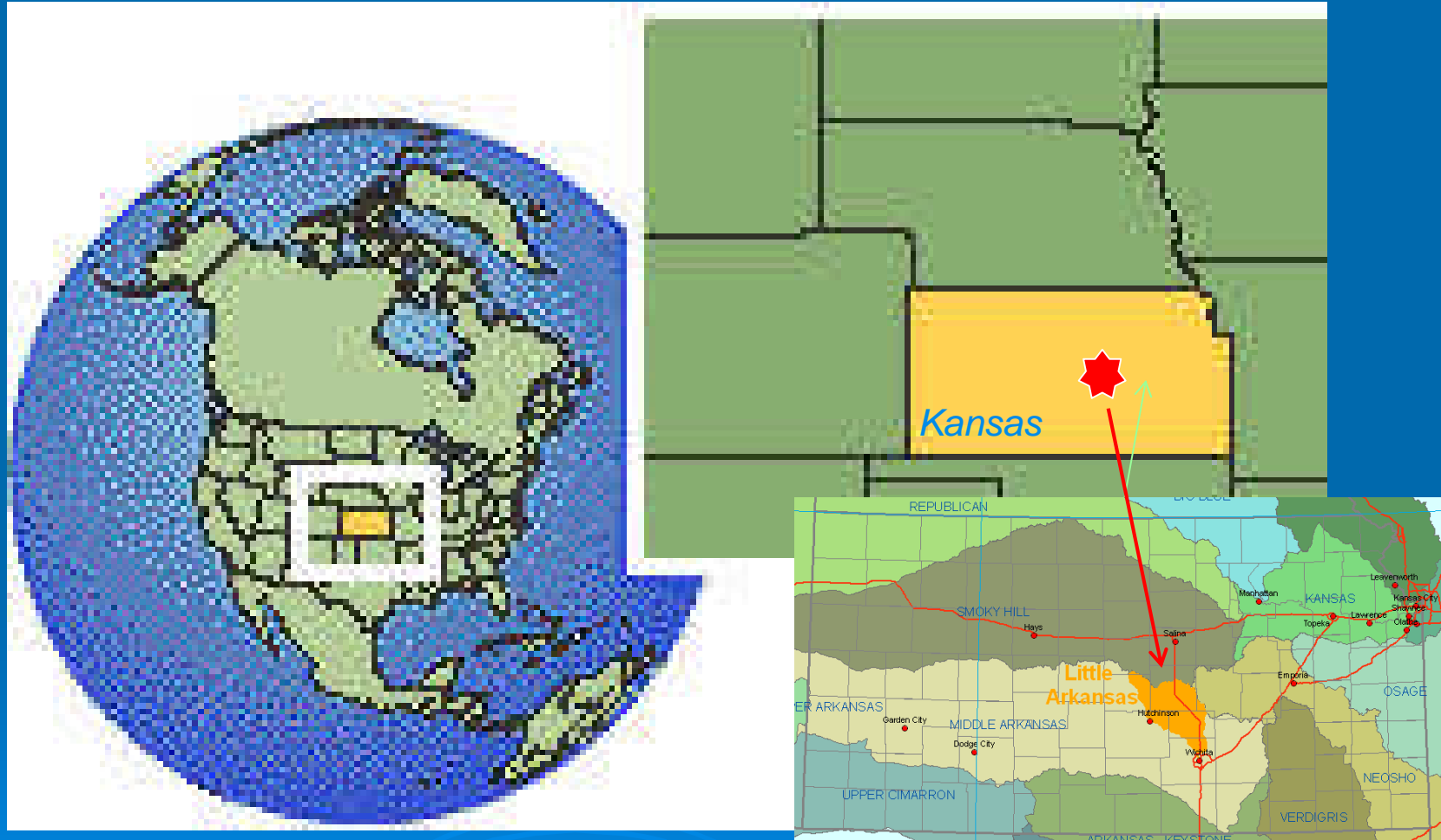


Implementing Practices to Improve Water Quality in an Agricultural Watershed in the Central United States



Daniel Devlin, Kyle Mankin, Philip Barnes, and Ron Graber
Kansas State University
Manhattan, Kansas USA

