

## Multiple-Source Tracking

Investigating Sources of Pathogens, Nutrients, and Sediment in the South Fork Little River Basin

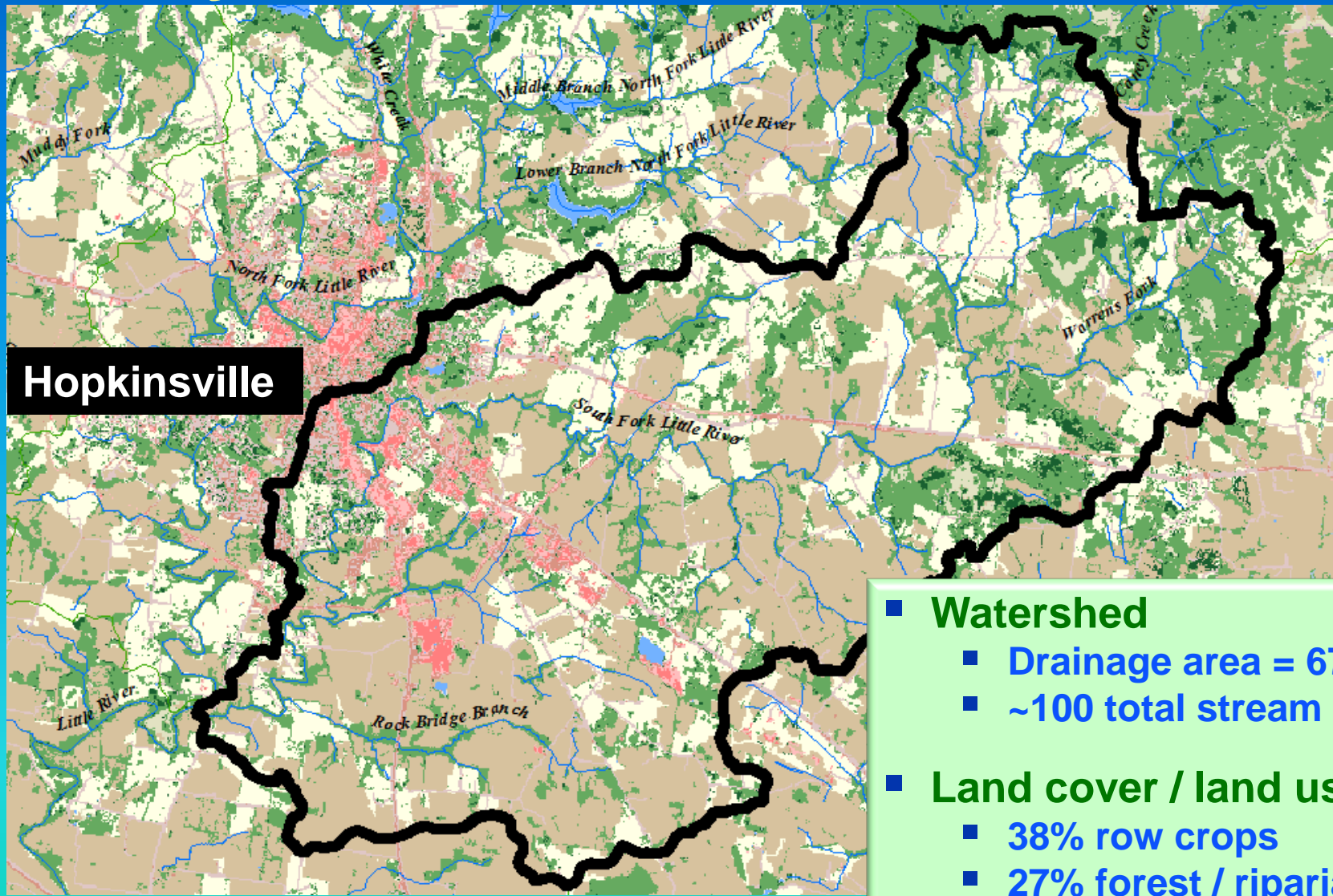


# Outline of Talk

- Study Area
- Purpose and Objectives
- Study Approach
- Preliminary Findings
- Summary



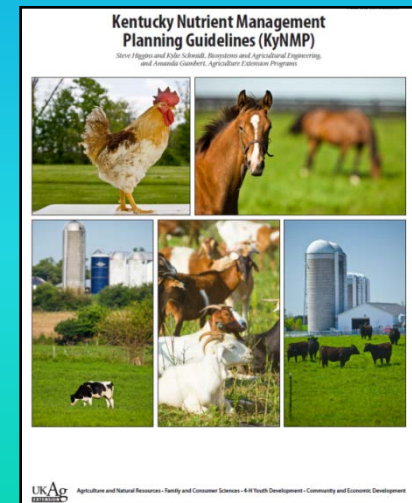
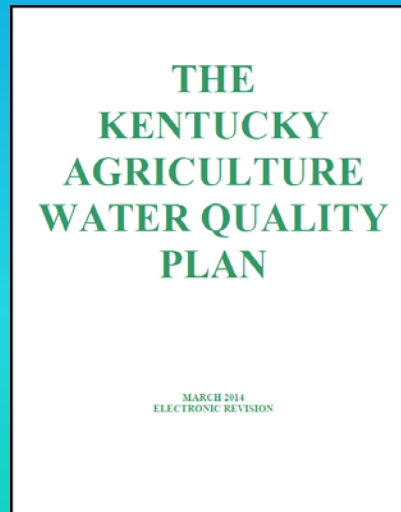
# Study Area



- **Watershed**
  - Drainage area = 67 mi<sup>2</sup>
  - ~100 total stream miles
- **Land cover / land use**
  - 38% row crops
  - 27% forest / riparian
  - 23% pasture
  - 12% residential / urban

# Study Purpose

- Develop and apply a multiple-source tracking approach to identify pathogens, nitrogen, and sediment sources
- To help guide placement of effective best management practices in the basin



# Study Objectives

1. Identify source(s) of bacterial contamination through microbial-source tracking using host-specific genetic markers
2. Evaluate utility of stable isotopes for characterizing nitrogen sources
3. “Fingerprint” potential sources of fine-grained suspended sediment

