

# SWAT Modeling for Subwatershed Prioritization



**Presented by:  
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M. Leh**

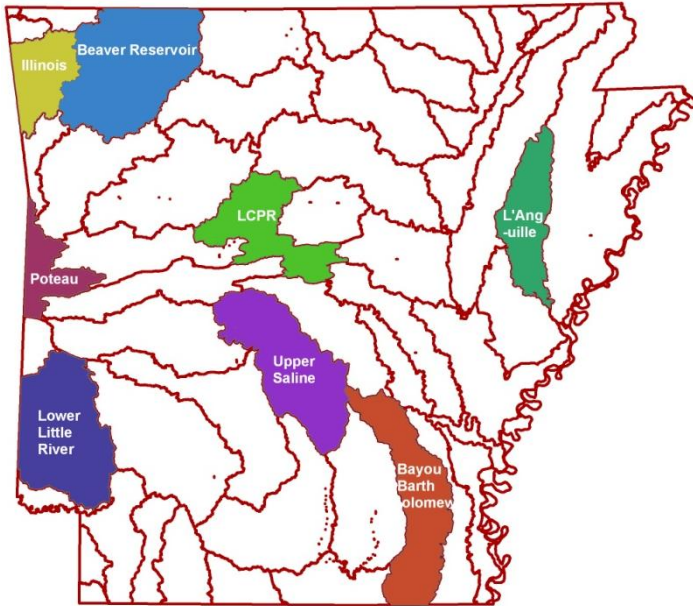
**Reviewed by:  
U of A Division of Agriculture  
Environmental Task Force**

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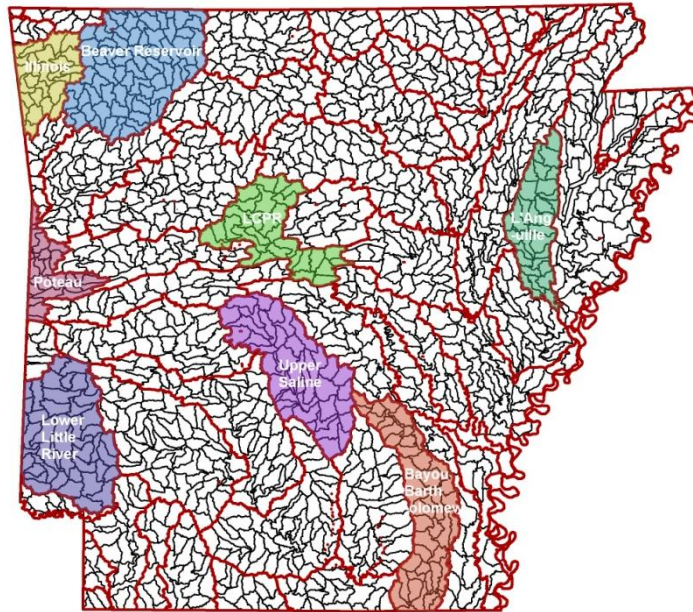
**2010 Non Point Source Project Review Meeting, September 22**

# MODELING OBJECTIVE

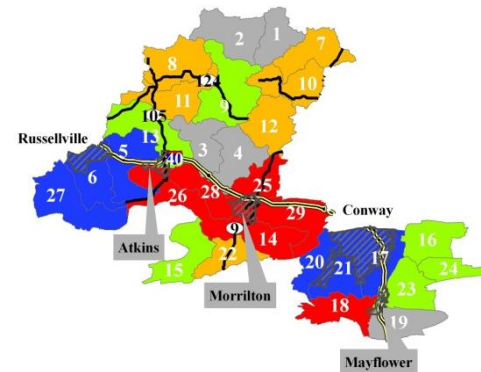
**Assess relative risk of 12- digit HUC sub-watersheds**