Little Arkansas River Watershed



Little Arkansas River Watershed

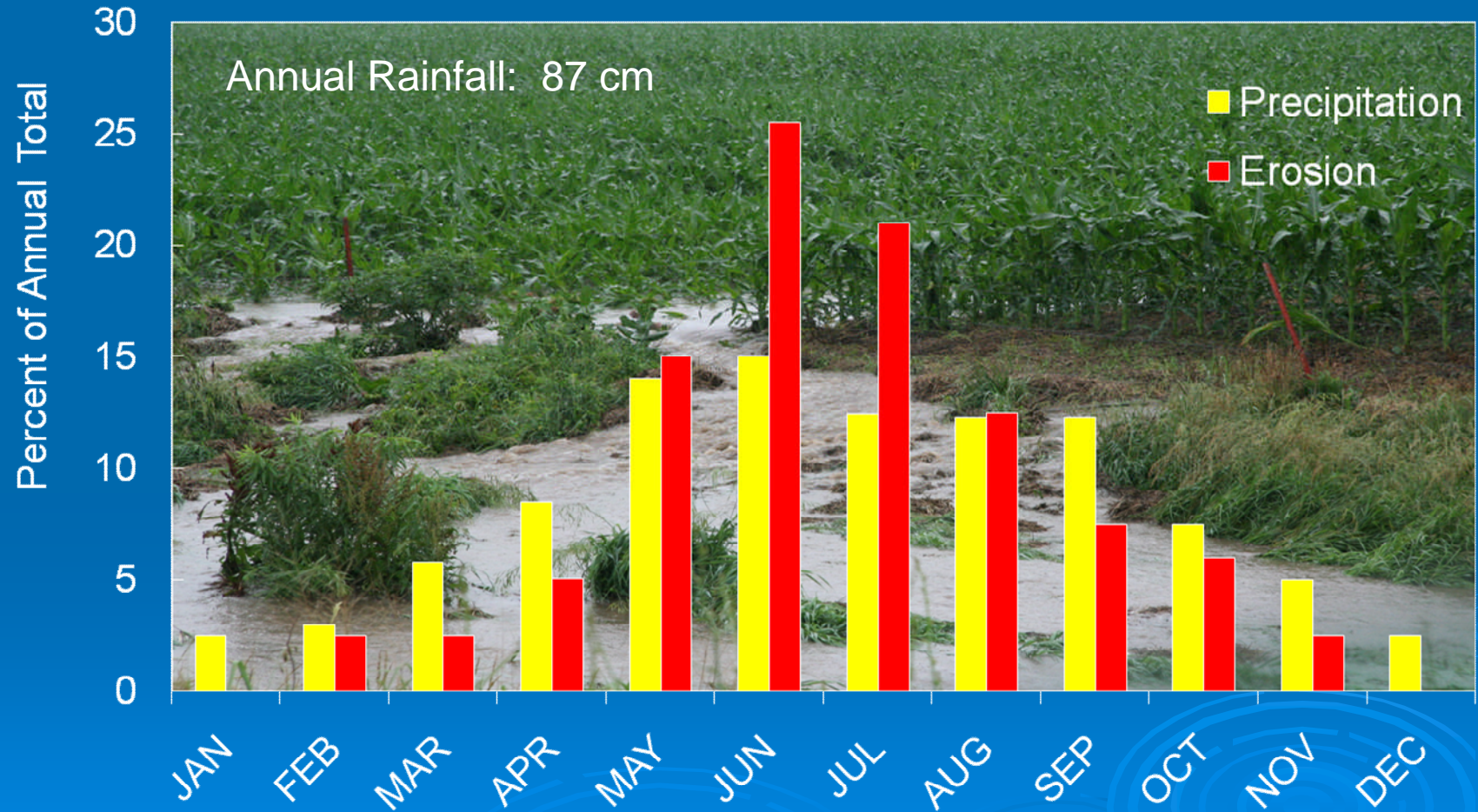


Little Arkansas River Watershed

- Agricultural watershed
 - 369,652 ha (913,430 acres)
 - 78% cropland
 - 19% grazingland
- Water quality concerns include bacteria, nutrients, sediments, and pesticides (atrazine herbicide)
- Drinking water source for city of Wichita and numerous smaller cities and towns
- Source for aquifer recharge



Monthly Precipitation and Erosion



Little Arkansas River Watershed



Watershed Restoration and Protection Strategy

Final Draft Plan September 2010

Funding for the development of this plan was provided through an EPA 319 grant from the Kansas Department of Health and Environment.



