

Multiple-Source Tracking

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

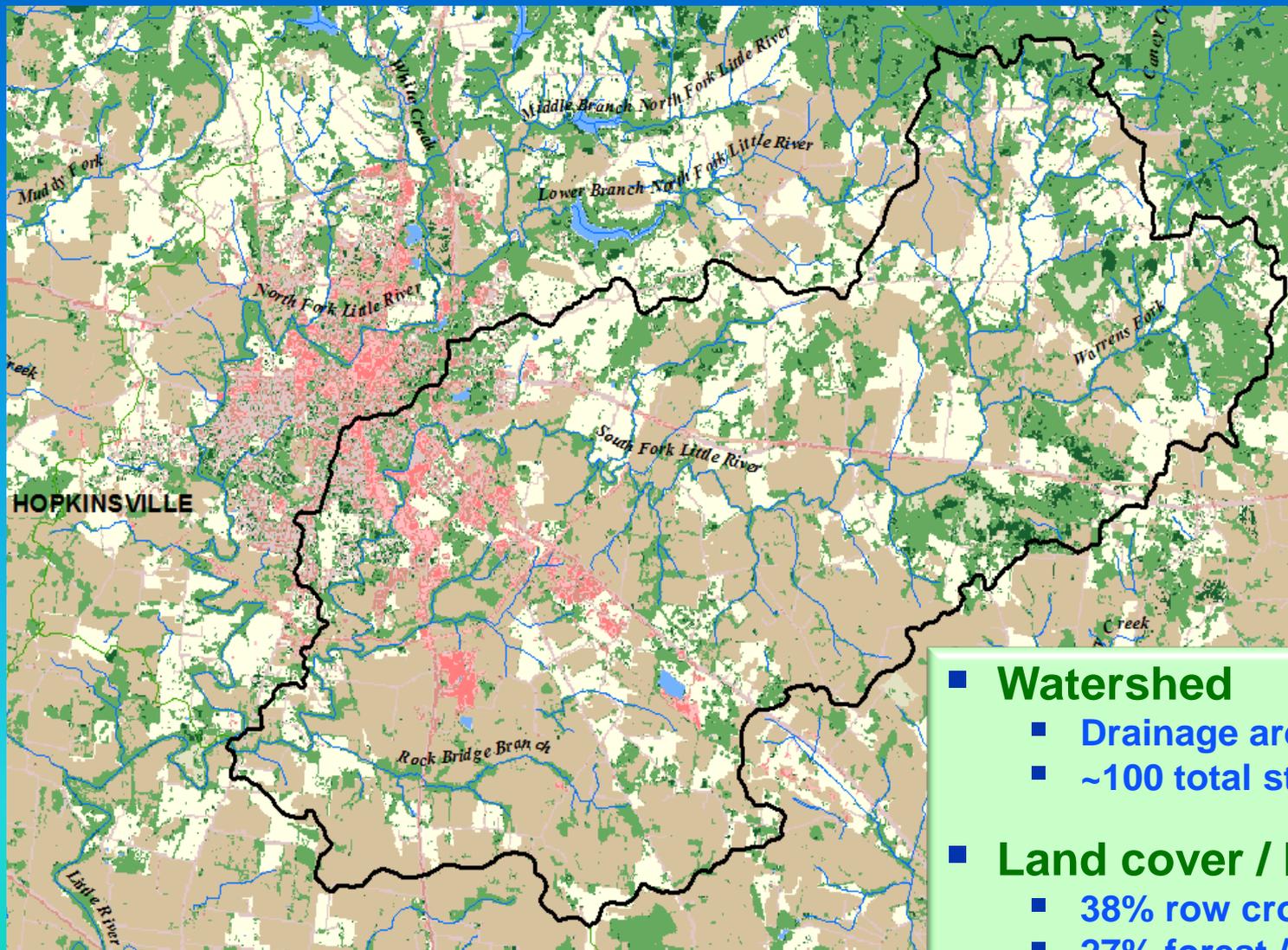


Outline of Talk

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



Study Area



■ Watershed

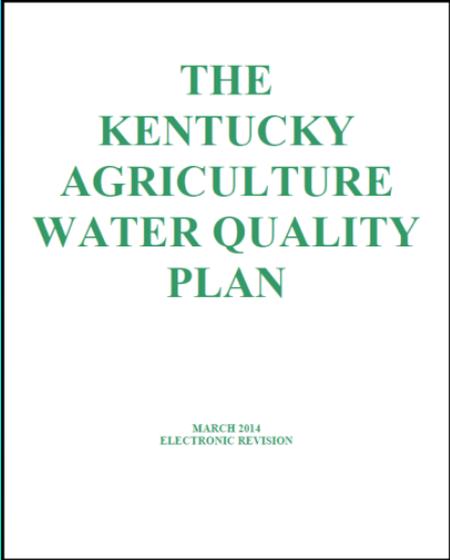
- Drainage area = 67 mi²
- ~100 total stream miles