**Priority Watersheds**

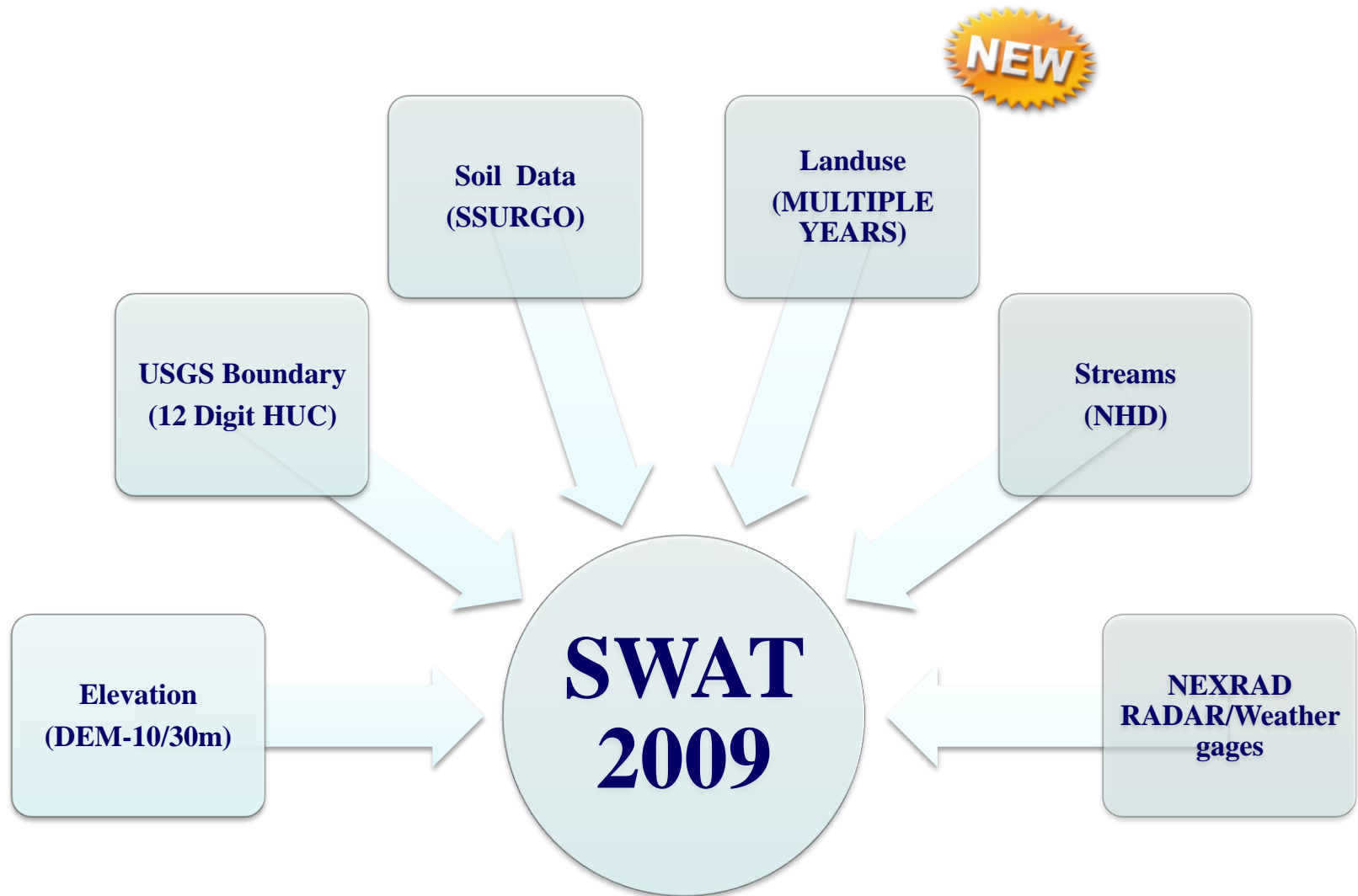


**12-digit HUC**



**12-digit HUC Priority**

# MODELING INPUTS- SPATIAL DATA



# MODELING INPUTS- TABULAR DATA

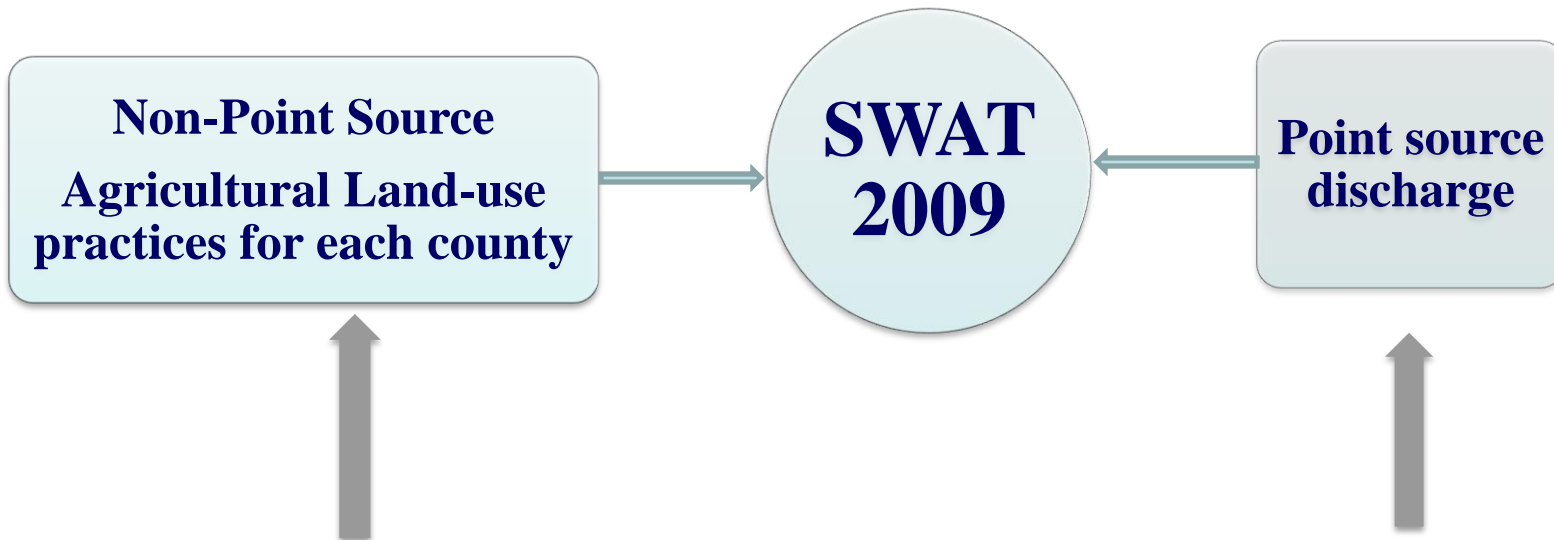


Table 3. Soil test results from RRVP fields and fertility recommendations

County	Soil pH	P LB/A	K LB/A	Zn LB/A	Nitrogen Rate Urea (45%) <sup>1</sup>	Total N Rate/A	Fertilizer P-K- Zn <sup>2</sup>
Arkansas	7.5	27	99	1.4	23-230-100	158	60-90-20
Chicot	6.1	20	605	4.4	300-100	180	60-0-0
Craighead 1	7.2	49	199	5.6	23-230-100	158	40-60-5
Craighead 2	6.8	44	221	5.3	23-230-100	158	40-60-5
Desha	7.4	18	358	4.8	300-100	180	46-0-0
Independence	5.3	72	204	4.9	260-100	162	74-111-0
Jackson	6.0	20	266	17.2	230-100	149	23-0-0
Lawrence	5.7	16	124	3.6	230-100	149	20-90-5
Lincoln	7.1	20	452	4.9	300-100	180	46-0-0
Mississippi	5.8	67	322	7.2	27-300-100	192	69-0-0
Poinsett	6.6	39	293	6.5	300-150	202	60-0-0

<sup>1</sup> Flushed in 2 leaf-preflood-midseason

<sup>2</sup> P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O-Zn includes seed treatments

## Average daily loadings for:

- ❖ water,
- ❖ sediment,
- ❖ ammonia,
- ❖ Carbonaceous biochemical oxygen demand
- ❖ dissolved oxygen and
- ❖ phosphorus