Little Arkansas Watershed WRAPS Implementation Goals

- Reduce atrazine herbicide runoff
- Reduce nutrient and sediment runoff
- Reduce fecal coliform bacteria in surface waters

***To Meet Water
Quality Standards***

KSU Worked with Stakeholders to Develop a Research, Education, and Implementation Project

- Wanted to target.
- Wanted to document water quality success.

Project Overview

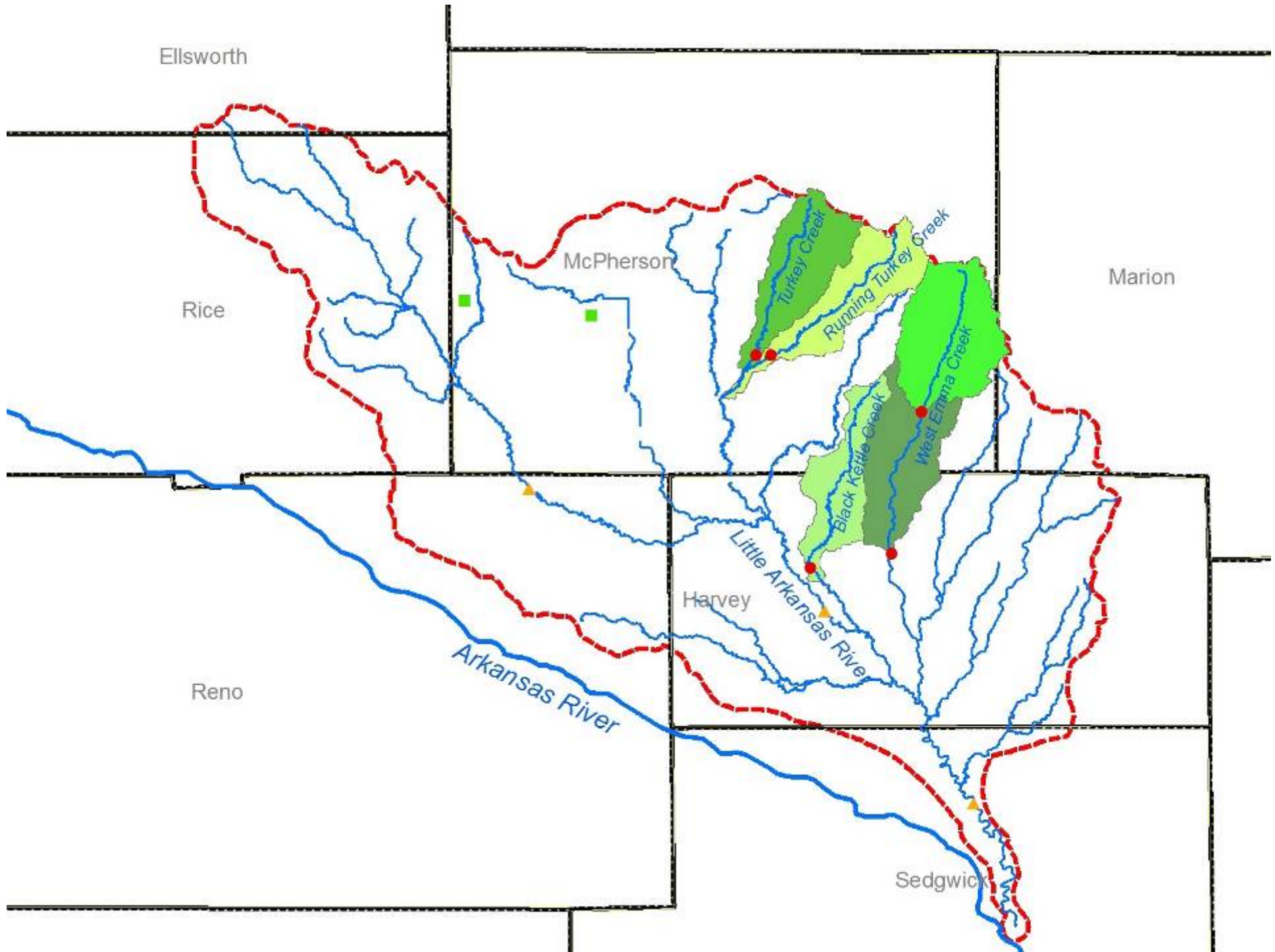
- Stream geomorphologic assessment on targeted streams to assess stream condition and sediment sources.
- Watershed modeling is being used to estimate the extent of target-BMP implementation to achieve measurable changes in water quality.
- Economic analysis is being conducted to determine the impact on net return per acre associated with potential improvements in water quality.