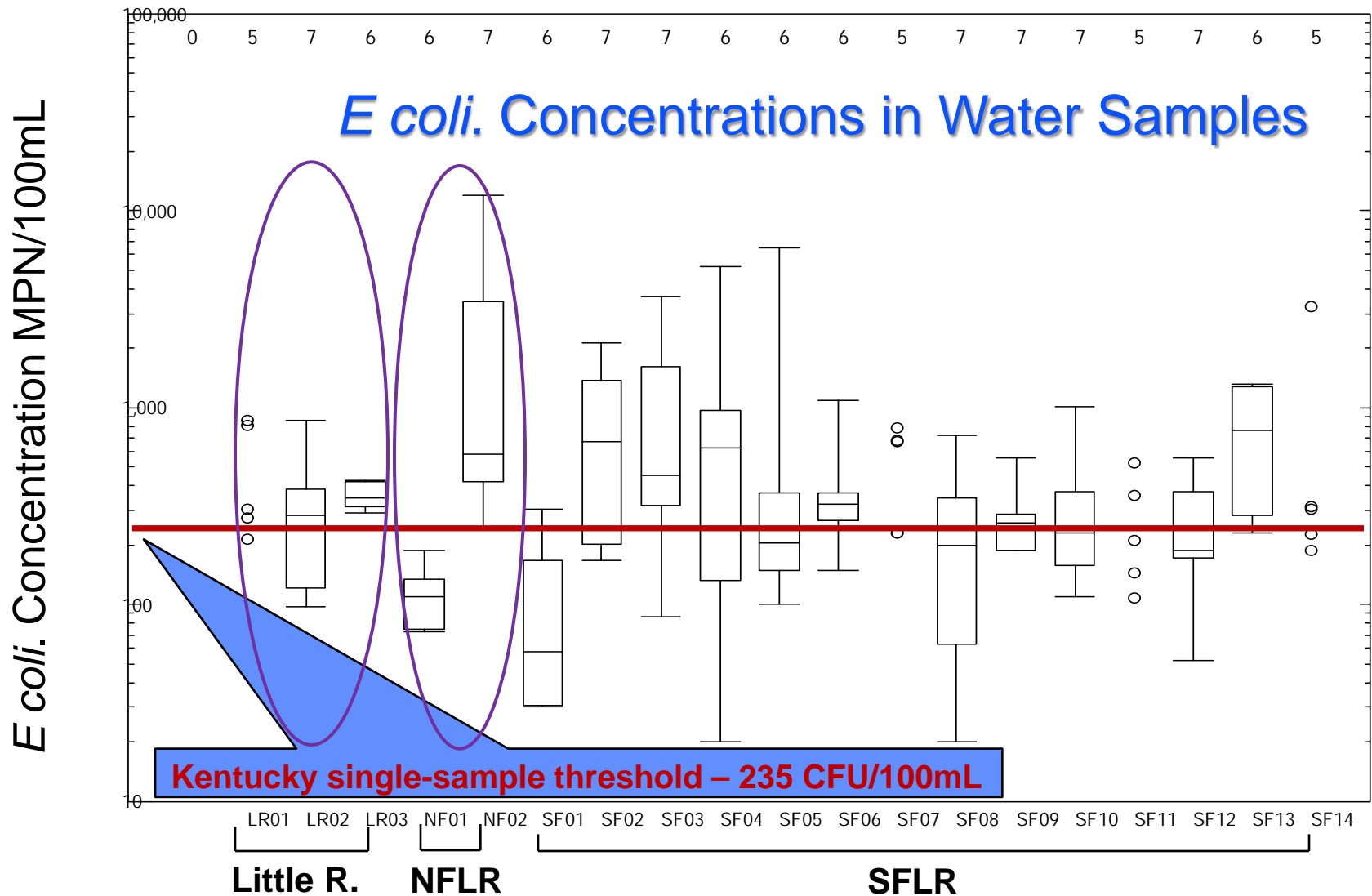


# Pathogens and Source Tracking

Shhh. Be vewy, vewy quiet,  
I'm tracking bacteria!



# *E. Coli* Results



# Microbial-source tracking



**Ruminants**



**Humans**

?????

**Geese**



**Pets**





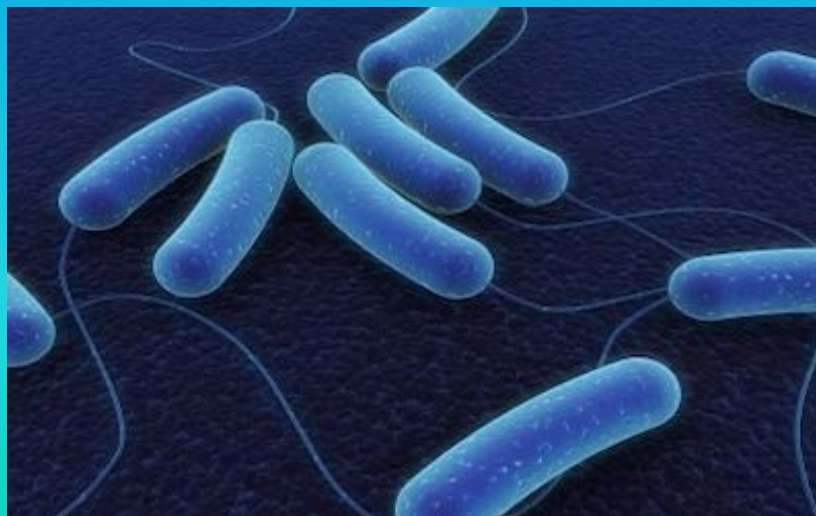
# Microbial-Source Tracking Objectives

- Demonstrate the presence and relative quantity of MST markers in potential sources
- Determine if...
  - Relative quantities of MST markers can corroborate suspected inputs in the basin
  - MST markers can differentiate cattle, canine, waterfowl, and human sources of fecal contamination



# Microbial-Source Tracking Study Markers

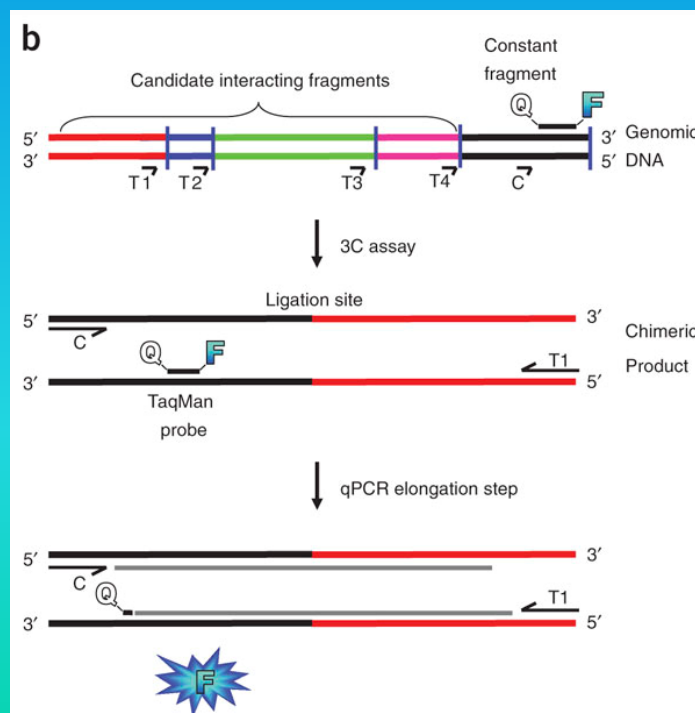
- AllBac – **general** marker of fecal contamination
- BoBac – marker of **bovine** fecal contamination
- *CanBac*– marker of **canine** fecal contamination
- qHF183 – marker of **human** fecal contamination
- GFD – marker of **waterfowl** fecal contamination