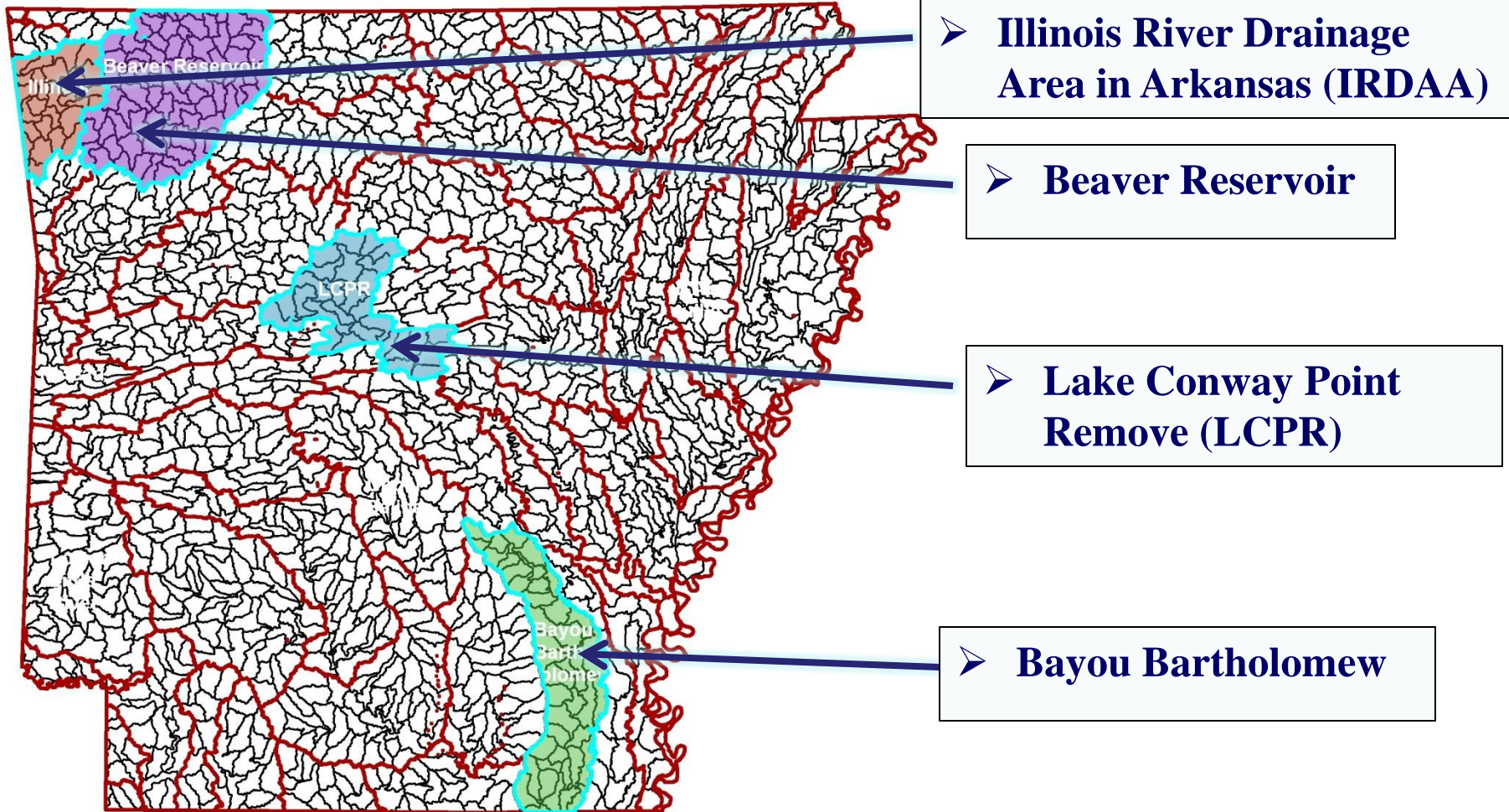
# MODEL EVALUATION PROTOCOL

## **Six components of model evaluation:**

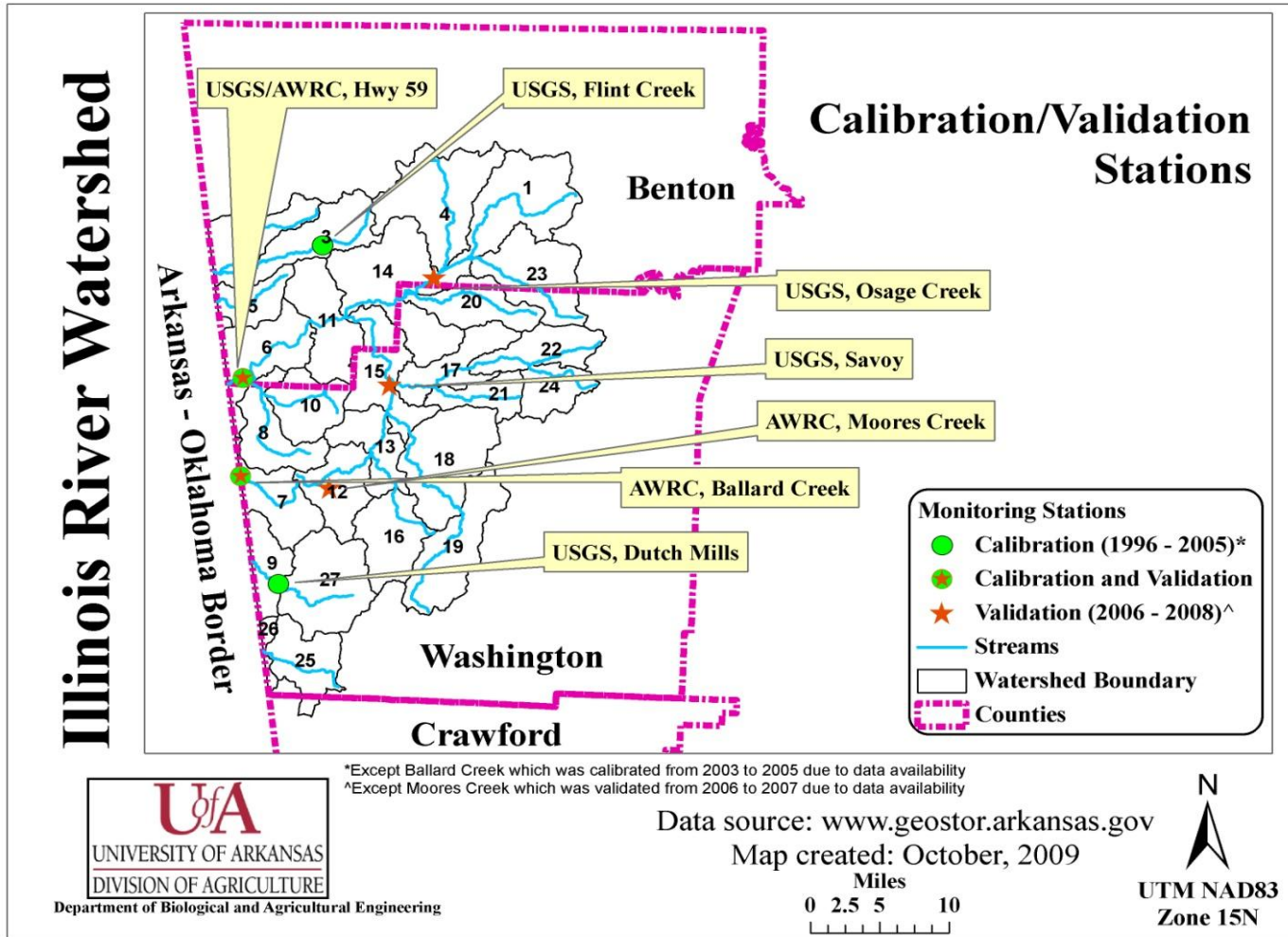
- **Model examination**
- **Algorithm examination**
- **Data evaluation: quality of data**
- **Sensitivity analysis: highest influence**
- **Validation: system performance**
- **Uncertainty analysis (recent trends)**

(Source: American Society for Testing and Materials, 1984)

# CASE STUDY



# CALIBRATION/VALIDATION



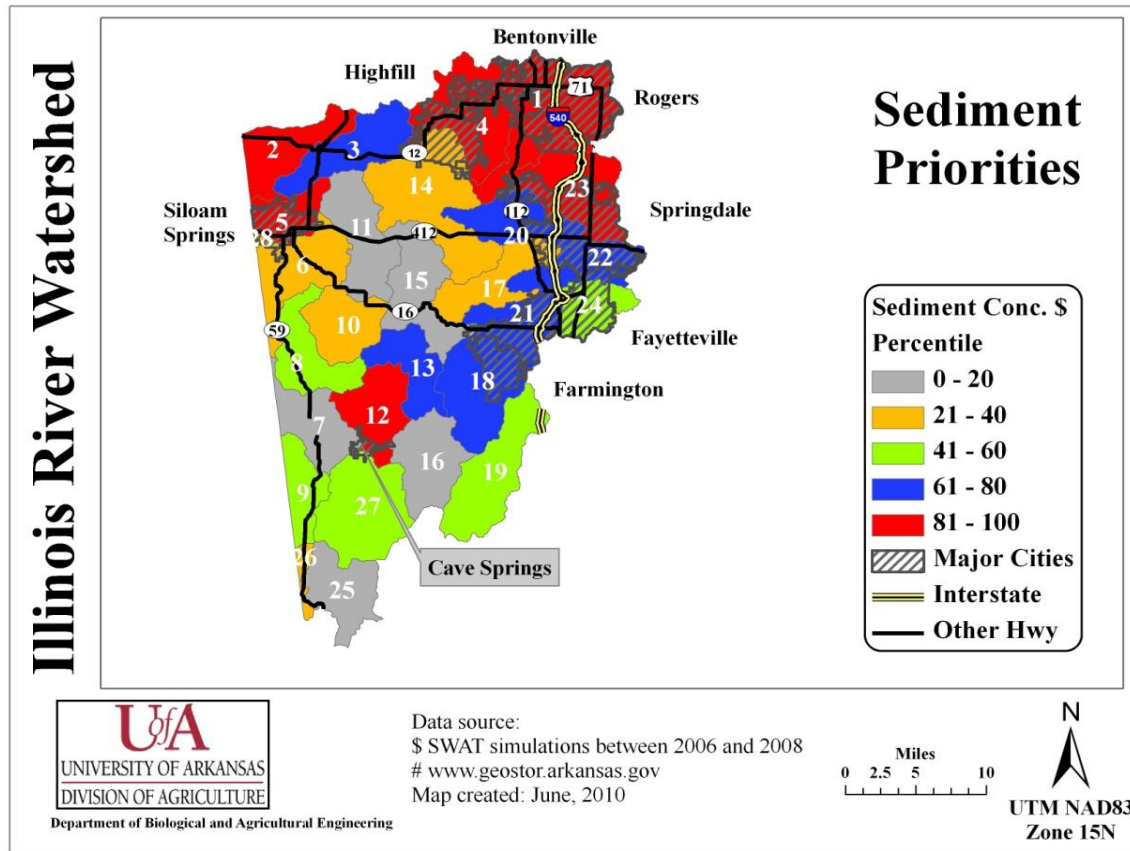
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**Subwatershed#16- ~44%, (80%) #19- ~60% (~89%),  
#18- 24% (~65%)**

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# SUBWATERSHED IDENTIFICATION