■ Land cover / land use

- 38% row crops
- 27% forest / riparian
- 23% pasture
- 12% residential / urban

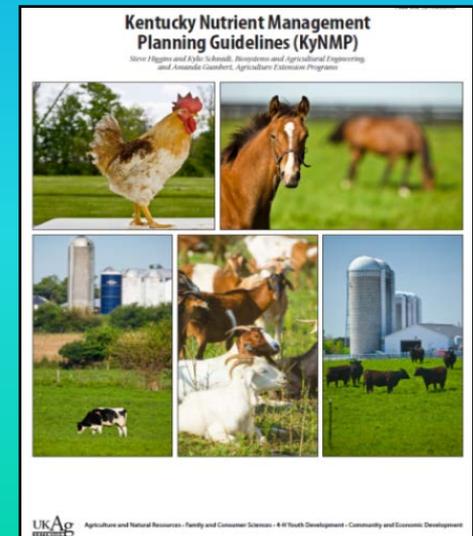
Study Purpose

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



THE
KENTUCKY
AGRICULTURE
WATER QUALITY
PLAN

MARCH 2014
ELECTRONIC REVISION



Study Objectives

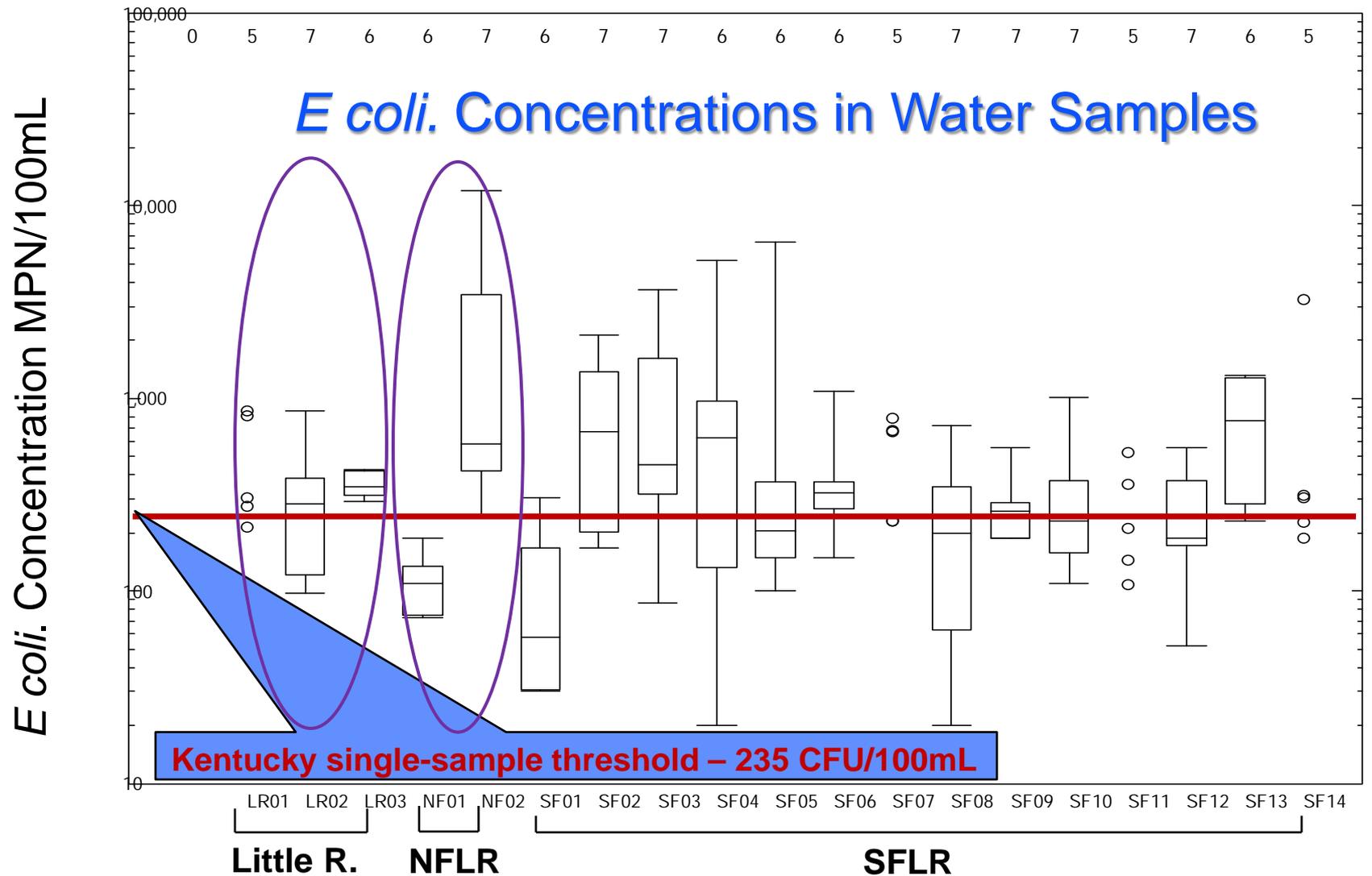
1. Identify source(s) of bacterial contamination through microbial-source tracking using host-specific genetic markers
2. Evaluate utility of stable isotopes for characterizing nitrogen sources
3. “Fingerprint” potential sources of fine-grained suspended sediment

Pathogens and Source Tracking

Shhh. Be vewy, vewy quiet,
I'm hunting microbes!



E. Coli Results



Microbial-source tracking



Ruminants



Humans

??????

Geese

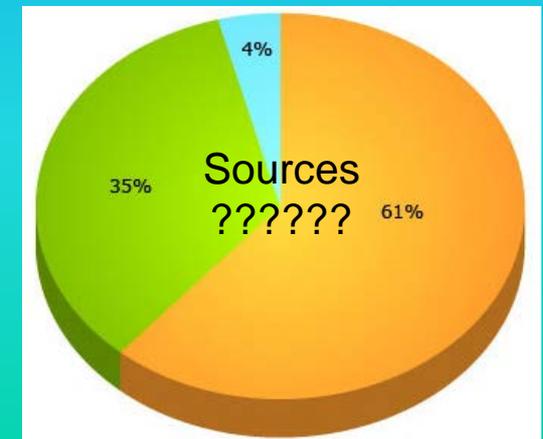


Pets



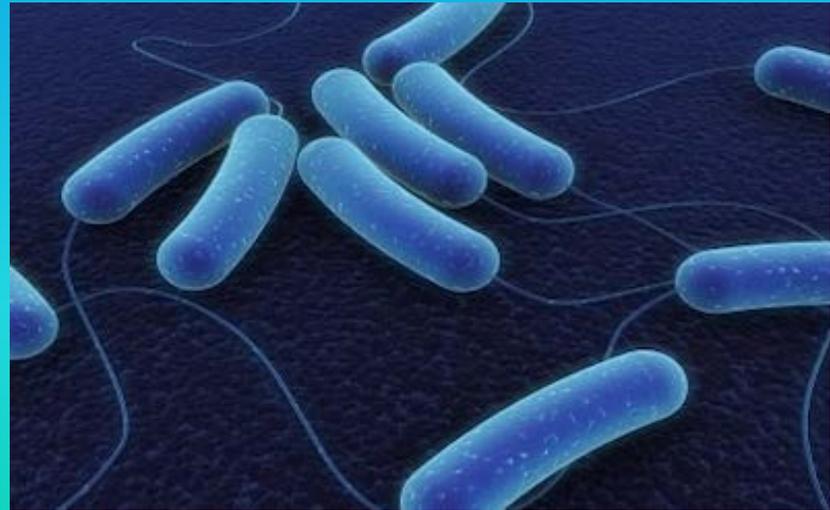
Microbial-Source Tracking Objectives

- 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

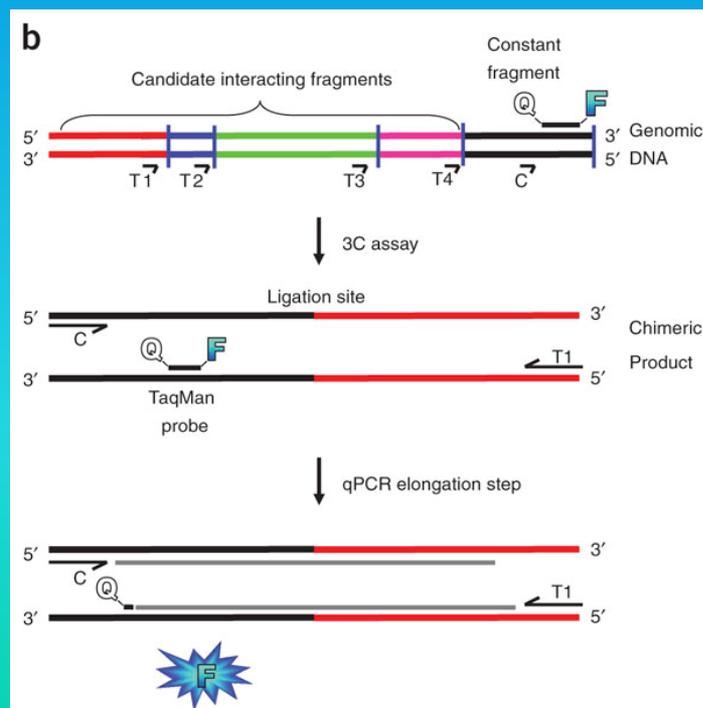
- AllBac – general marker of fecal contamination
- BoBac – marker of **bovine** fecal contamination
- *CanBac*– marker of **canine** fecal contamination
- qHF183 – marker of **human** fecal contamination
- GFD – marker of **waterfowl** fecal contamination