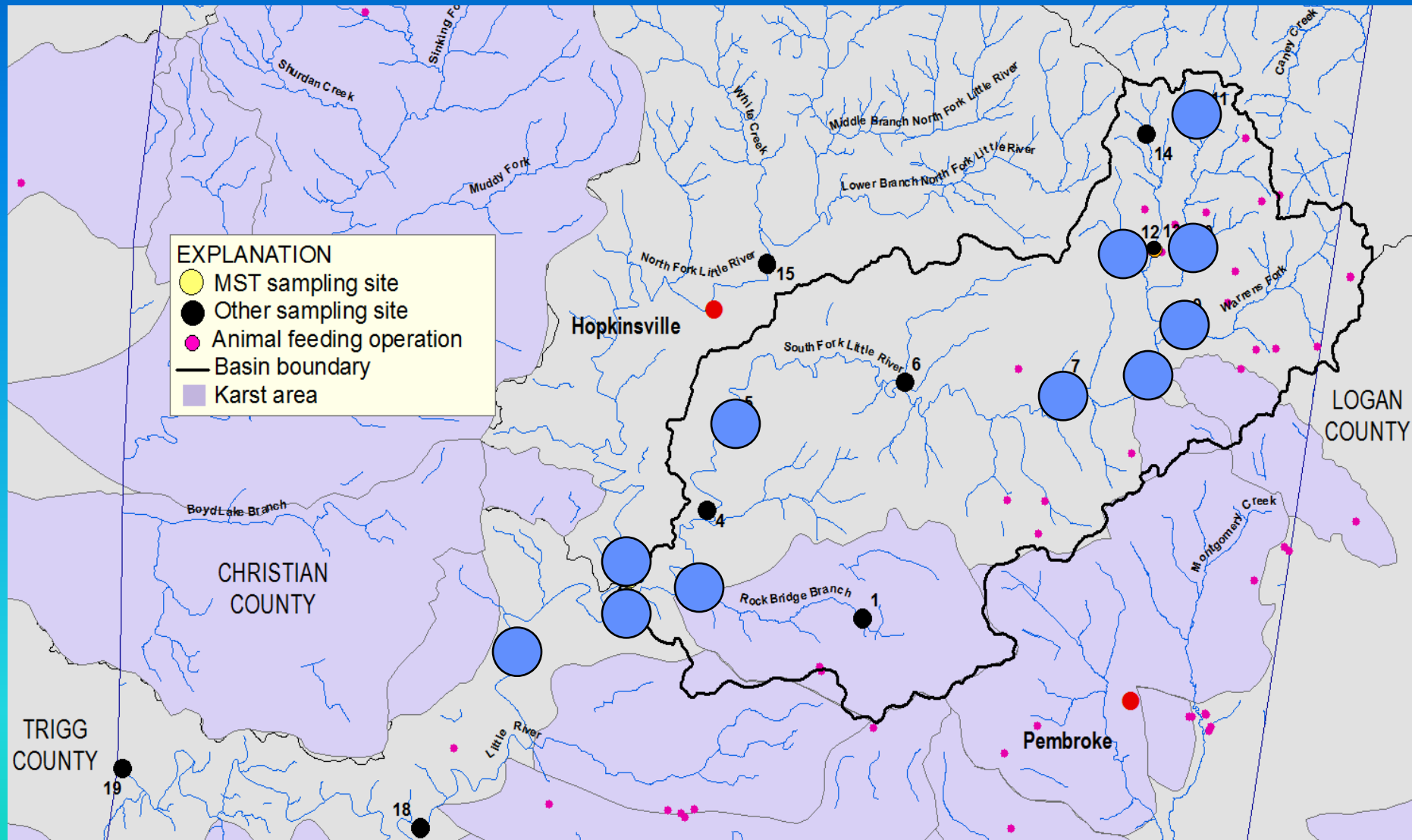
# Microbial-Source Tracking Method

## Quantitative Polymerase Chain Reaction (qPCR)

- Enables researchers to produce millions of copies of a specific DNA sequence in a short time