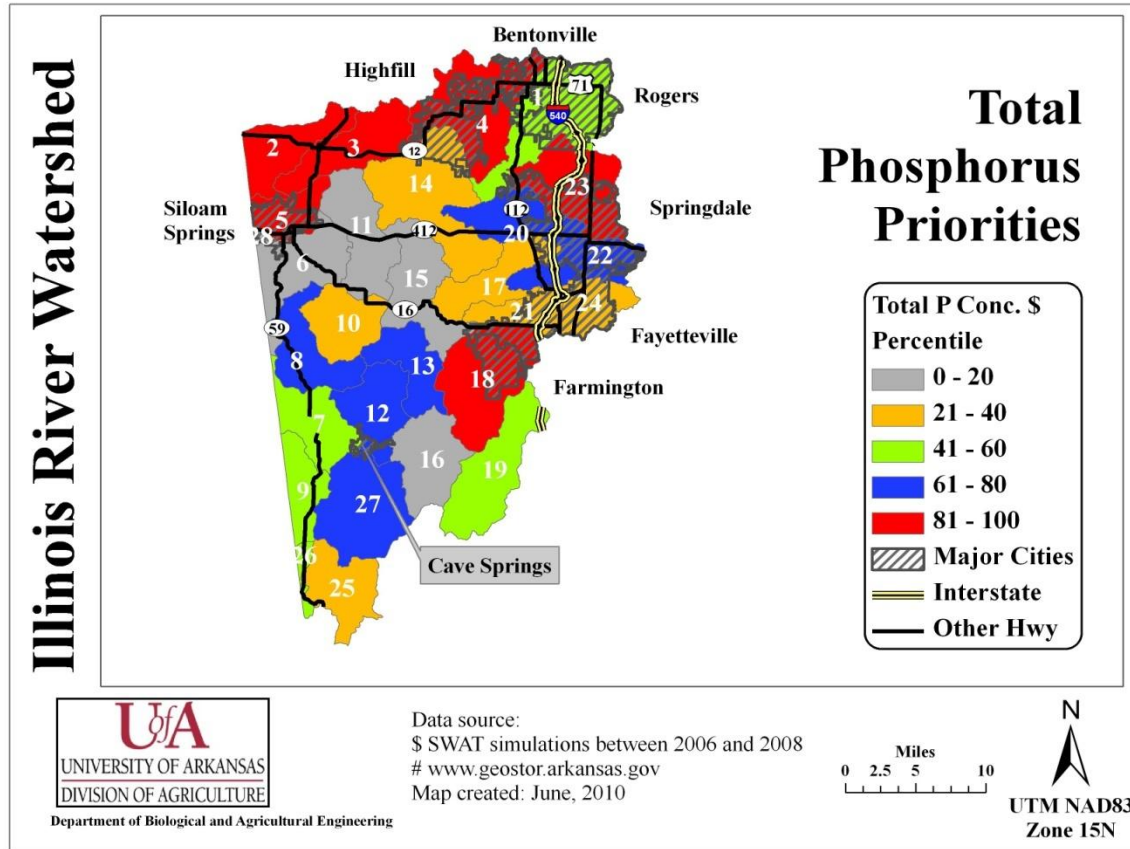
## Percentile Approach – Sediment, TP, NO3-N





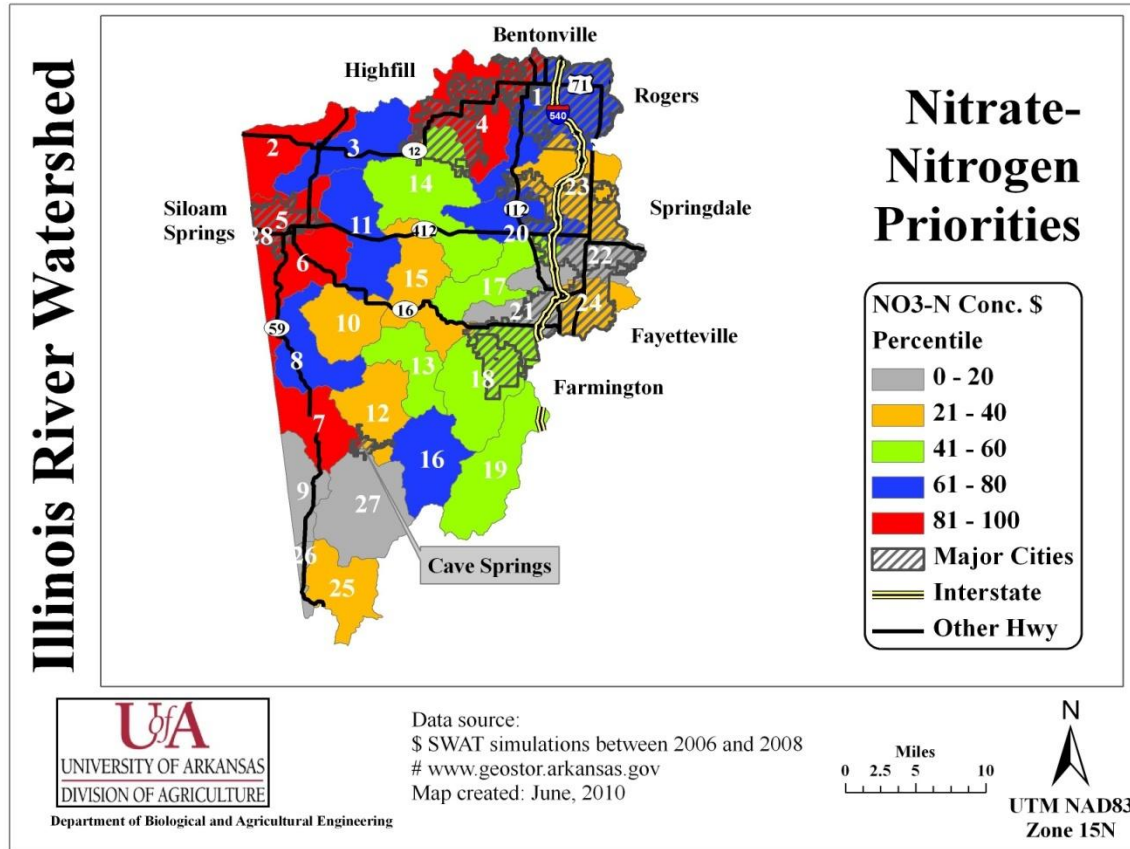
# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, NO3-N



# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, NO3-N



# MODEL SETUP

**Model:** SWAT2009

**Delineation:** USGS 12-digit HUC

**DEM:** 30 m

**Soil:** SSURGO

**Land Use:** 1992, 1999, 2001, 2004,  
and 2006

**Subwatersheds:** 76

**HRUs:** 2199

(5% land use, 10% soil type, 0% slope)