Project Overview

- Biomonitoring on targeted streams.
- Research/demonstration program to evaluate BMPs.
- Education and information.
- BMP implementation – pesticide (atrazine herbicide), sediments and nutrients.
- Automated and grab sample water quality monitoring system established throughout watershed to evaluate success.

Atrazine BMP Implementation

- Focused on reducing atrazine herbicide runoff from corn (2007-2010) and grain sorghum (2006-2010) fields.
- Targeted three (2006), five (2007) and six (2008, 2009, 2010) watersheds for rapid implementation of atrazine herbicide BMPs (approx. 10,000 ha watersheds).
- Installed automated water quality monitoring stations at the base of the targeted watersheds and two adjoining watersheds – “paired watersheds.”



Elements of Pesticide BMP Implementation

- Developed and delivered educational meetings to farmers and pesticide dealers.
- Research/demonstrations of BMPs on farmer fields
- Incentive payments for atrazine BMP adoption.
- Met one-on-one with farmers in targeted watersheds.
- Evaluated progress.

Educational Meetings

- Trained crop consultants and pesticide dealers.
- Trained farmers.
- Atrazine BMPs publication.

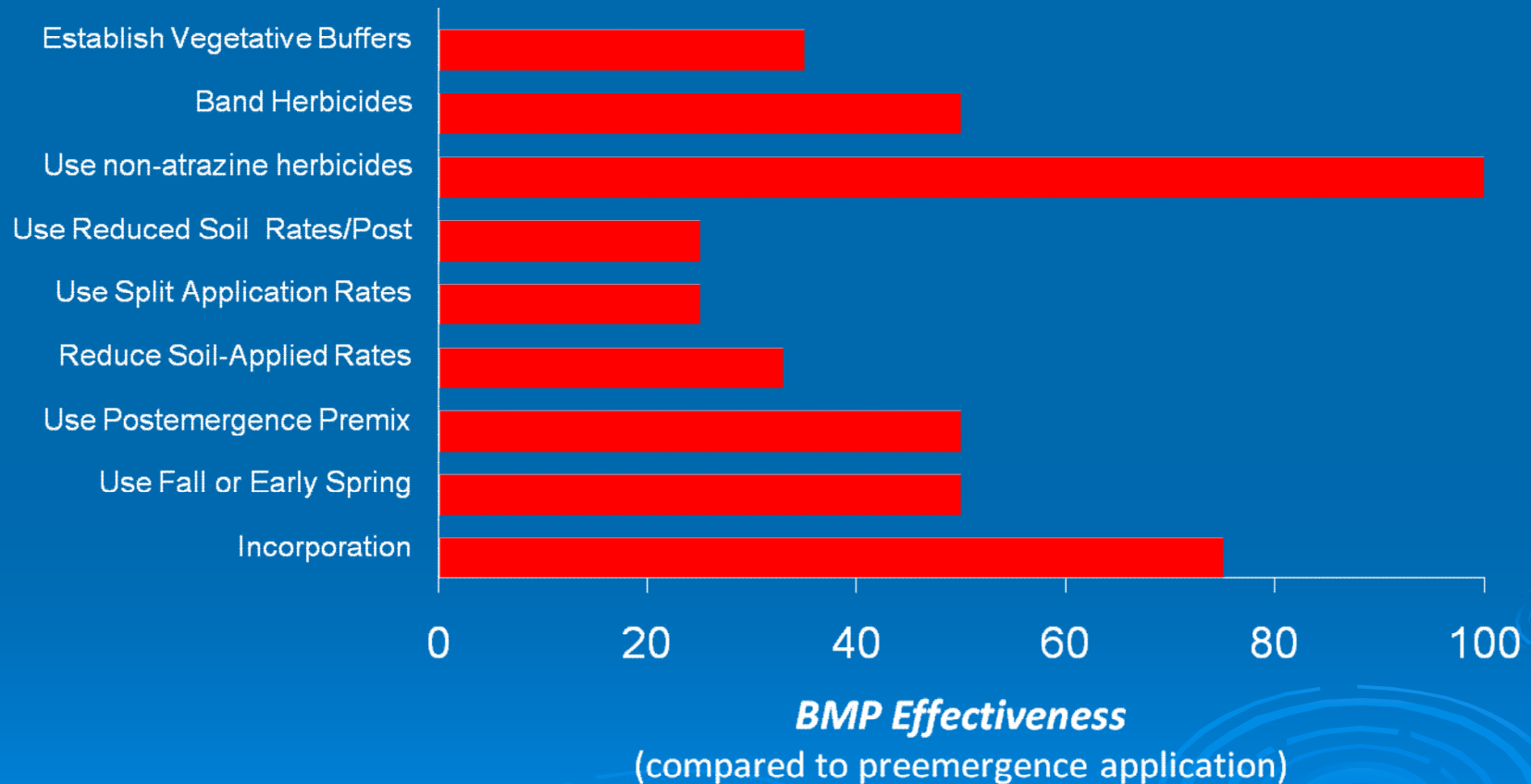


Research/Demonstration of BMPs on Farmer Fields

- Three locations.
- Demonstrated BMPs for pesticides, sediments, and nutrients.
- Automated water quality monitoring equipment installed to evaluate effectiveness.
- Tours.



Atrazine BMP Effectiveness



Atrazine BMP Incentive Program

- Incentive \$ program developed for atrazine BMPs - \$20,000 (2006), \$40,000 (2007), \$50,000 (2008) and \$80,000 (2009, 2010).