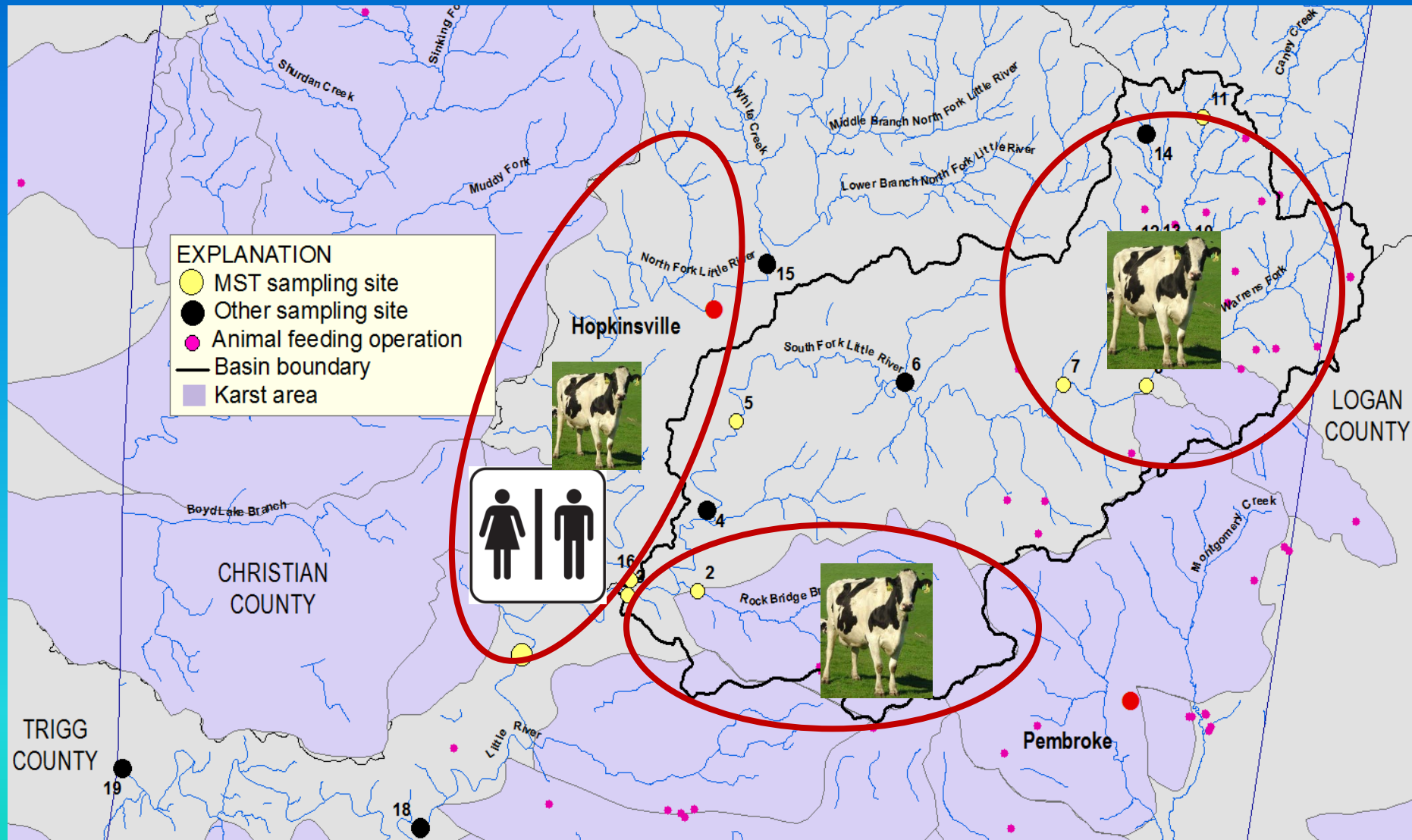


# Site Locations—MST sampling

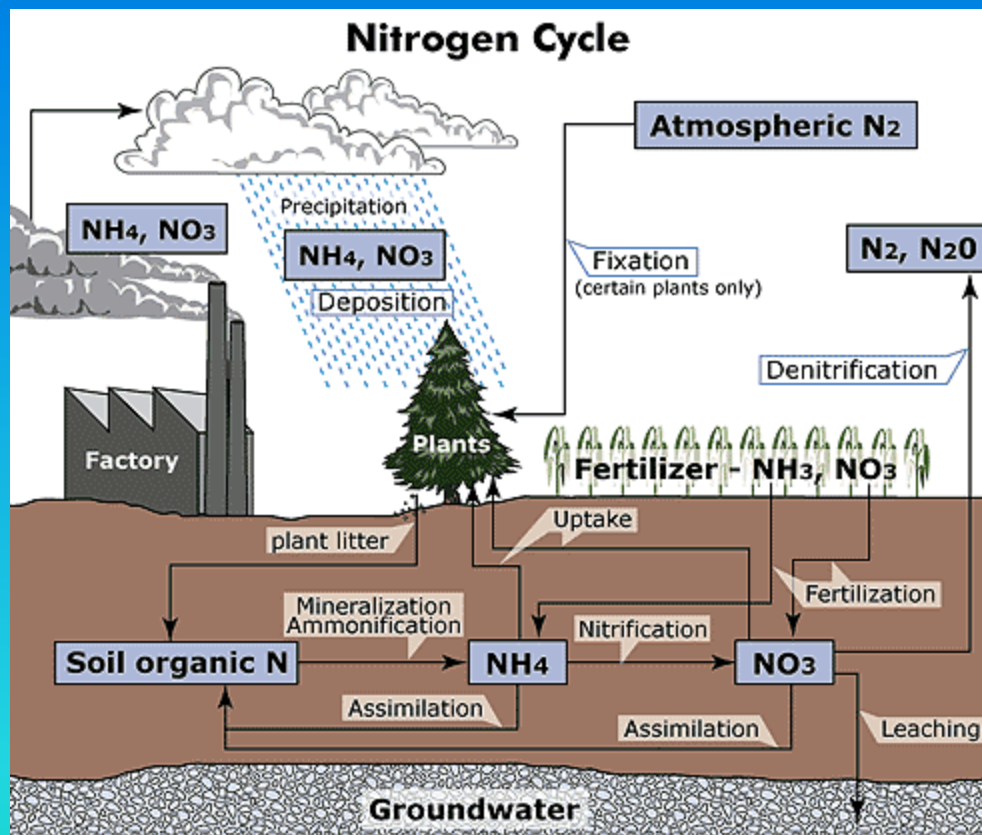




# Site Locations—MST sampling

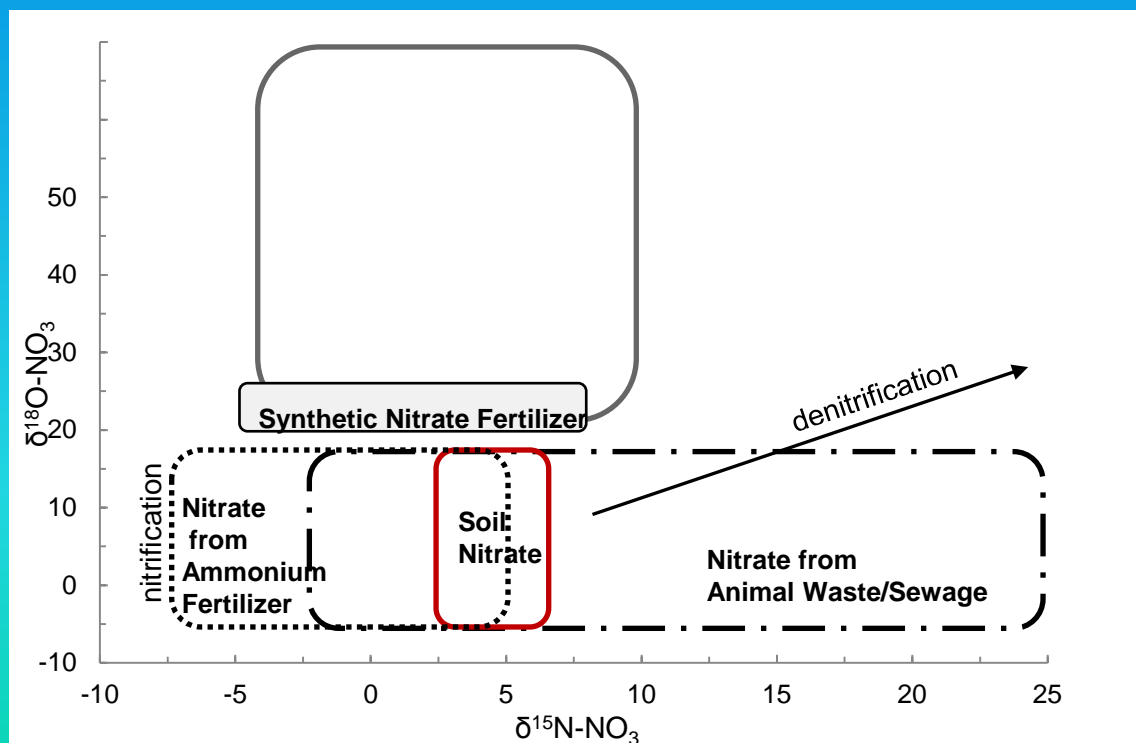


# Stable Nitrate Isotopes

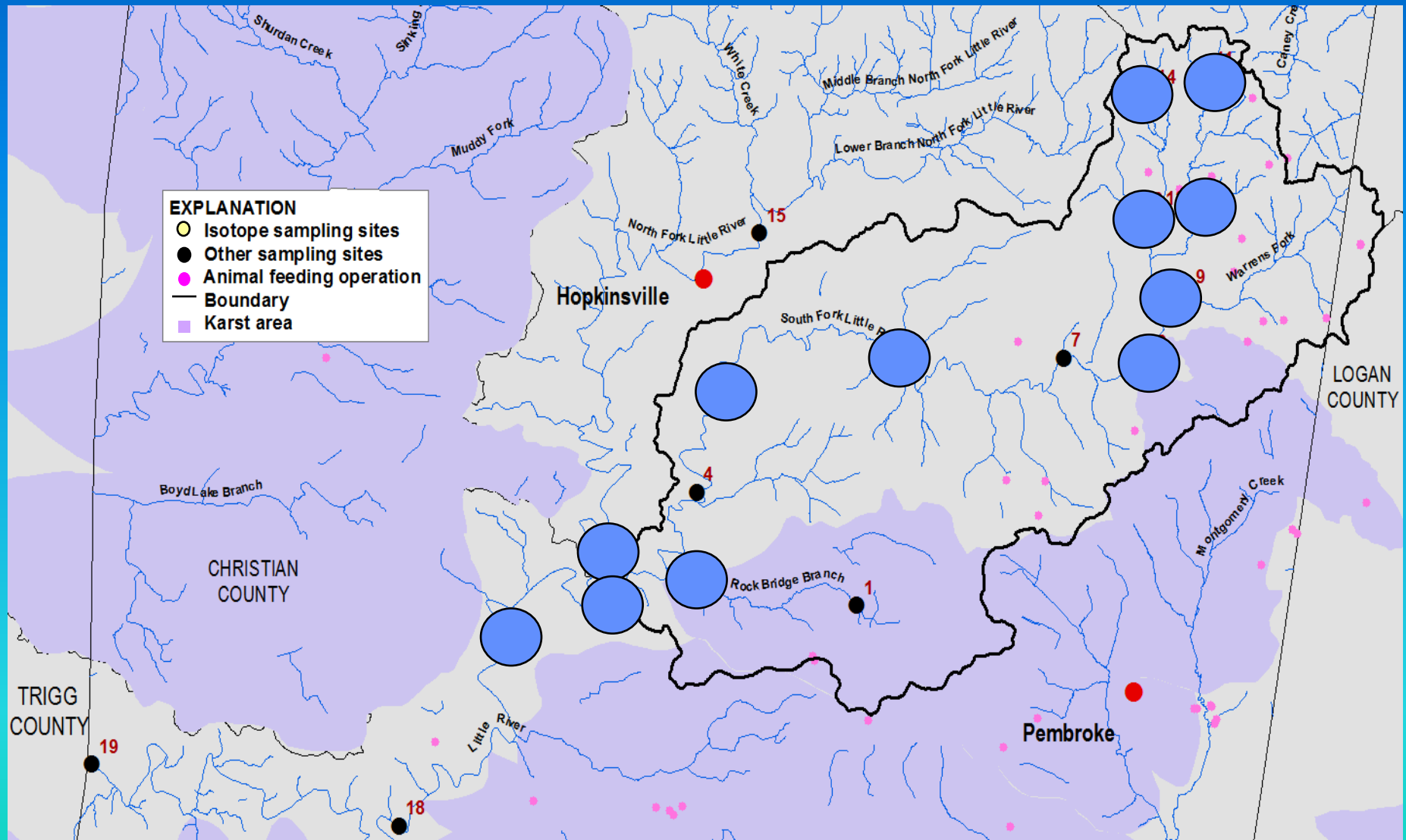


# Stable Nitrate Isotopes Objectives

- Determine the source(s) of nitrate
  - Fertilizer
  - Animal/Human Waste
  - Soil
  - Atmosphere