**Ponds:** 6100 (4857 acres)

**Study Period:**

**Calibration:** 1996-2005 (2003-2005)

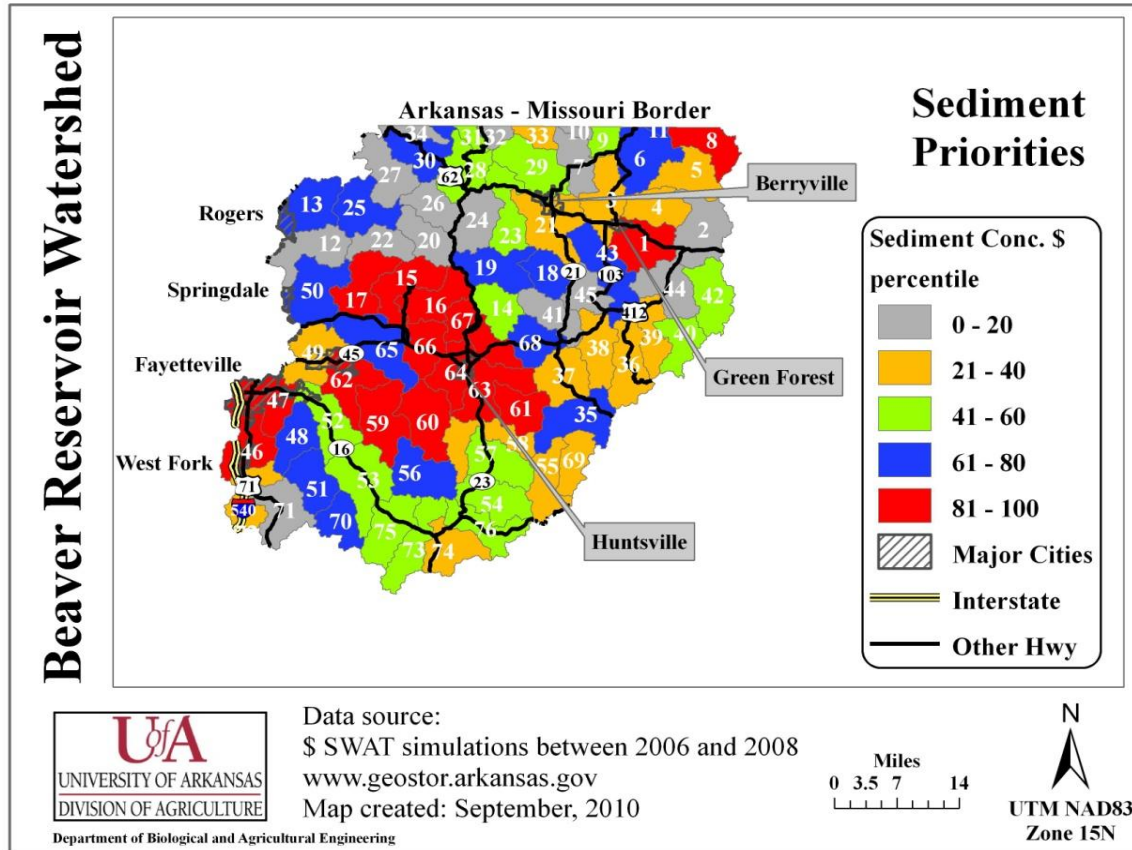
**Validation:** 2006-2008

**Point Sources:** 23



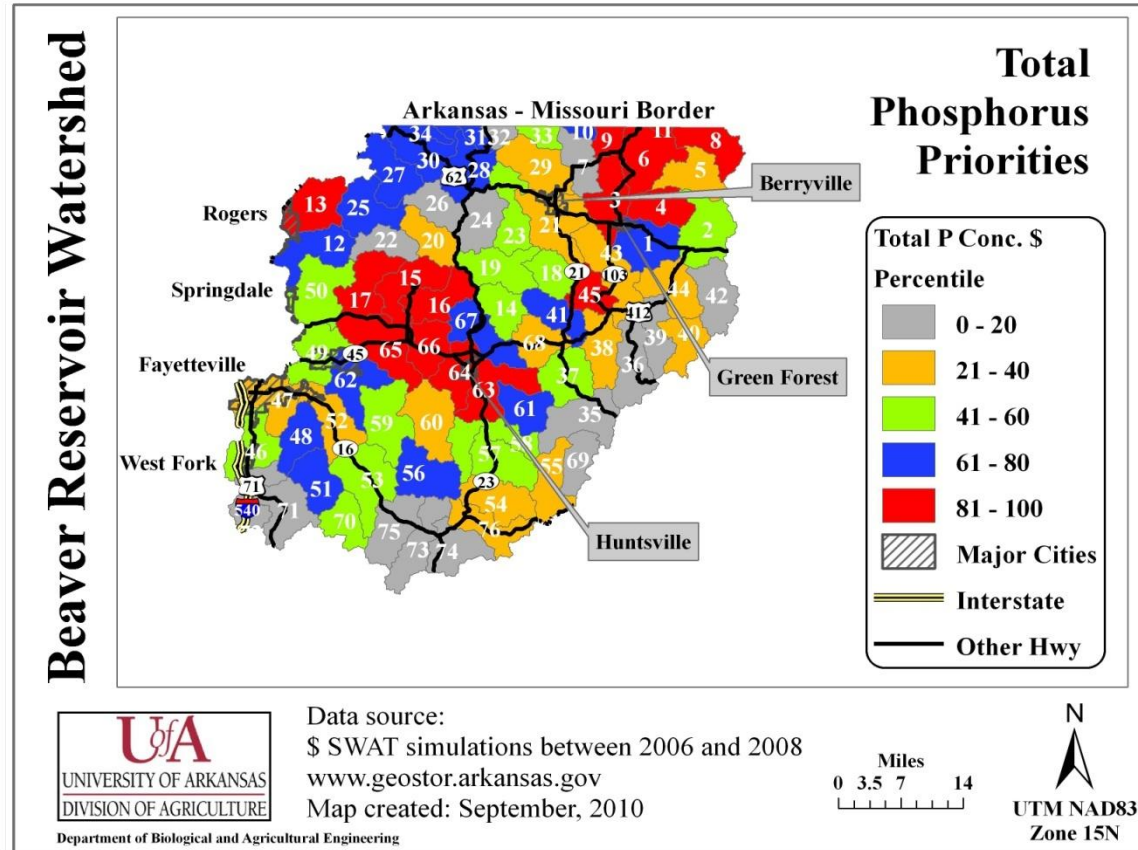
# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, and NO3-N



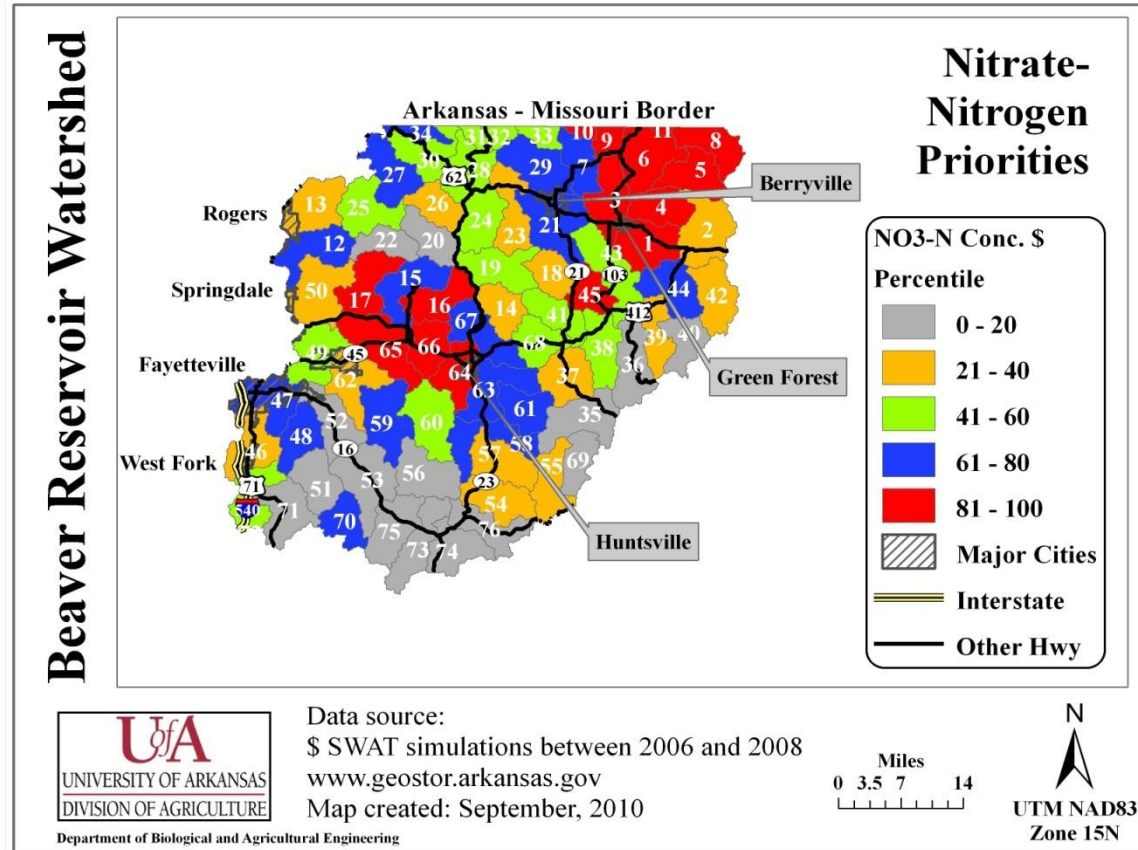
# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, and NO3-N



# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, and NO3-N



# MODEL SETUP

**Model:** SWAT2009

**Delineation:** USGS 12-digit HUC

**DEM:** 10 m

**Soil:** SSURGO

**Land Use:** 1999, 2004, and 2006

**Subwatersheds:** 29

**HRUs:** 2668

(0% land use, 5% soil type, 0% slope)