- Had an agronomist meet one-on-one with farmers in the targeted watersheds. Our goal was to have 50 (2006), 70 (2007), and 100 (2008-2010) farmers adopt BMPs.
- Farmers signed up for program in the field. Payments based on level of protection.





Atrazine Herbicide Best Management Practice
2008 Program Incentive Worksheet

Name _____

WI 0191

Address _____

Telephone: _____

Field(s) Legal Description _____

Crop Planted _____ Tillage System (no tillage, conventional, reduced)

Atrazine BMPs Utilized (Check all that apply)

Reduction in
Runoff Factor

- Incorporate atrazine into the first 2 inches of soil prior to planting .70
- Apply atrazine in the fall or prior to April 15 .50
- Apply atrazine as part of a postemergence premix .50
- Reduce soil-applied atrazine rates based on 1.6# rate —
- Use split applications of atrazine, e.g. 2/3 prior to April 15 and 1/3 at planting .25
- Band apply atrazine at planting .50
- Use no atrazine 1.00
- Established Buffer Strip .25
- Incorporate atrazine with 1/2" sprinkler irrigation 60

TOTAL ATRAZINE BMP RUNOFF EFFECTIVENESS (TABRE) _____

Add Reduction in Runoff Figure

- Grain Sorghum \$8.00
- Corn \$4.00

Incentive Payment Per Acre \$_____ X TABRE \$_____

Erosion Factor Extreme & Very High x 1.1 \$_____ x 1.1 = \$_____

TOTAL FIELD PAYMENT

_____ Acres X \$_____ Incentive Payment Per Acre = \$_____

Landowner/Operator _____ Date _____

Conservation District Representative _____ Date _____

Operator Signature That Practice completed _____ Date _____



Atrazine BMP Implementation Results

- Visited one-on-one with 50 (2006), 77 (2007), 100 (2008), 135 (2009), and 122 (2010) farmers.
- 41 (2006), 74 (2007), 95 (2008, 2009) and 114 (2010) farmers committed to implementing atrazine BMPs.