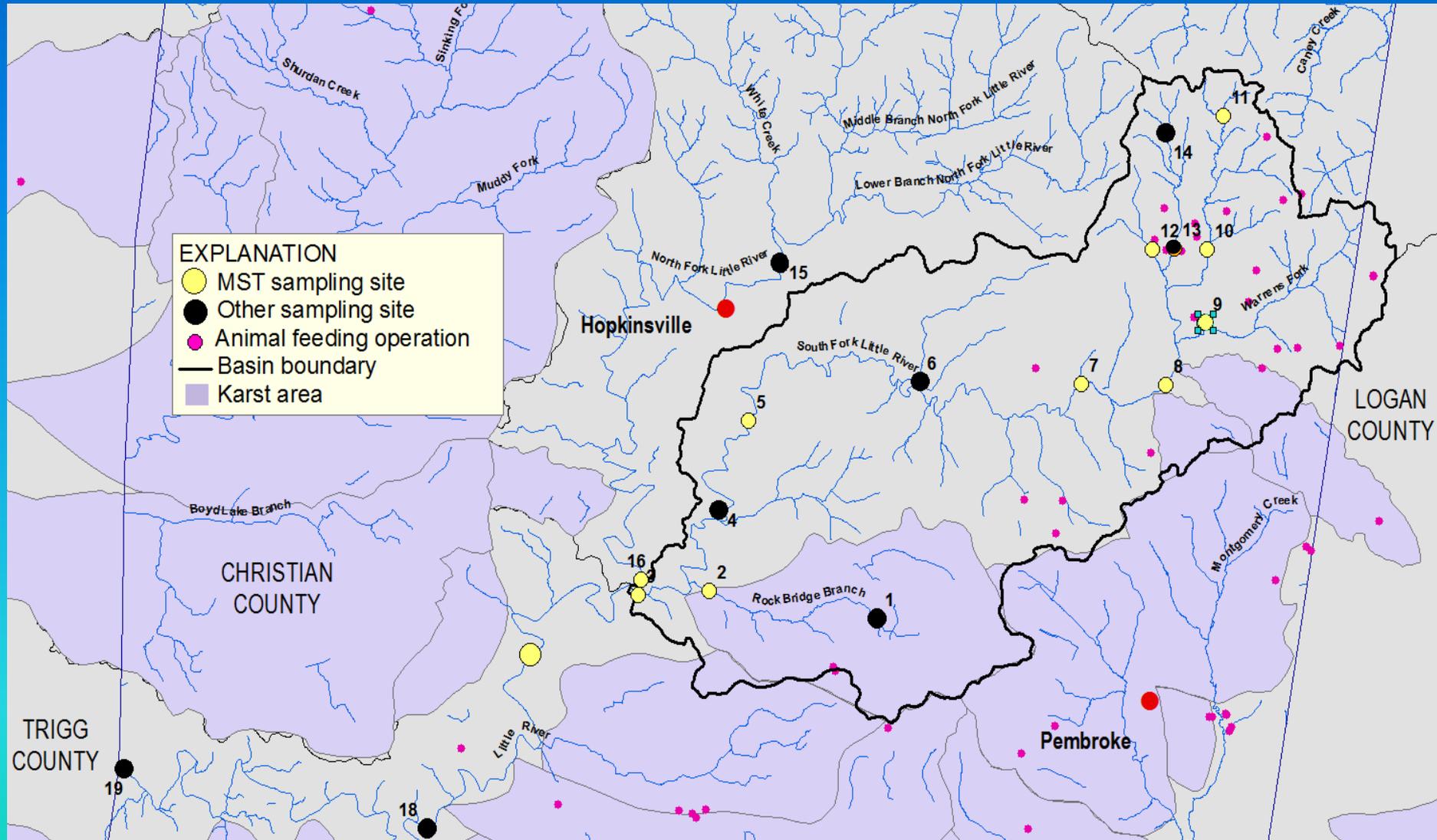
Microbial-Source Tracking Method

Quantitative Polymerase Chain Reaction (qPCR)

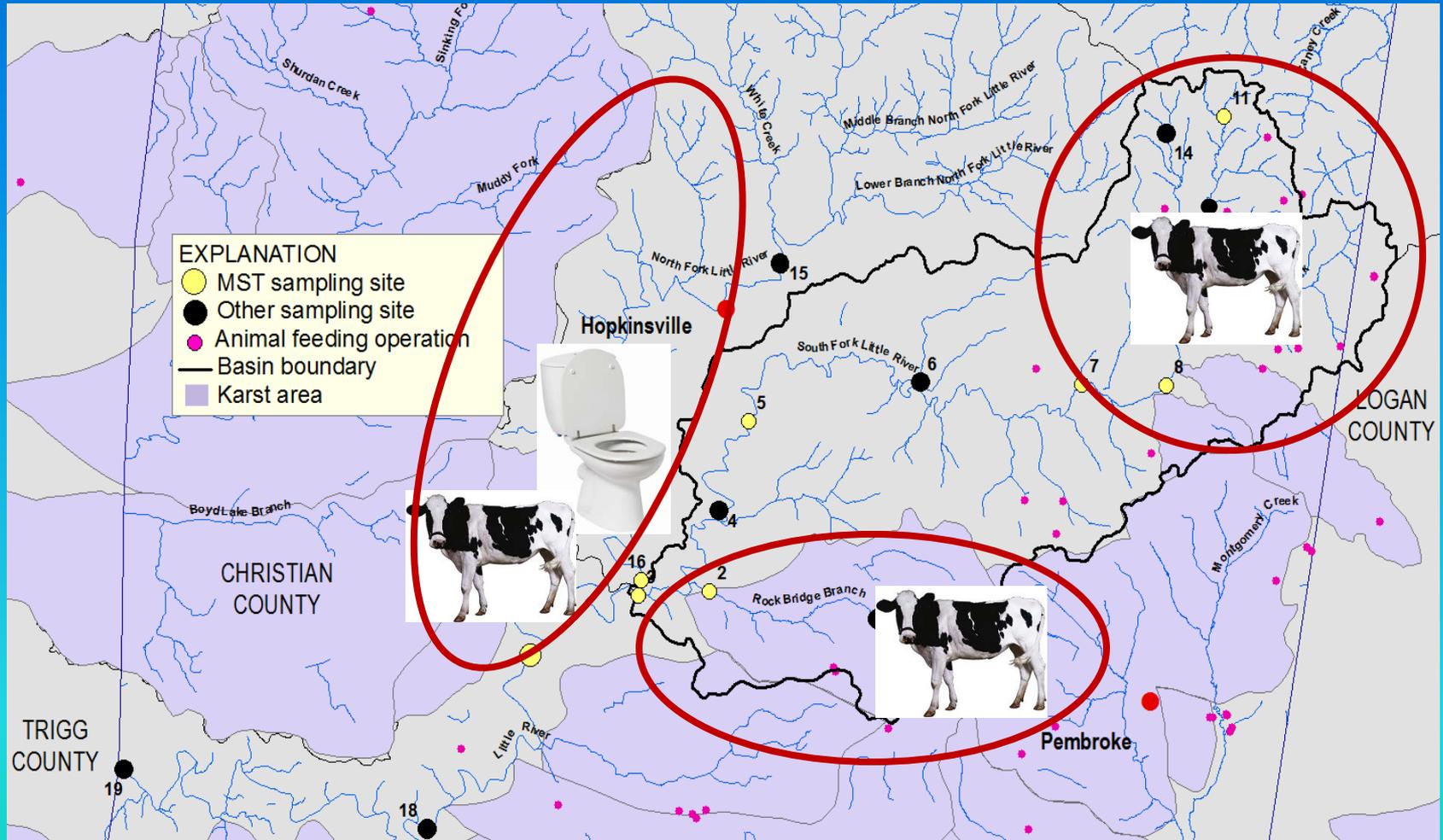
- Enables researchers to produce millions of copies of a specific DNA sequence in a short time