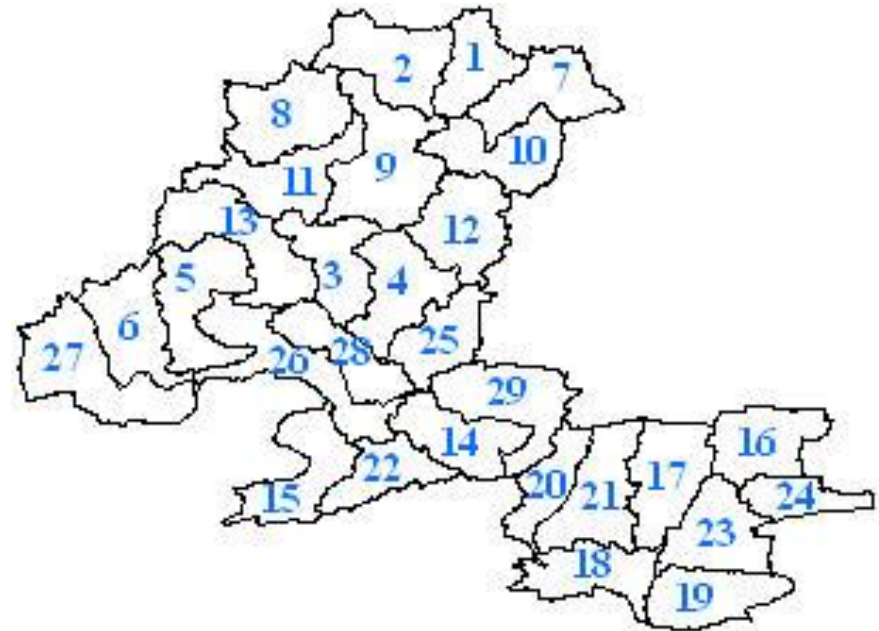
**Ponds:** 6100 (4857 acres)

**Study Period:**

**Calibration:** 2001-2005(Flow)

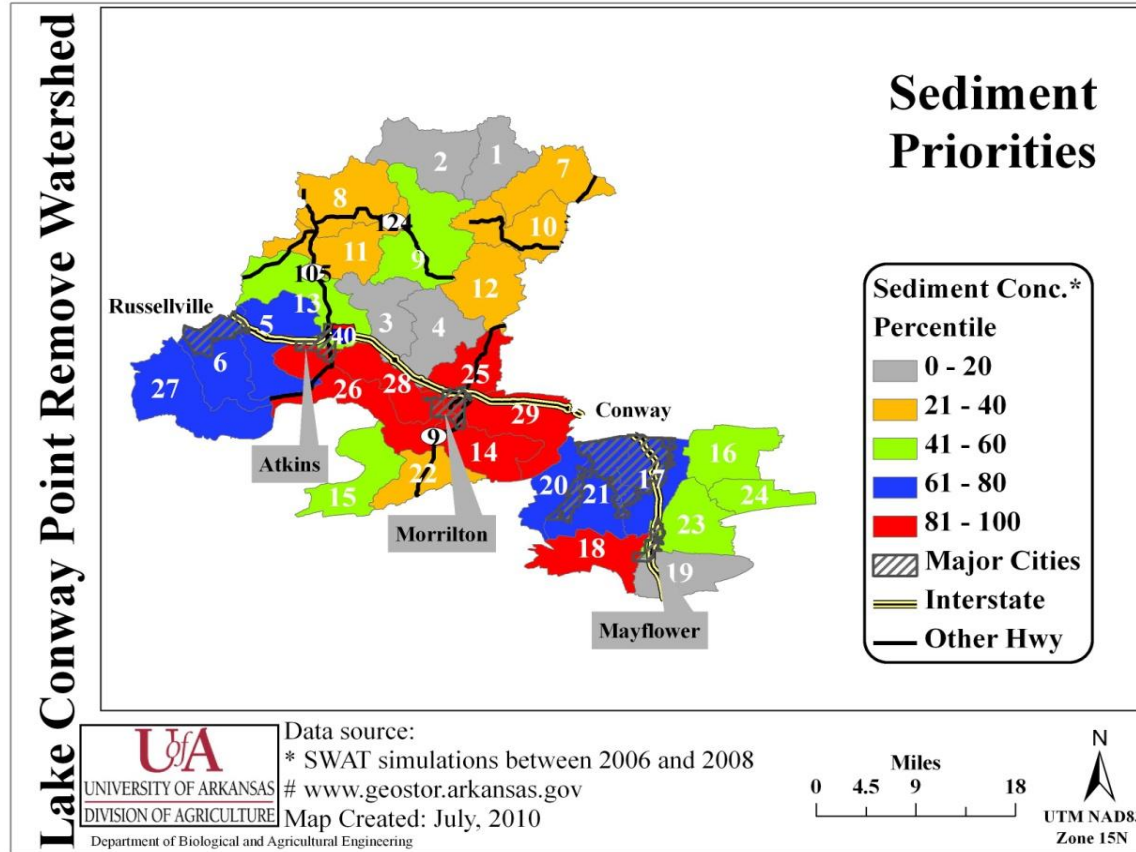
**Validation:** 2006-2008 (Flow)

**Point Sources:** 34



# SUBWATERSHED IDENTIFICATION

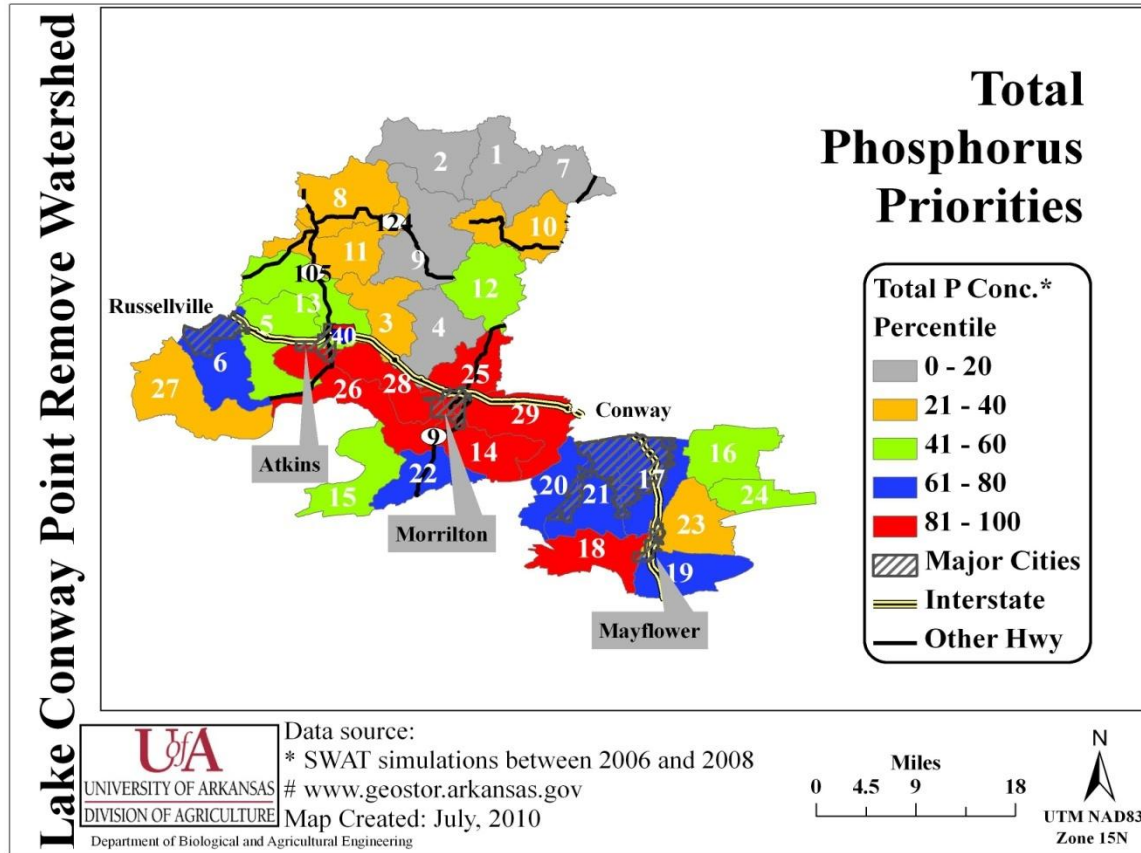
## Percentile Approach – Sediment, TP, NO3-N