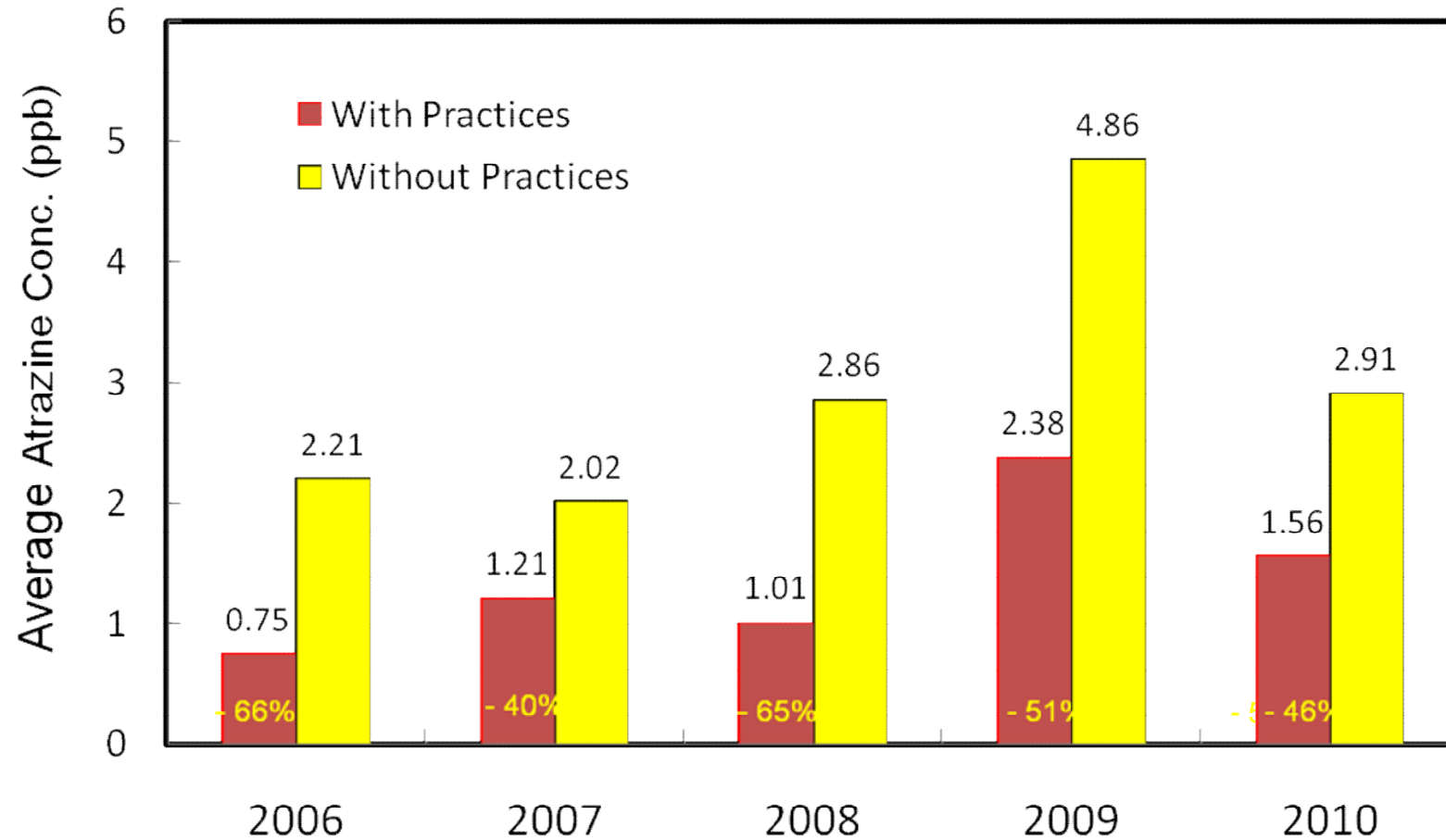
Atrazine BMP Implementation Results

- (2006) 4,792 acres of corn and grain sorghum had BMPs implemented.
- (2007) 10,512 acres of corn and grain sorghum had BMPs implemented.
- (2008) 14,991 acres of corn and grain sorghum had BMPs implemented.
- (2009) 23,178 acres of corn and grain sorghum had BMPs implemented.
- (2010) 24,992 acres of corn and grain sorghum had BMPs implemented.

Percent Corn and Grain Sorghum Acres with Atrazine BMP Implementation in Targeted Watersheds

<u>2006</u>	<u>2007</u>	<u>2008</u>	<u>2009</u>	<u>2010</u>
37%	40%	51%	44%	49%

Atrazine Herbicide Concentrations in Surface Water in Watersheds With and Without BMP Implementation



Summary

- A watershed plan was developed for the watershed.
- Watersheds were targeted for rapid implementation of pesticide and sediment/erosion BMPs.
- Research/demonstration BMP sites were established on farmer fields.
- An education program taught BMPs to farmers and consultants.
- An incentive program to encourage BMP implementation was developed and funded.