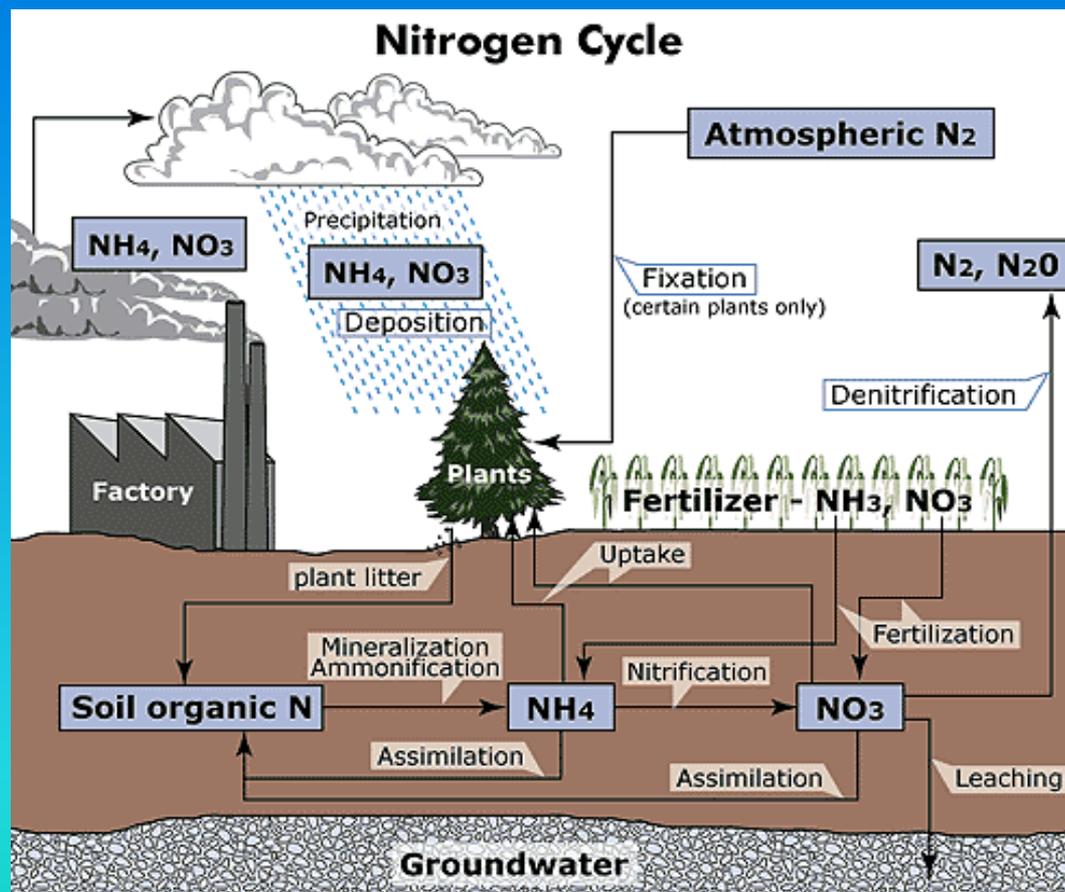
Site Locations—MST sampling



Site Locations—MST sampling results

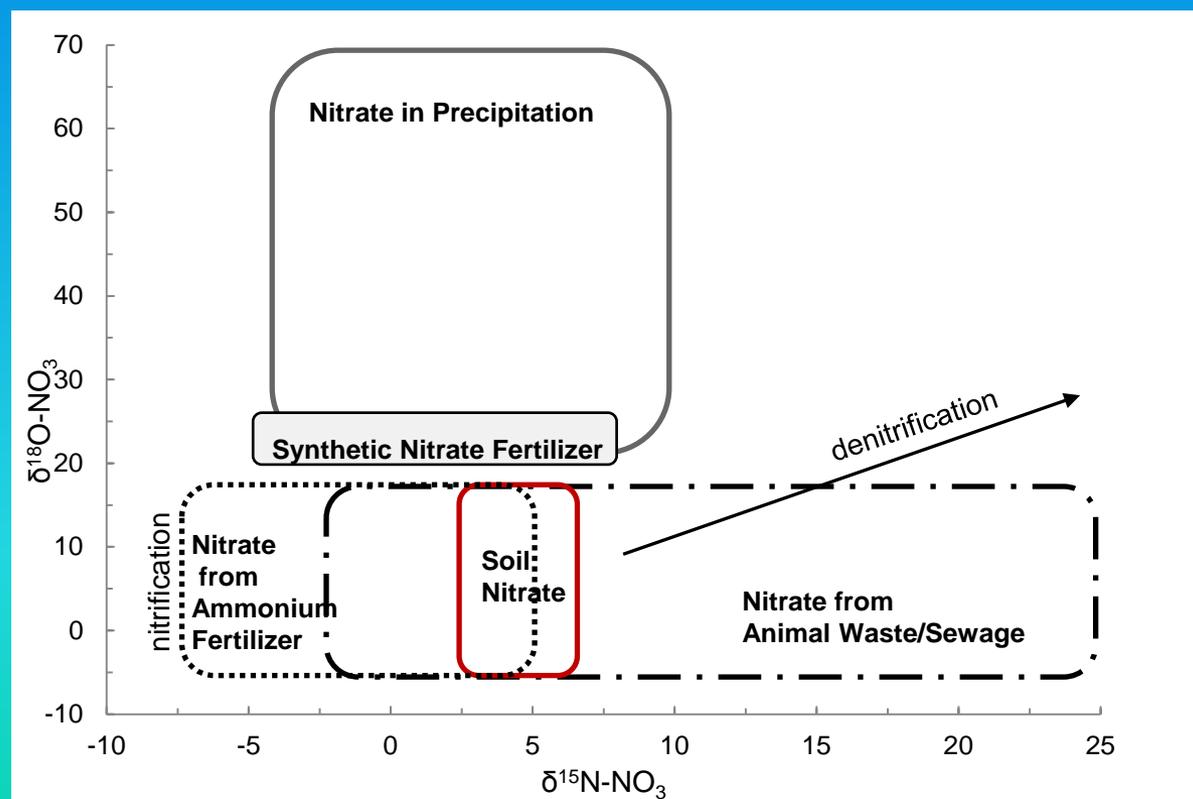


Stable Nitrate Isotopes

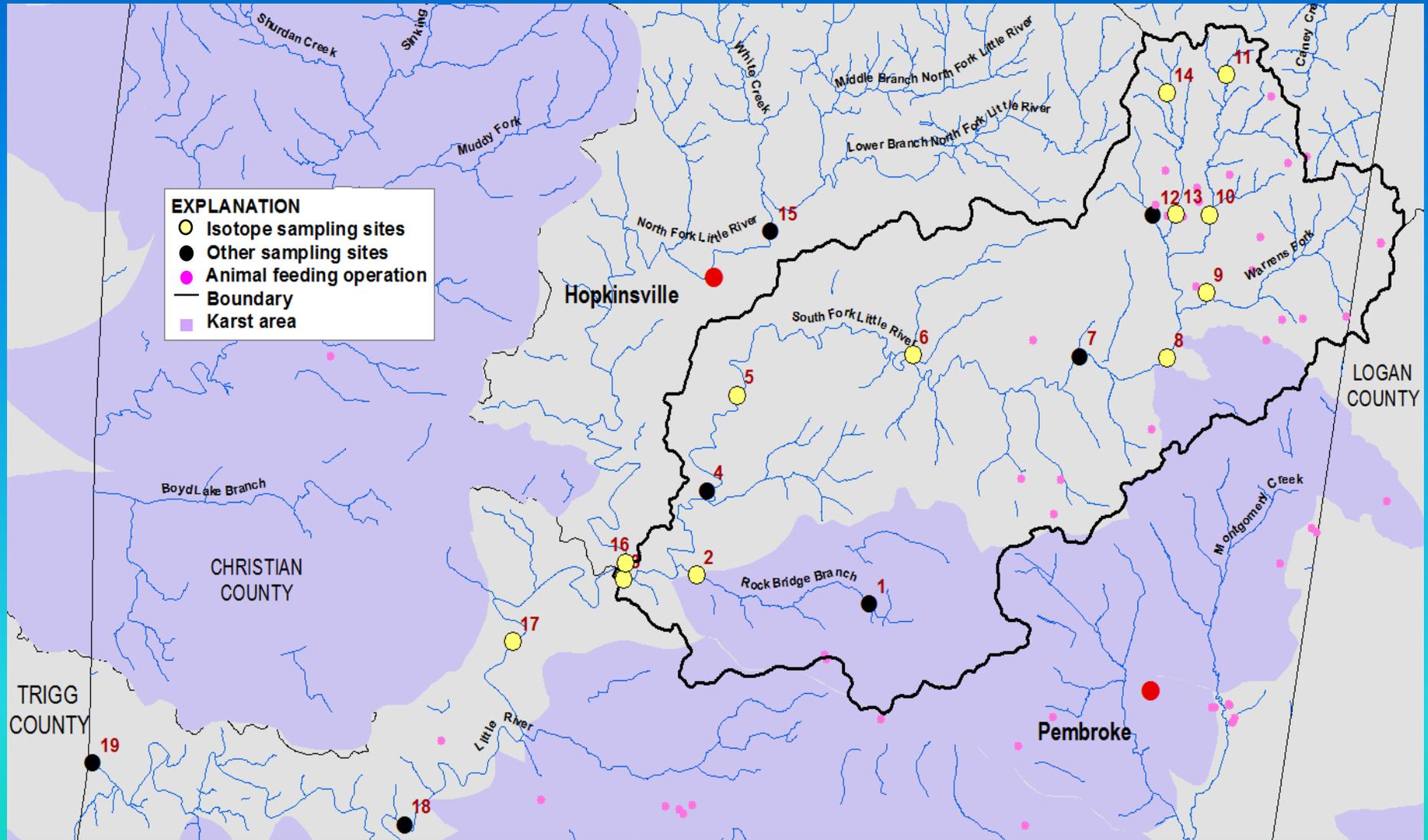


Stable Nitrate Isotopes Objectives