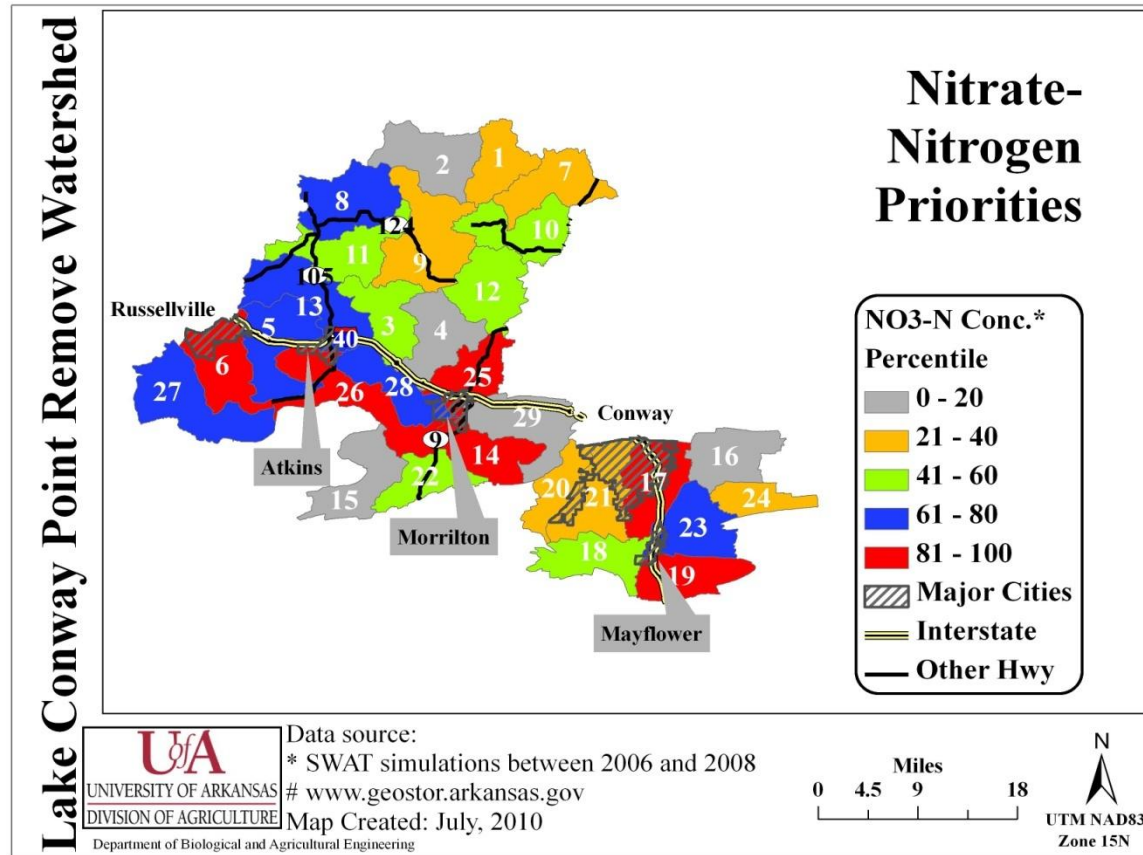
# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, NO3-N



# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, NO3-N



# MODEL SETUP

**Model:** SWAT2009

**Delineation:** USGS 12-digit HUC

**DEM:** 10 m

**Soil:** SSURGO

**Land Use:** 1992, 1999, 2004, and  
2006

**Subwatersheds:** 44

**HRUs:** 3657

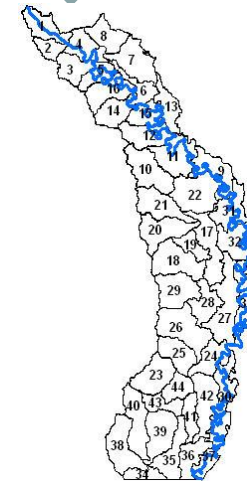
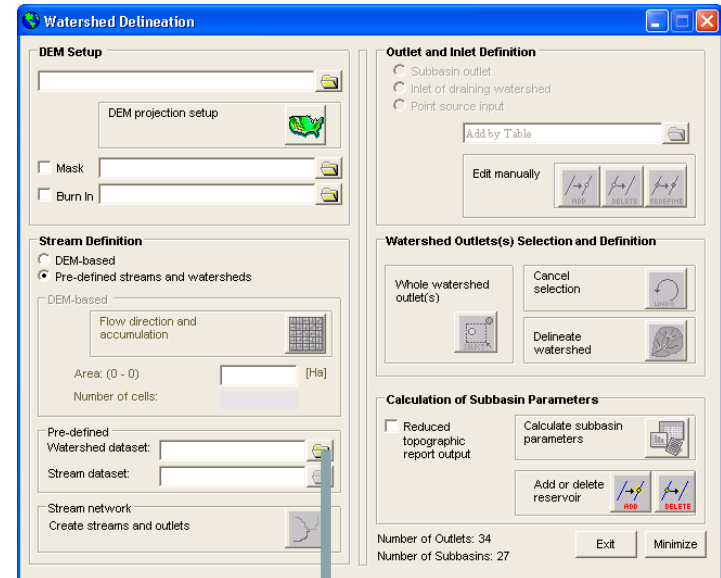
(0% land use, 5% soil type, 0% slope)

**Study Period:**

**Calibration:** 1996-2005

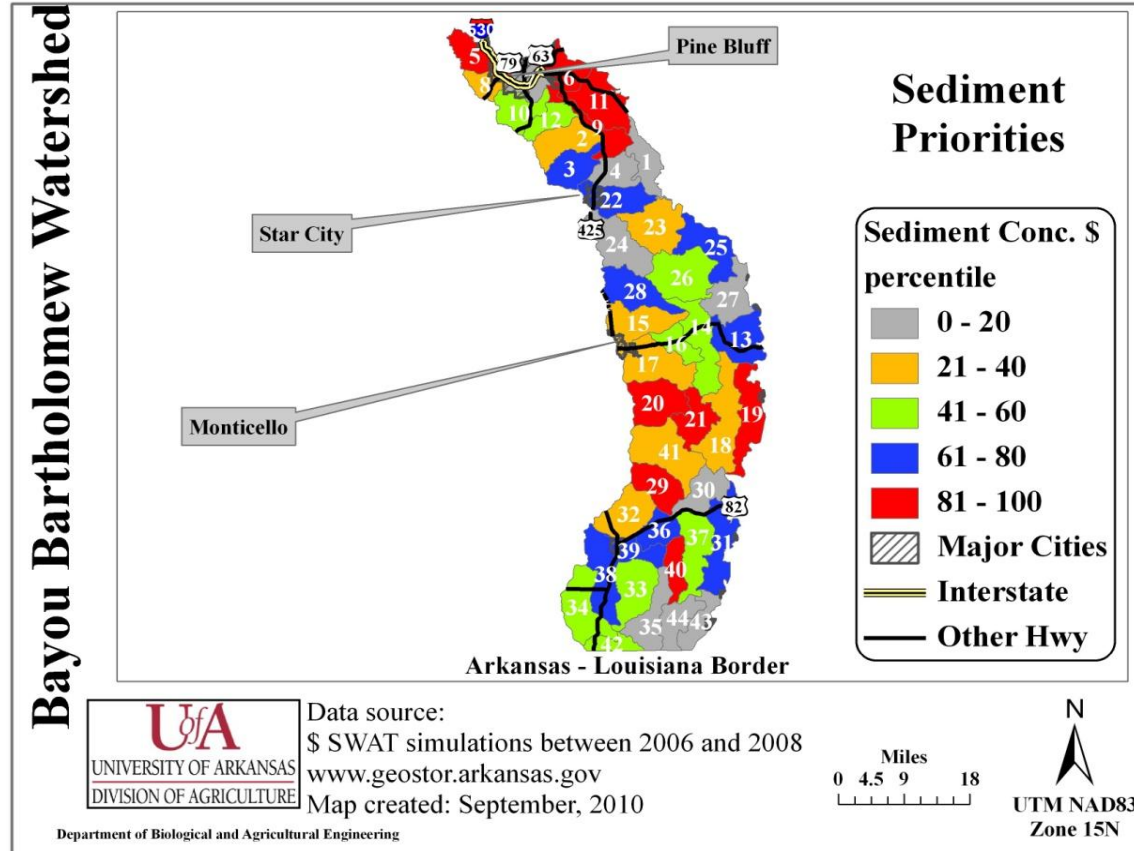
**Validation:** 2006-2008 (2004-  
2008)-Portland