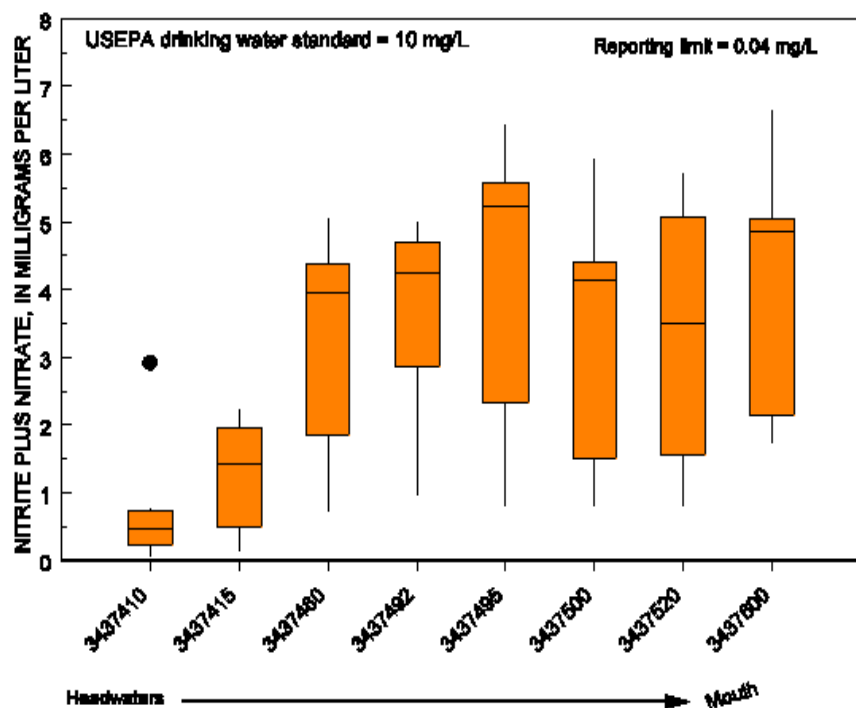
# Site Locations—Isotope sampling



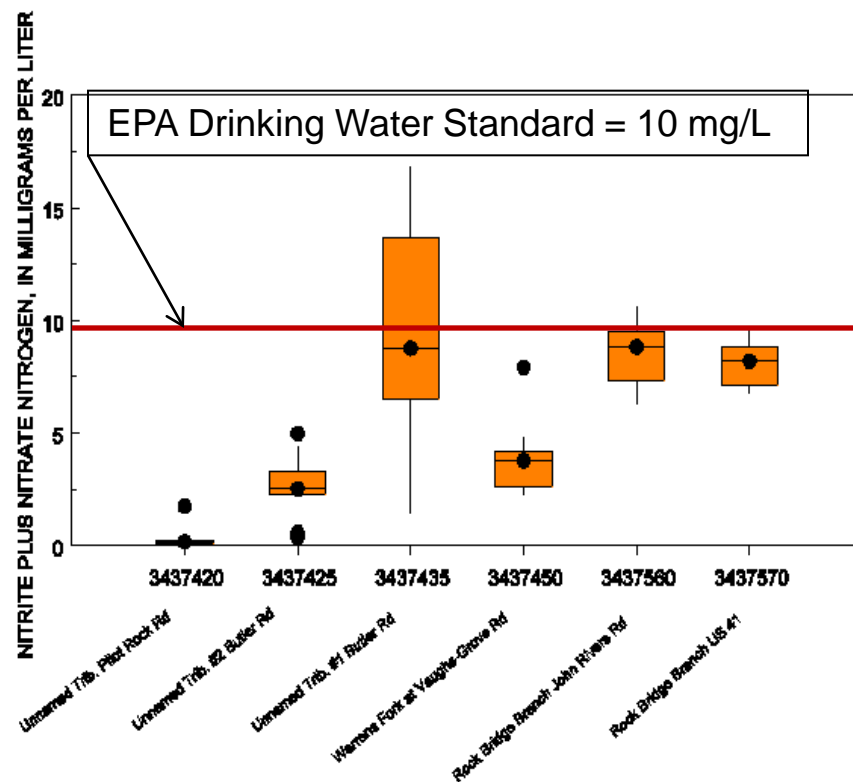


# Nitrate—Preliminary Findings

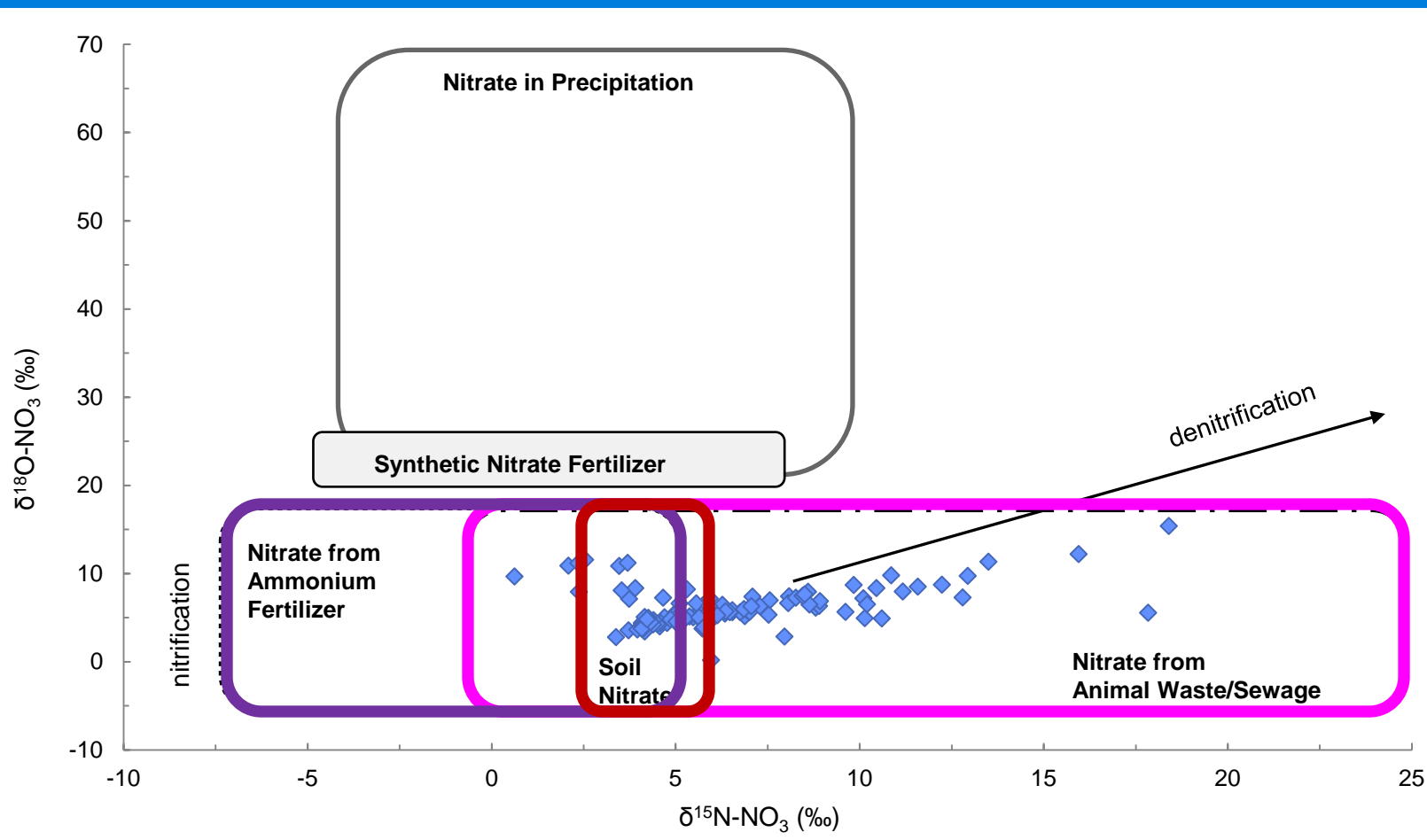
## SF Little River mainstem



## SF Little River tributaries



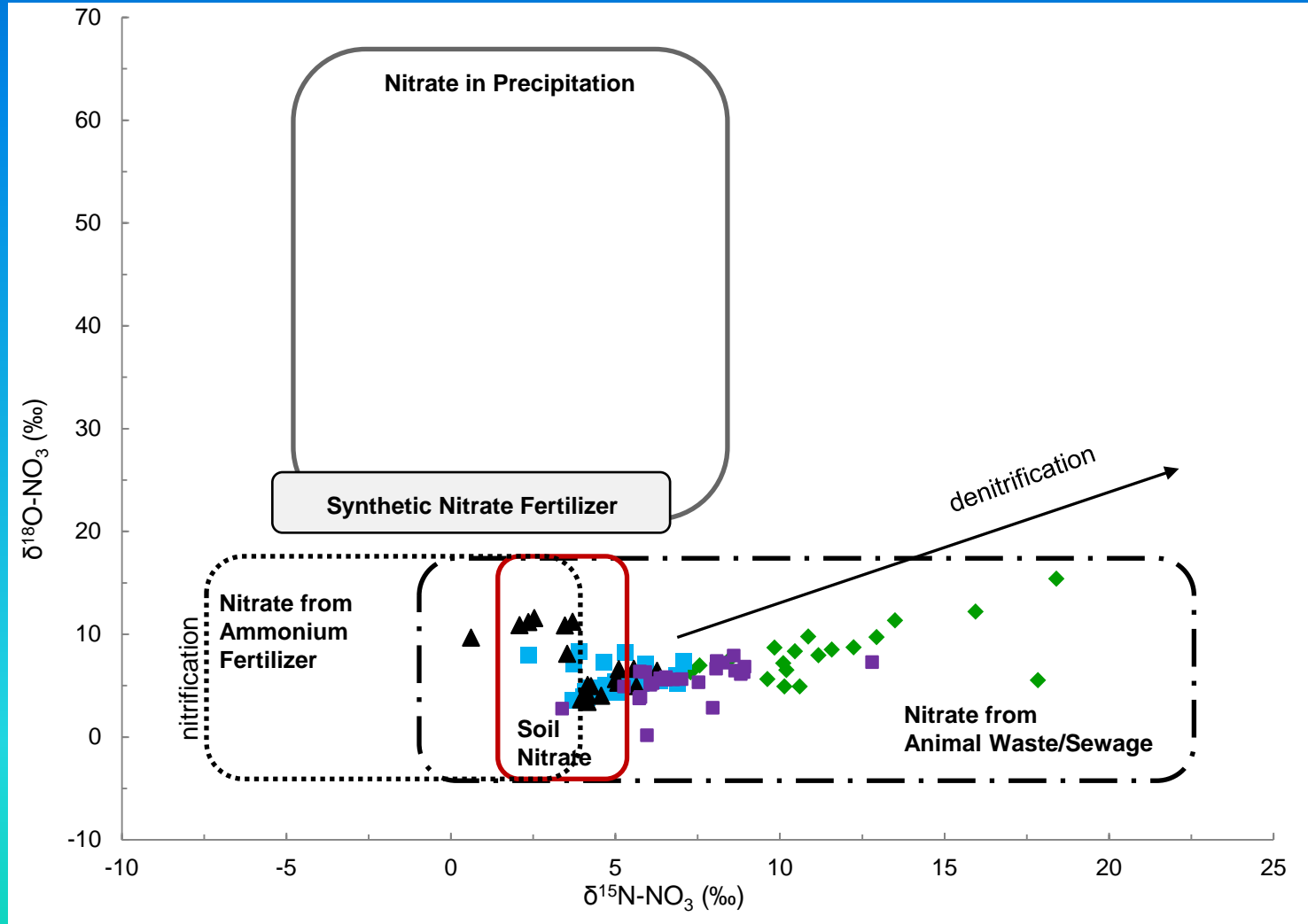
# Isotopes—Preliminary Findings



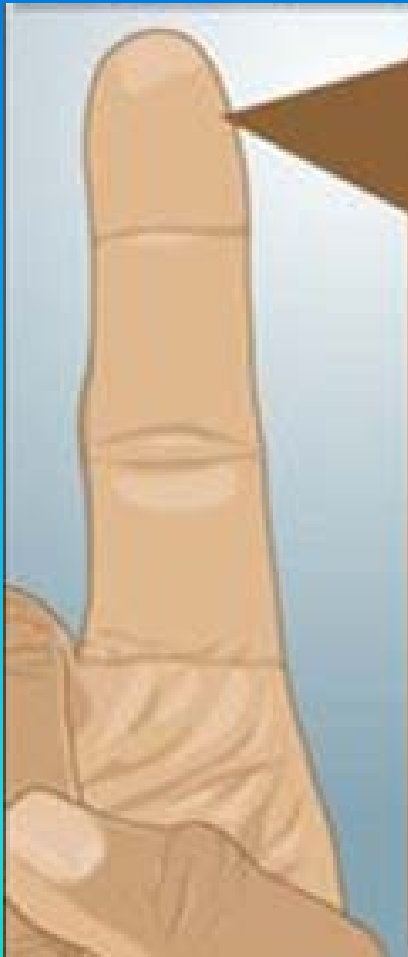
# Isotopes—Preliminary Findings

## EXPLANATION

Green = Fall  