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

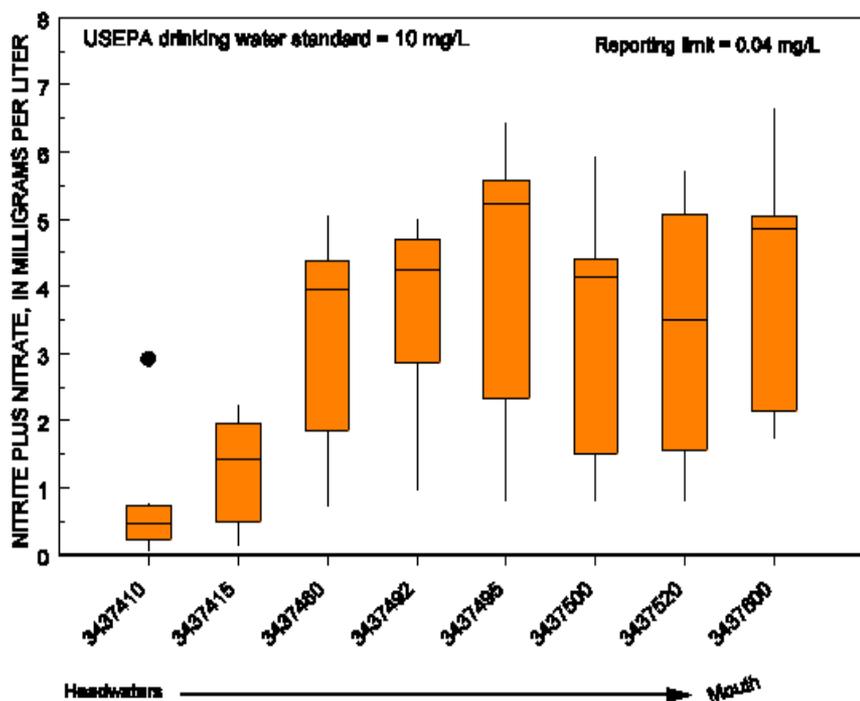


Site Locations—Isotope sampling

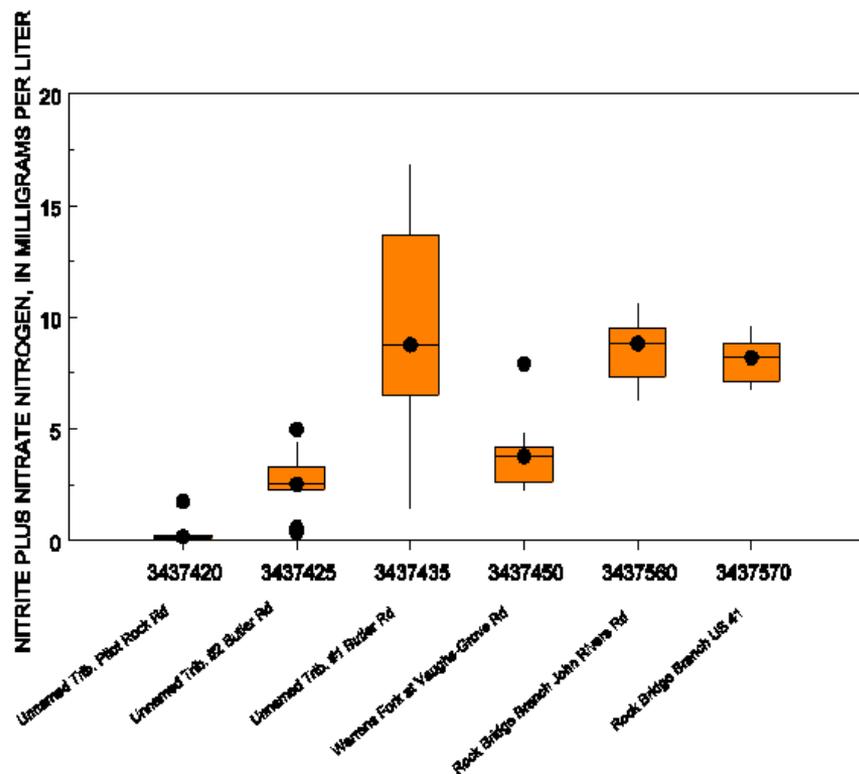


Nitrate—Preliminary Findings

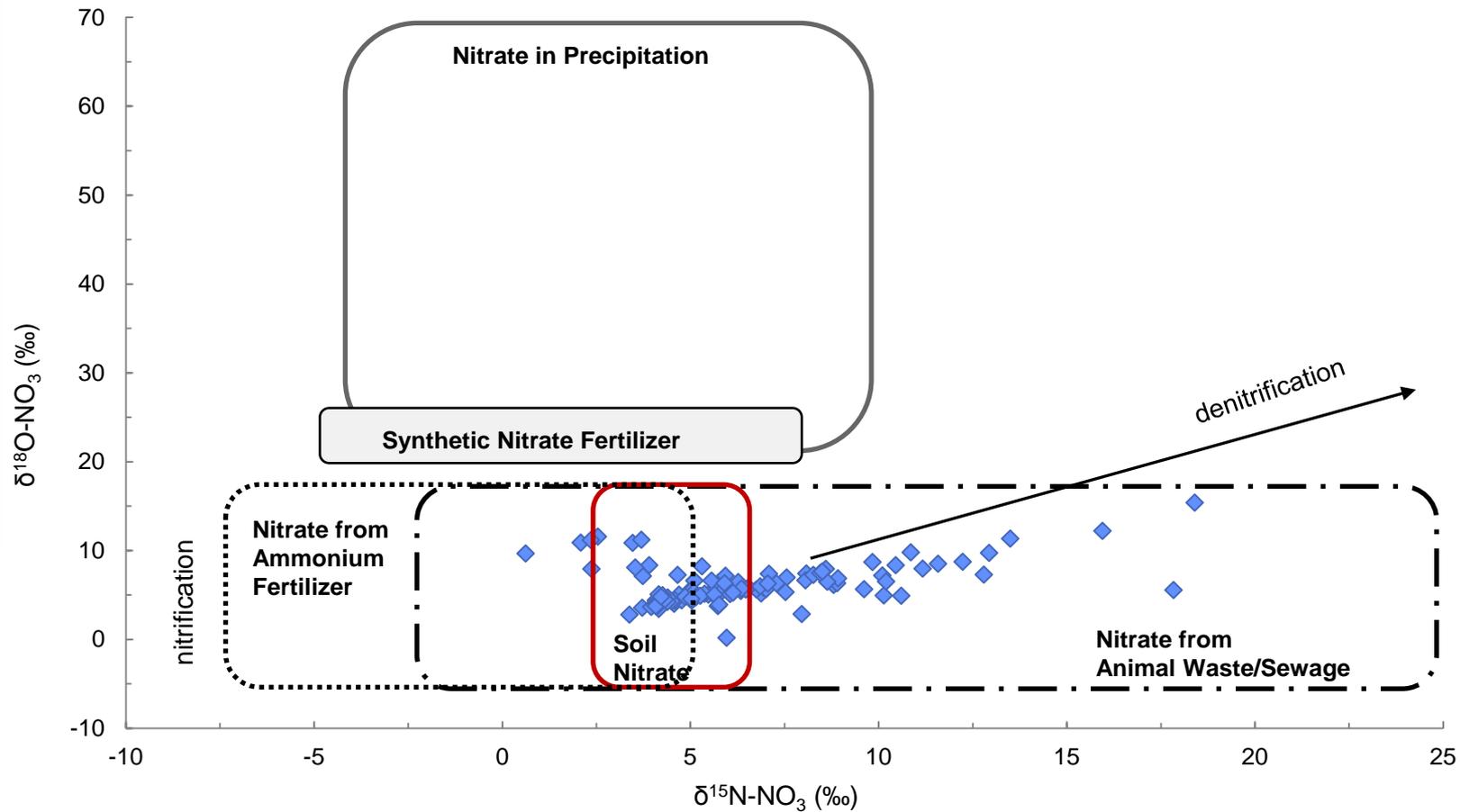