**Point Sources:** 9



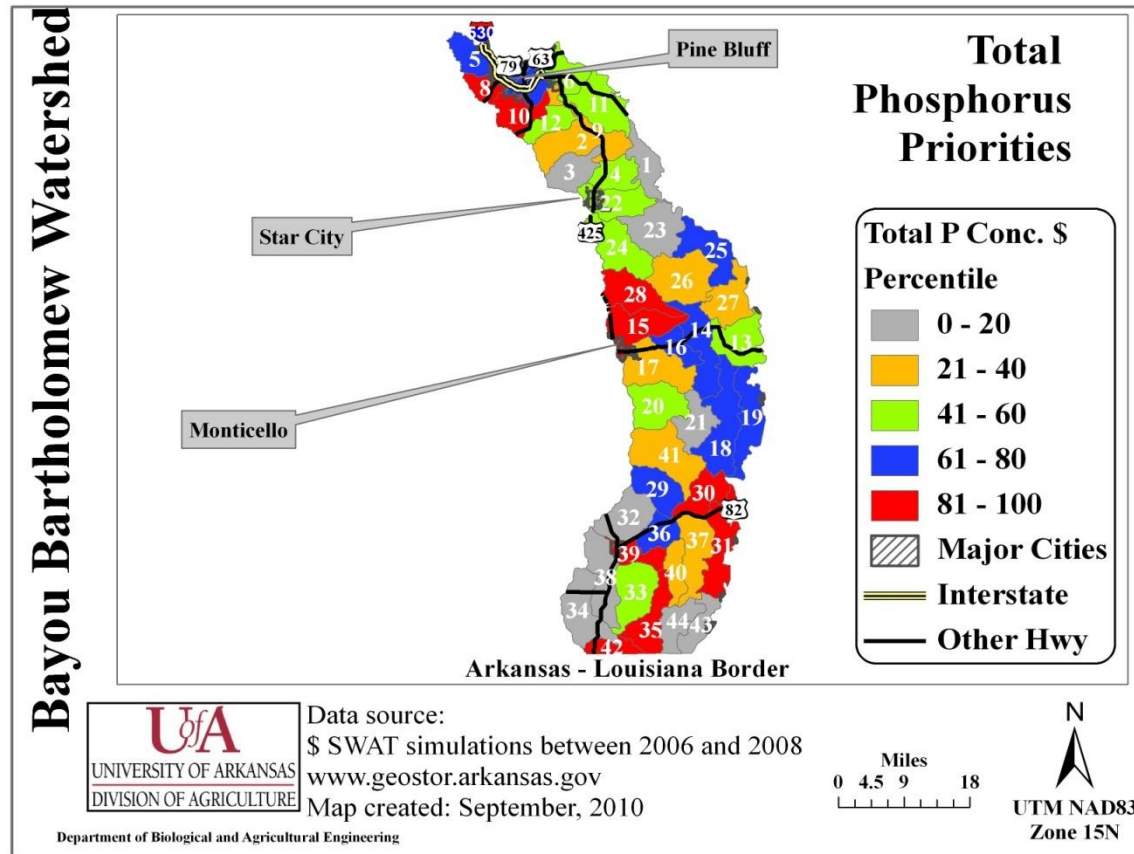
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## Percentile Approach – Sediment, TP, NO3-N



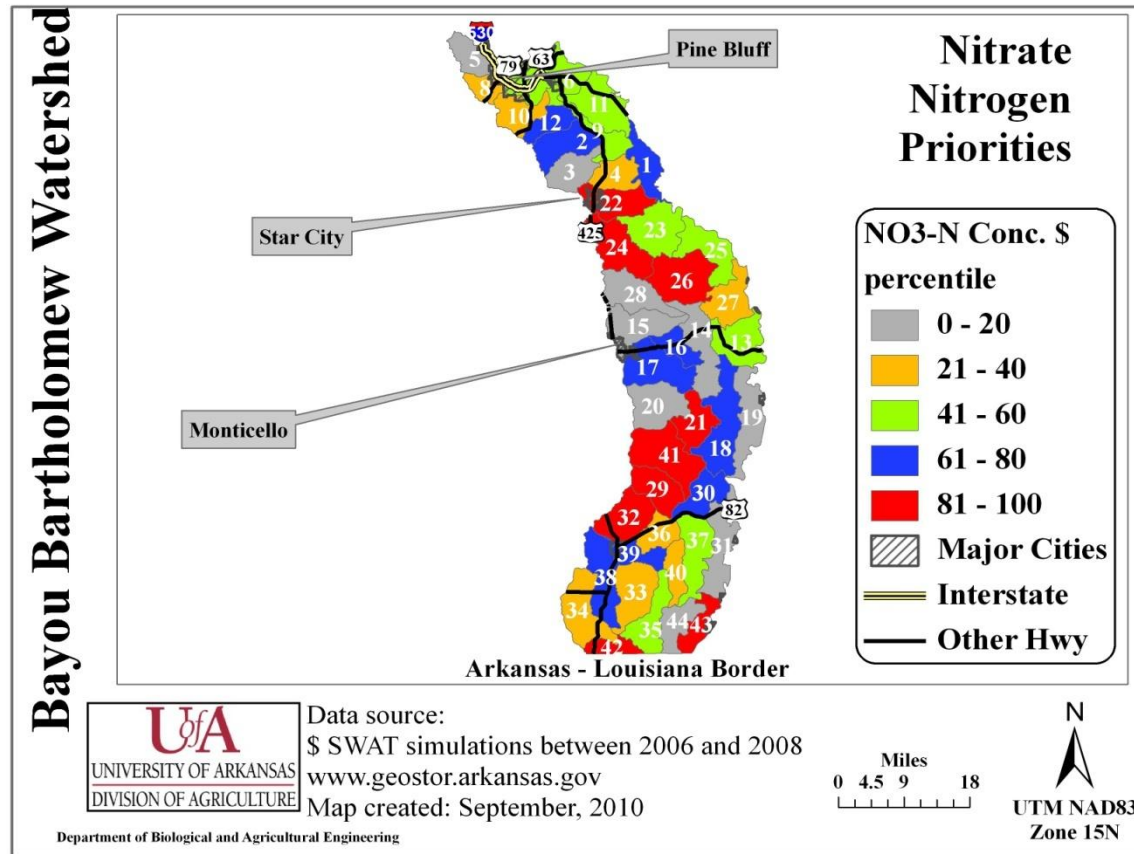
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# SUBWATERSHED IDENTIFICATION

## Percentile Approach – Sediment, TP, NO3-N



- **State of the art modeling and latest data was used for calibrating and validating SWAT model**
- **Model outputs such as, total flow, surface flow, base flow, sediment, nitrate-nitrogen, and total phosphorus were rigorously evaluated using latest performance criteria**
- **In most of the subwatersheds, generally land use, soils, and slope association seen with high/low concentrations for water quality constituents**

- **The model output has been used to rank subwatersheds on a relative basis. Absolute conc. of water quality constituent may not be of concern**
- **Data gaps noticed in LCPR**
- **It is encouraged that modeling results are also compared with other local information for decision making purposes**
- **Monitoring and Modeling are complimentary and monitoring data is required for having confidence in modeling results**



## Arkansas Natural Resources Commission



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and Nancy Sammons**

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# QUESTIONS?/ SUGGESTIONS

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