Purple = Summer  
Blue = Winter  
Black = Spring



# Sediment Fingerprinting



Cropland



Pasture



Riparian



Streambank

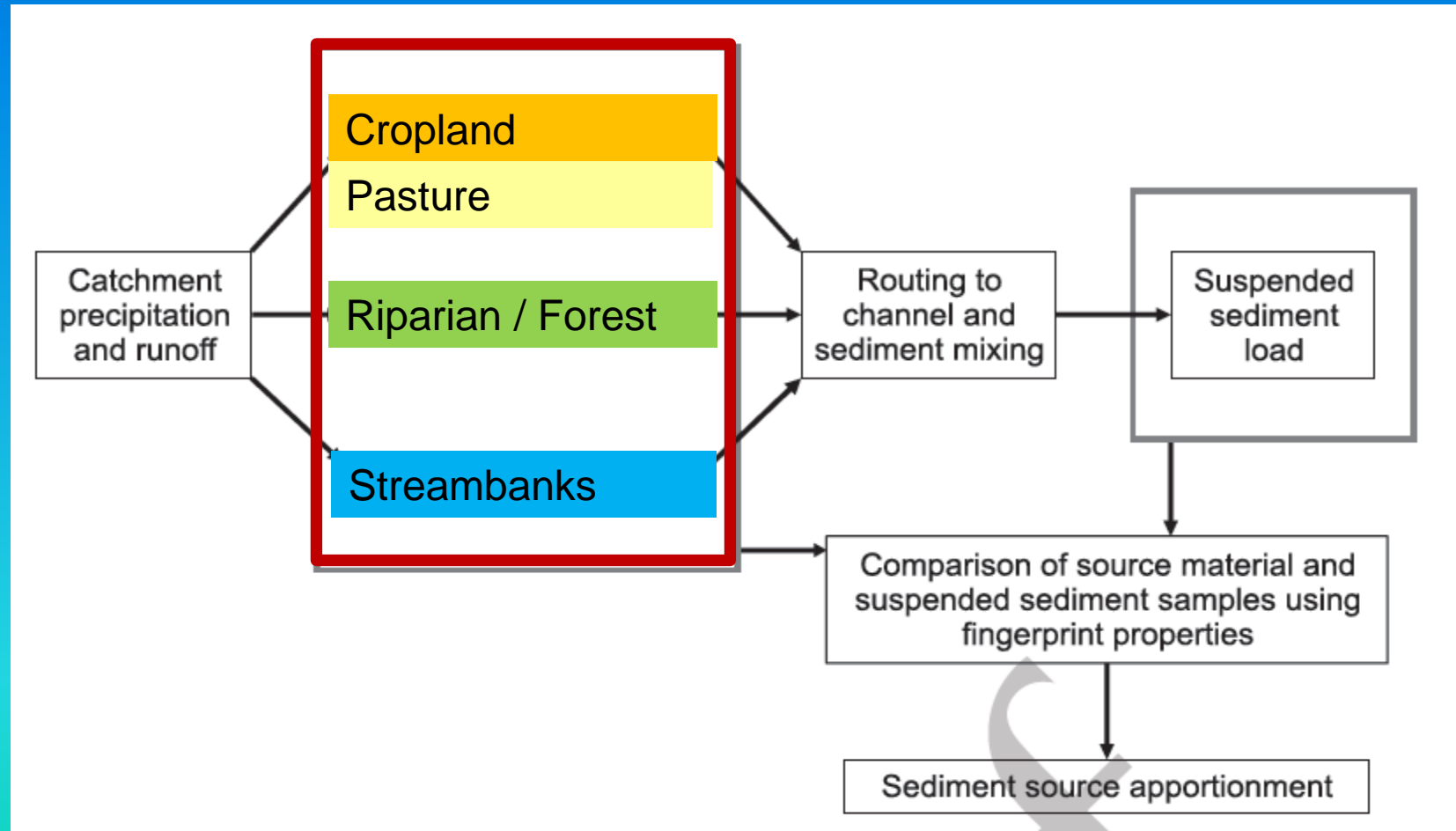


# Sediment Fingerprinting

- **Concept:** One or more of the properties of suspended sediment will reflect its origins and can be used as a tracer to track the sediment back to its source(s)
  - Geochemistry (Ni, Pb, Mg, etc.)
  - Organic matter (C, N)