SF Little River mainstem



SF Little River tributaries



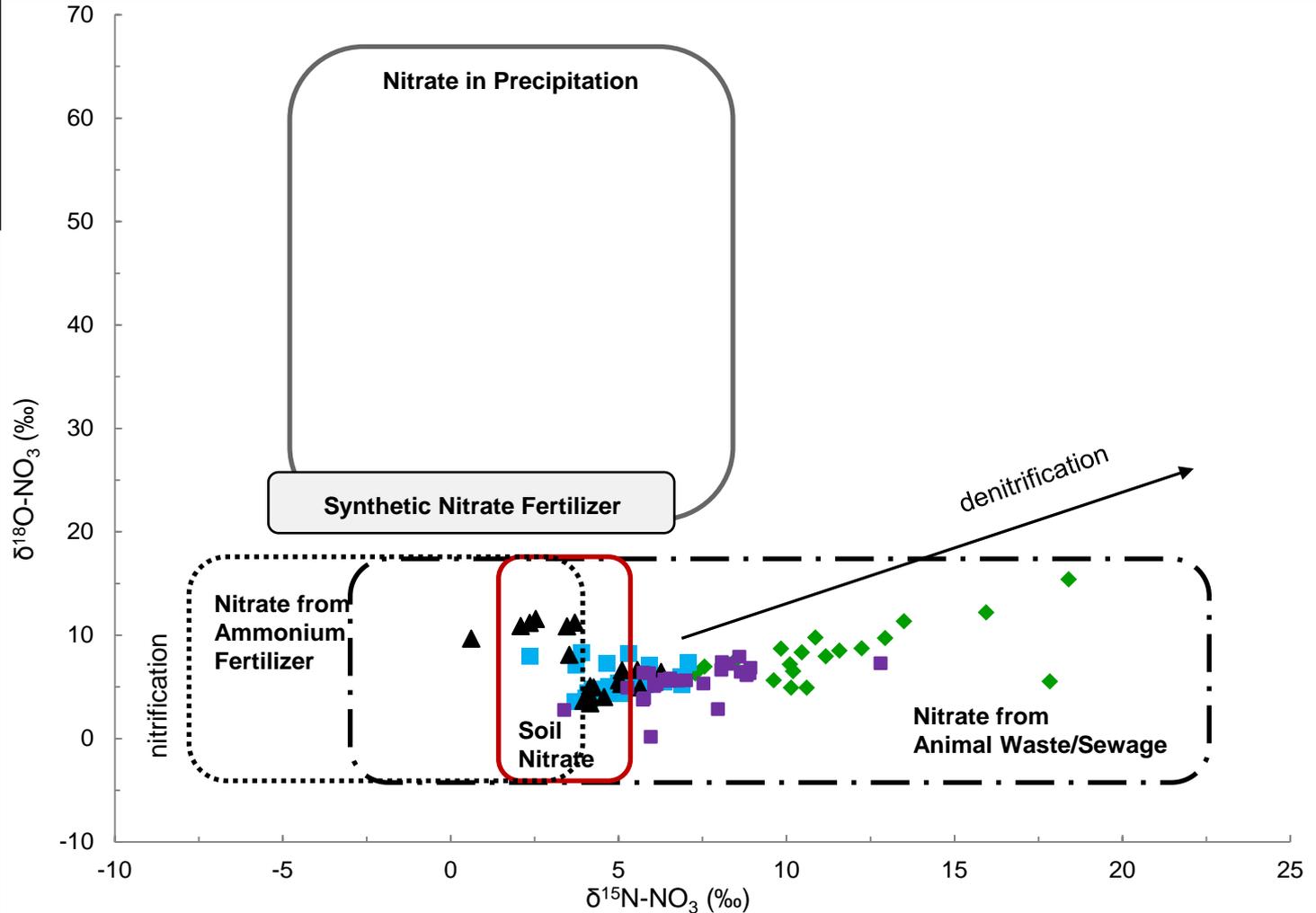
Isotopes—Preliminary Findings



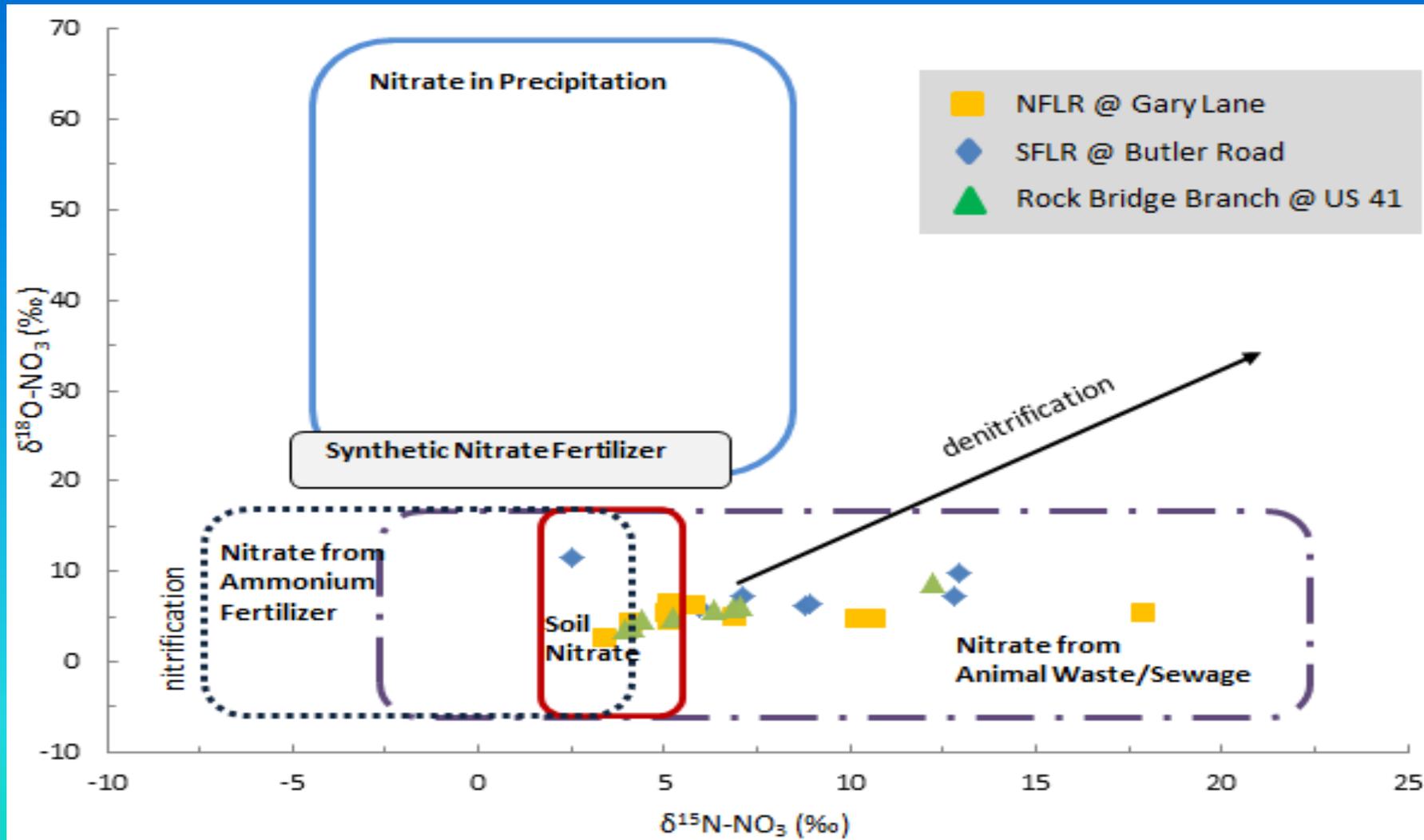
Isotopes—Preliminary Findings

EXPLANATION

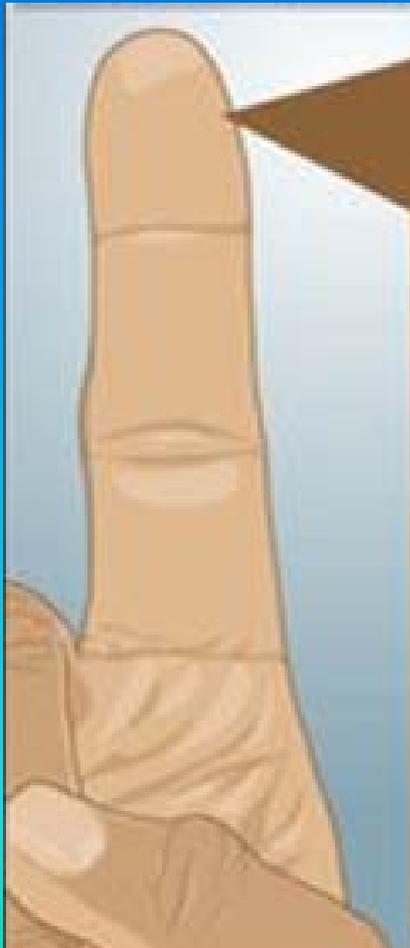
Green = Fall