Summary

- An agronomist met one-on-one with farmers.
- Farmers implemented atrazine herbicide BMPs on 76,517,525 acres over the 5-year project. This equated to approximately 50% of the crop acres.
- Atrazine herbicide concentrations in surface waters in the targeted watersheds were reduced by an average of 56%.

Summary

Sediment/Nutrient Management BMP Results

25 landowners/operators in Black Kettle Creek Watershed have committed to implementing soil erosion/sediment delivery BMPs on 138 crop fields (4,810 acres), resulting in annual reduction in sediment delivery to streams in the watershed from 9,219 tons to 2,926 tons.



Kansas State University
Research and Extension

*“Knowledge
for Life”*

Project Funding

- USDA CSREES 406 Project, “Measuring success of a TMDL implementation plan: land, stream, and economic responses to targeted stakeholder actions”
- EPA 319 Project, “Little Arkansas River Watershed Restoration and Protection Strategies”
- City of Wichita, Kansas
- Kansas State Conservation Commission

Form Used Calculate Incentive Payment - 2006

<u>Atrazine BMPs Utilized</u> (Check all that apply)	<u>Reduction in Runoff Factor</u>
<input type="checkbox"/> Incorporate atrazine into the first 2 inches of soil prior to planting	.70
<input type="checkbox"/> Apply atrazine in the fall or prior to April 15	.50
<input type="checkbox"/> Apply atrazine as part of a postemergence premix	.60
<input type="checkbox"/> Reduce soil-applied atrazine rates to 1 lb ai/acre or less	.33
<input type="checkbox"/> Use split applications of atrazine, e.g. 2/3 prior to April 15 and 1/3 at planting	.25
<input type="checkbox"/> Band apply atrazine at planting	.50
<input type="checkbox"/> Use no atrazine	1.00

TOTAL ATRAZINE BMP RUNOFF EFFECTIVENESS (TABRE) _____
 Add Reduction in Runoff Figure

Incentive Payment Per Acre \$6.00 X TABRE \$ _____
 (Maximum payment per acre \$6.00)

TOTAL FIELD PAYMENT
 _____ Acres X \$ _____ Incentive Payment Per Acre = \$ _____

Atrazine BMPs Implemented

<i>Best Management Practice</i>	<i>Percent of Total Atrazine BMPs</i>			
	(2006)	(2007)	(2008)	(2009)
<i>Preplant incorp.</i>	15	18	9	6
<i>Early application</i>	17	15	8	21
<i>Postemergence application</i>	3	8	9	5
<i>Reduce soil-applied rates</i>	10	43	52	42
<i>Alternative crop</i>	38	---	---	---
<i>Combination of early application and reduced soil applied rate</i>	18	3	9	7
<i>No atrazine applied</i>	.1	12	13	20

Equus Beds Aquifer—Artificial Recharge Process



Project Overview

- **Goal is to reduce soil erosion/sediment delivery from agricultural lands in the Black Kettle Watershed.**
- **Innovative is to target high contributing fields and use a market-based approach.**
- **\$270,000 in incentive payments. Requires 100% match. Subcontracts for \$135,000 for both Harvey and McPherson County Conservation Districts.**

Overall Objective

- **To reduce sediment transport to surface water in the Little Arkansas River Watershed.**
- **To reduce sediment concentrations by 25% at the base of Black Kettle Creek watershed.**

Mechanics

- **Assess all crop fields and pastures within the watershed for potential soil erosion and sediment delivery.**
- **Rank fields from most to least vulnerable for erosion and sediment delivery.**
- **Design a set of incentives for BMPs that will result in BMPs being implemented in the most vulnerable fields.**

Mechanics

- **In-field signup similar to atrazine BMP program.**
- **Estimate reduction in soil erosion and sediment delivery.**
- **Use surface water monitoring to determine outcomes.**

Current Status

- **Conducted field assessment.**
- **Developed and used modified SWAT modeling.**
- **Estimated soil erosion and sediment delivery from every field in Black Kettle Creek watershed.**
- **Held several landowner/operator meetings.**
- **Landowners/operators committed to installing practices and contracts signed.**
- **Landowners/operators installing practices.**
- **Surface water monitoring.**