  - Stable isotopes ( $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$ )
  - Radiochemistry ( $^{137}\text{Cs}$ )

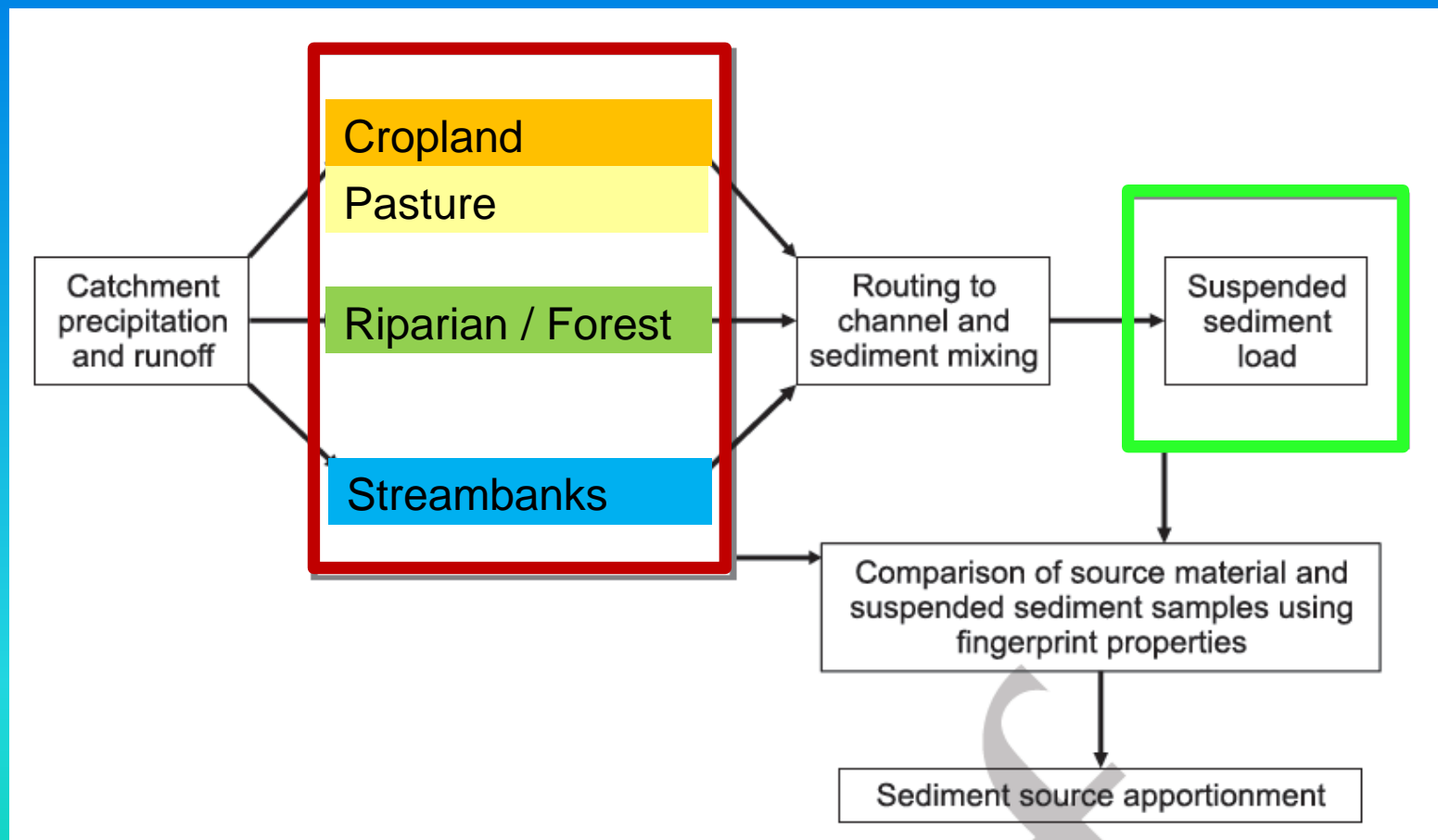
# Sediment Fingerprinting Technique

- Identify and collect sediment-source samples



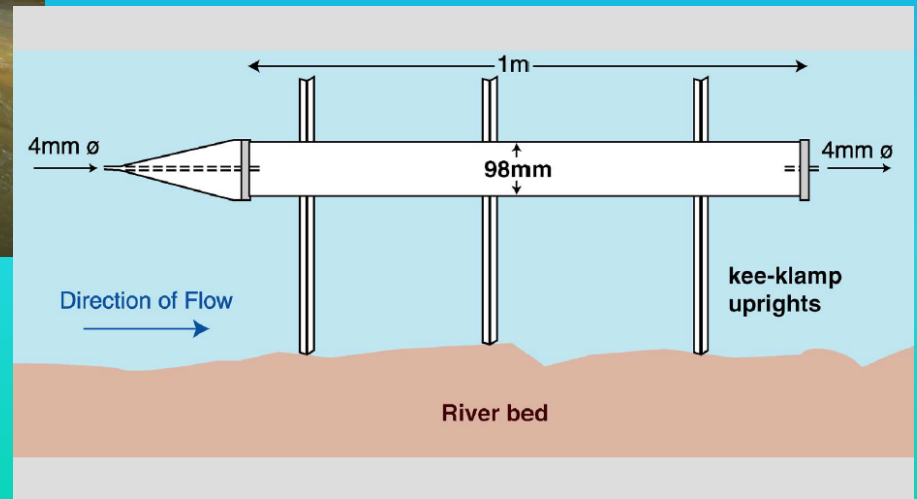
# Sediment Fingerprinting Technique

- “Fingerprints” are measured in the **suspended sediment** at the outlet of the watershed