Purple = Summer
Blue = Winter
Black = Spring



Isotopes—Preliminary Findings



Sediment Fingerprinting



Cropland



Pasture



Riparian



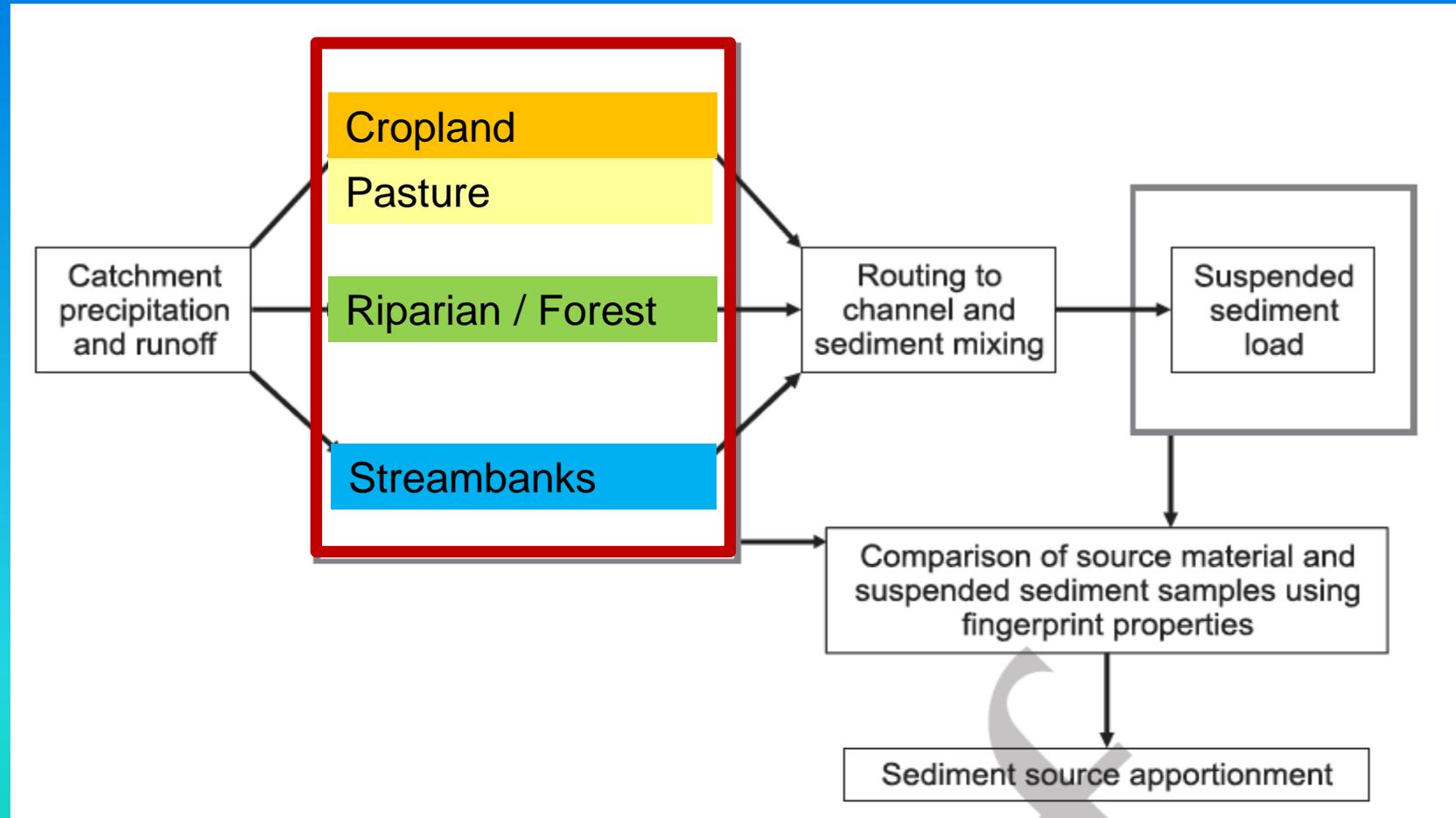
Streambank

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}Cs)

