quality (percent reduction atrazine) in Little Arkansas River Watershed

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

- 1862 Extension
- 1862 Research

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

Change in Condition Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	71

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

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

The project goal is to assist farmers to voluntarily implement atrazine herbicide best management practices (BMPs) to meet surface water quality standards of 3 µg/L, with no seasonal spikes. A decision was made to target specific sub-watersheds within the Little Arkansas River watershed in order to document water quality improvements.

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

Four watersheds within the Little Arkansas River watershed were targeted for implementation of BMPs for atrazine herbicide. Atrazine runoff vulnerable fields outside of the four targeted watersheds were also made eligible for incentive payments.

##### **Results**

Atrazine BMP implementation was predicted to reduce atrazine runoff by 71% on 17,984 acres and a total load reduction of 1015 lbs a.i. in targeted acres.

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

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

## **Outcome #4**

### **1. Outcome Measures**

Improve utilization of biological raw materials as bioconversion substrates (measured by number of new processes developed).

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

- 1862 Research

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

Change in Action Outcome Measure

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

<b>Year</b>	<b>Actual</b>
2014	3

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

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

The U.S. consumes more than 140 billion gallons of transportation fuels annually. Due to finite reserves, non-uniform distribution, and volatile prices of fossil fuels, renewable fuels from biomass could make a significant contribution toward a more sustainable future. Recent legislation has called for this nation to annually produce 36 billion gallons of renewable fuel by 2022 to help offset impending concerns over climate change and energy security. Such targets have implications of national security, economic development, and sustainable practices for the future.

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

Both fundamental and applied research has been conducted in the area of biofuel production. Key projects include 1) grain sorghum, sorghum biomass and sweet sorghum as a viable renewable resource for biofuels; 2) Impact of water availability on grain quality; 3) potential of big bluestem for biofuel production; 4) pelleting biomass to increase cellulosic ethanol production; 5) syntheses of acid functionalized nanoparticles for hydrolysis and pretreatment of lignocellulosic biomass; and 6) pyrolysis of biomass for bio-oil and bio-char production.

#### **Results**

Our main results include: 1) further confirmed that waxy sorghum is an excellent feedstock for bioethanol production with low energy input; 2) developed a new method to increase biofuel yield from photoperiod sensitive sorghum through utilizing both soluble sugars and cellulose; 3) identified the effects of biomass pelleting on composition change and biofuel yield; 4) improved the performance of acid-functionalized nanoparticles for biomass pretreatment and hydrolysis; and 5) evaluated the potential of big bluestem for biofuel production. As research results, we published 17 peer reviewed papers and presented 9 meeting papers.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

##### Outcome #5

###### 1. Outcome Measures

An enhanced or improved economy as a result of bioenergy development (measured by number of new bio-based businesses created)

Not Reporting on this Outcome Measure

##### Outcome #6

###### 1. Outcome Measures

Improved environmental conditions through sustainable biofuel production and utilization (measured by: gallons biofuel; gallons of cellulosic ethanol; gallons of biodiesel . . . produced in KS)

Not Reporting on this Outcome Measure

##### Outcome #7

###### 1. Outcome Measures

Improved environmental conditions through sustainable biofuel production and utilization (measured by: PPM OF CO2 in atmosphere; water quality; average temperature during year)

Not Reporting on this Outcome Measure

##### Outcome #8

###### 1. Outcome Measures

Agricultural/natural resource producers, and/or business representatives modify existing practices or technologies and/or adopt new practices to protect/enhance natural resources and/or enhance biodiversity (Measured by # documented)

Not Reporting on this Outcome Measure

### **Outcome #9**

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

Development of new knowledge and technologies (Measured by percentage of participants who increase knowledge of management practices under climate variability and change)

Not Reporting on this Outcome Measure

### **Outcome #10**

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

Improve climate mitigation strategies and their adoption (Measured by number of farms and landowners reducing carbon and energy footprints)

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
- Other (Educational funding)

#### **Brief Explanation**

{No Data Entered}

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

#### **Evaluation Results**

Faculty engaged in Outcomes 5-8 on sabbatical at this time.

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