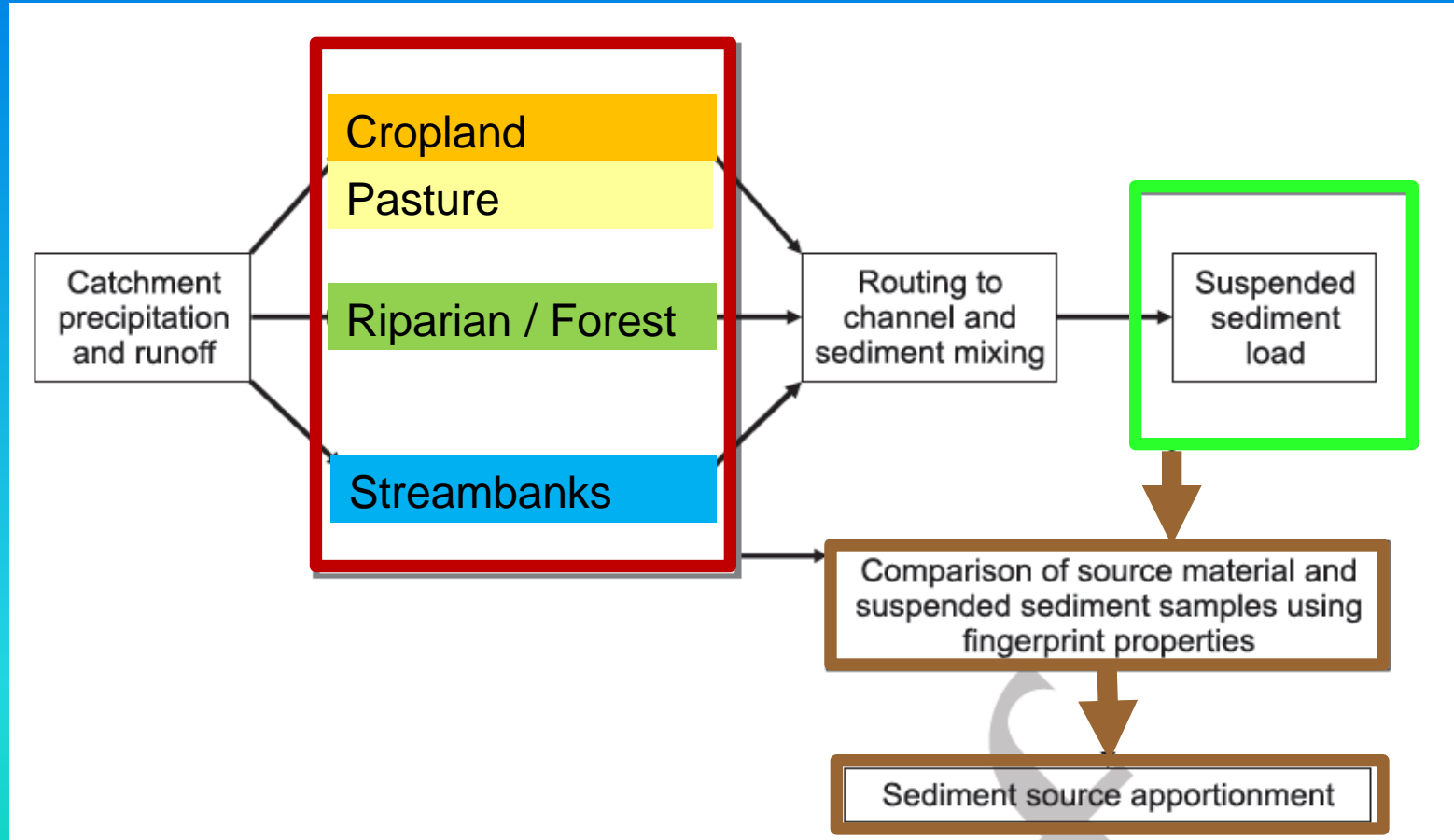
# Sediment Fingerprinting Technique

- Collect fine sediment samples from select stream sampling sites using passive samplers



# Sediment Fingerprinting Technique

- A statistical model is used to link the suspended sediment back to sources and an estimated contribution of sediment from each source is calculated



# Key Preliminary Findings in 2013

## ■ MST findings

- Mouth of **North Fork Little River** site suggests **human** as the main potential source of fecal contamination.
- Headwater sites, and a lower tributary site in the **South Fork Little River Basin** suggest **bovine** as the main potential source of fecal contamination.

## ■ Isotope findings

- Probable source of nitrate in the South Fork Little River Basin is **human and/or animal waste**.
- Findings help support the MST findings.



# Key Preliminary Findings

- **Sediment Fingerprinting**
  - Results being received from laboratories



# Partnerships



Christian Co. Fiscal Court



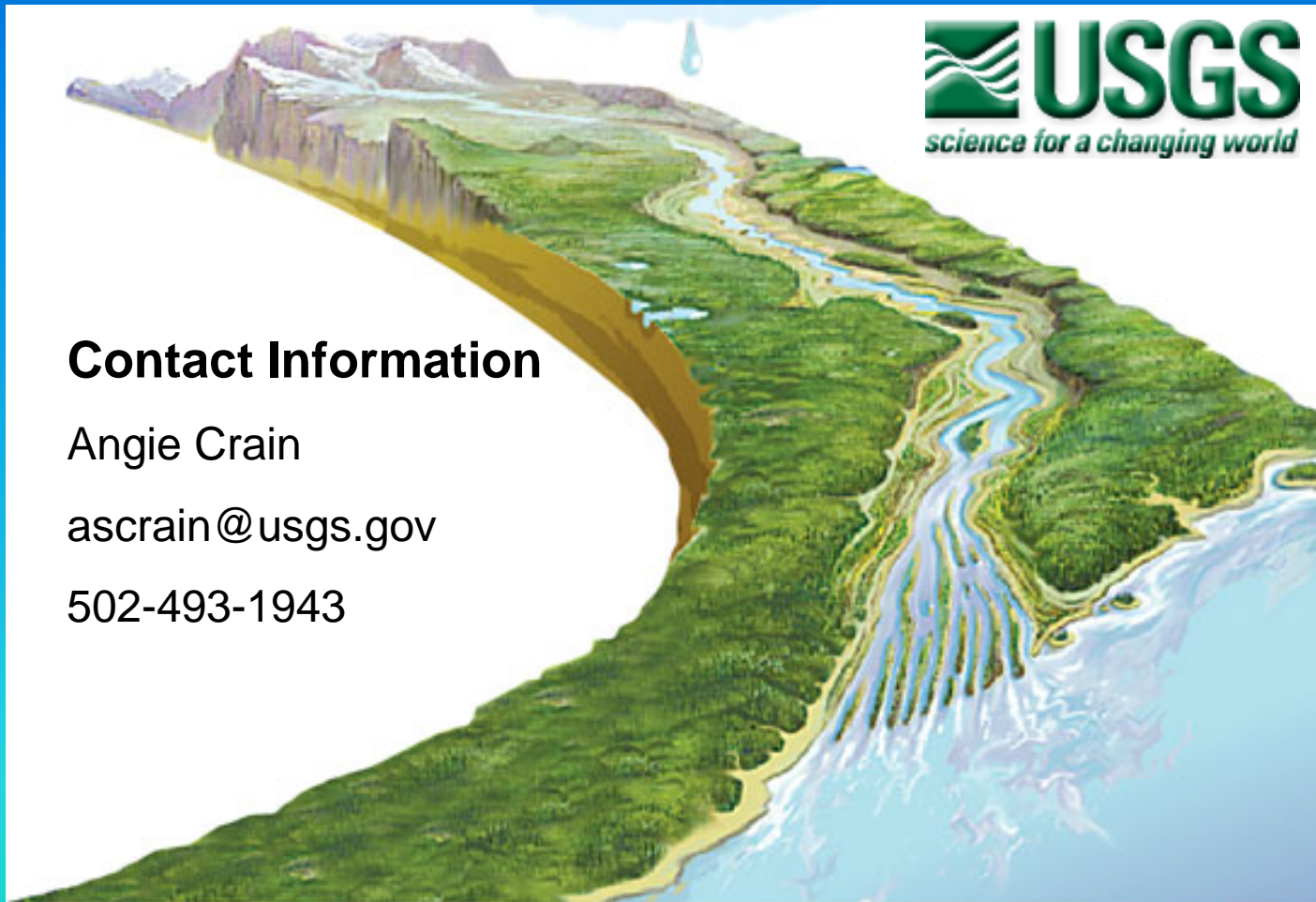
## County Agriculture Development Boards

- Christian
- Trigg
- Todd



Local producers  
and many others

# Questions?



## Contact Information

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