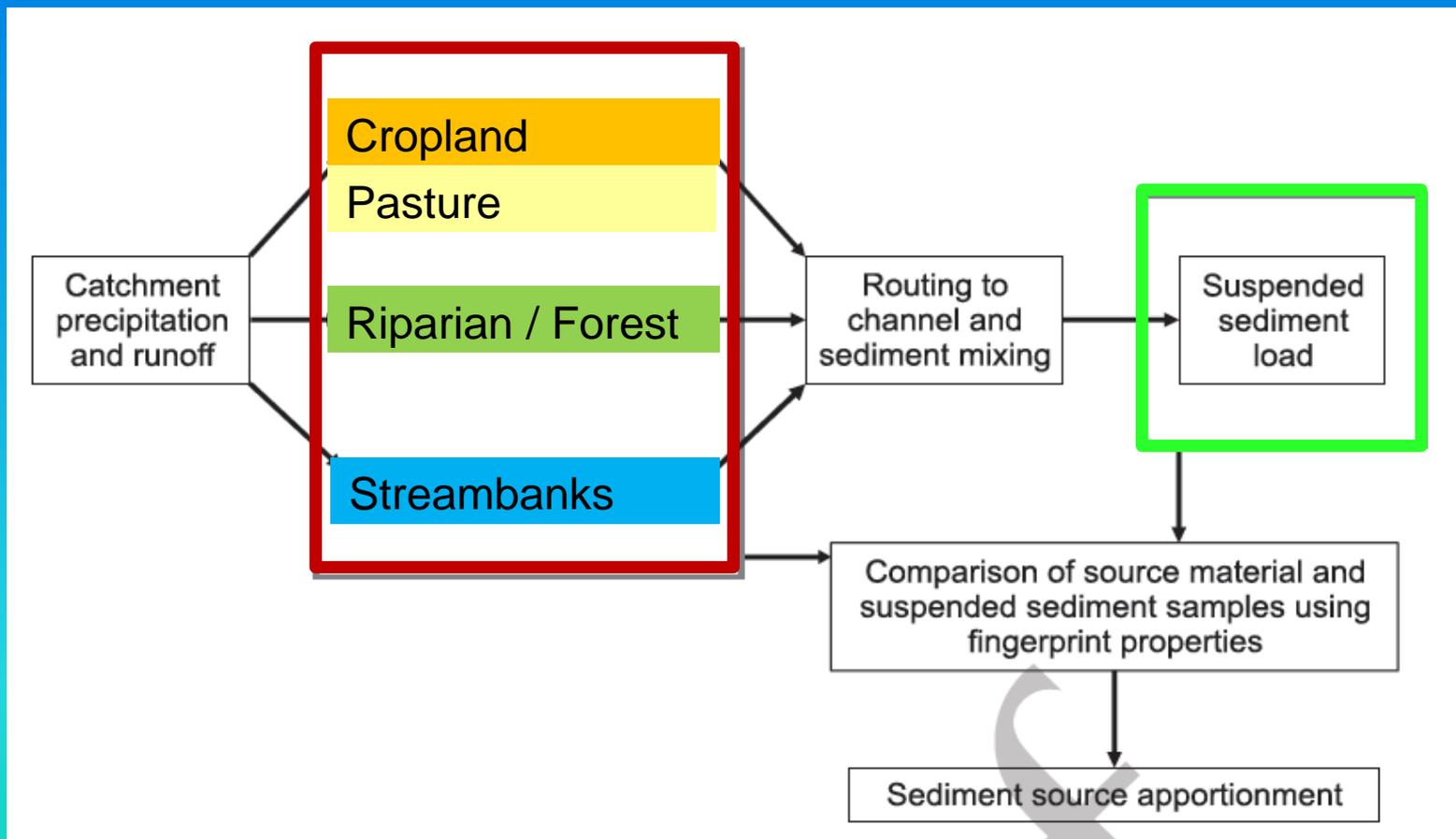
Sediment Fingerprinting Technique

- Identify and collect sediment-source samples



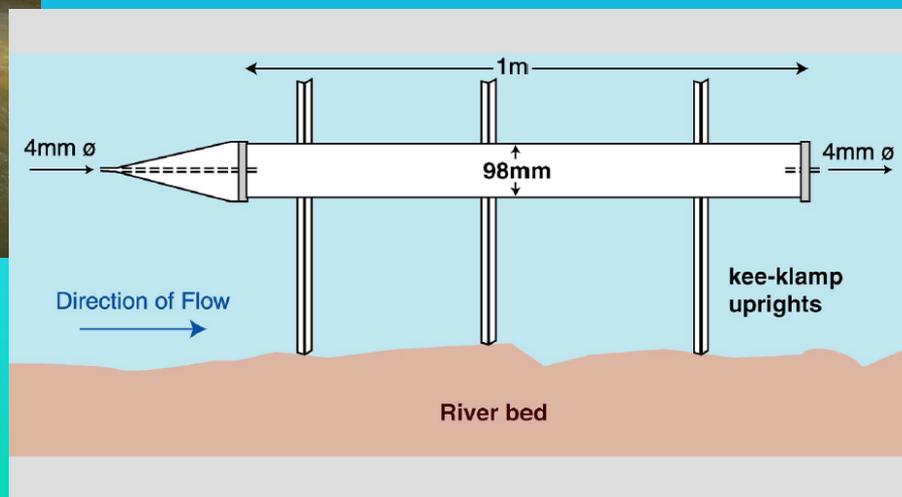
Sediment Fingerprinting Technique

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



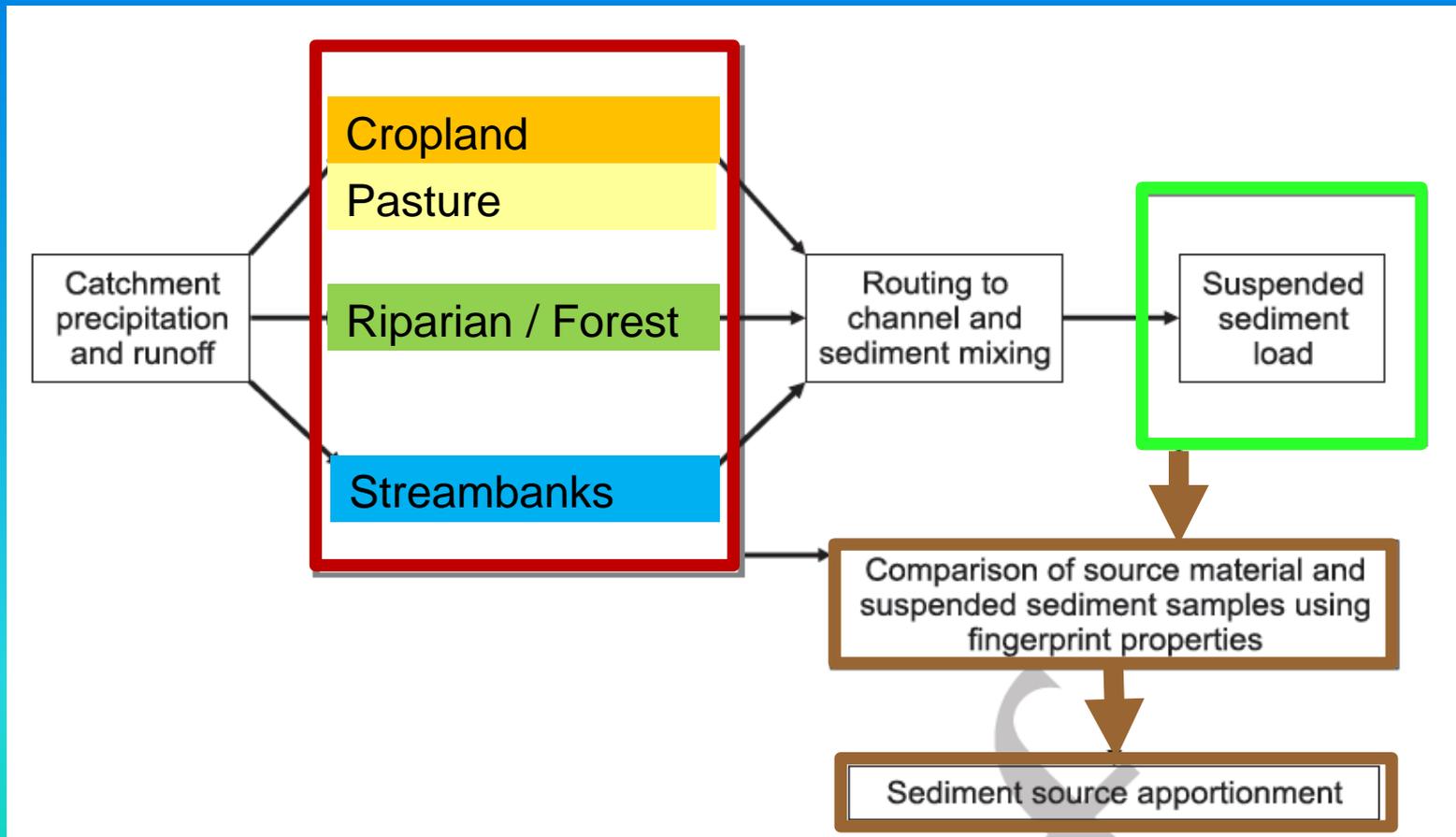
Sediment Fingerprinting Technique

- 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.
- Select sites 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 SF Little River Basin is human and/or animal waste
- Findings help support the MST findings

Key Preliminary Findings in 2013

■ Sediment Fingerprinting

- No results just yet

- Goals

- Better understanding of how human activities impact sediment fluxes
- Effectively target management strategies to achieve greatest reduction in sediment runoff
- Better understanding of how natural systems function

Partnerships

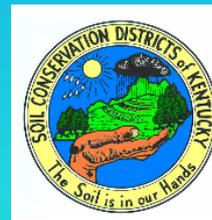


Christian Co. Fiscal Court



County Agriculture Development Boards

- Christian
- Trigg
- Todd



Local producers
and many others

Questions?



Contact Information

Angie Crain

ascrain@usgs.gov

502-493-1943