

Understanding Contaminant Sources, Ground-Water Residence Times, and Flow Patterns in a Karstic Springshed

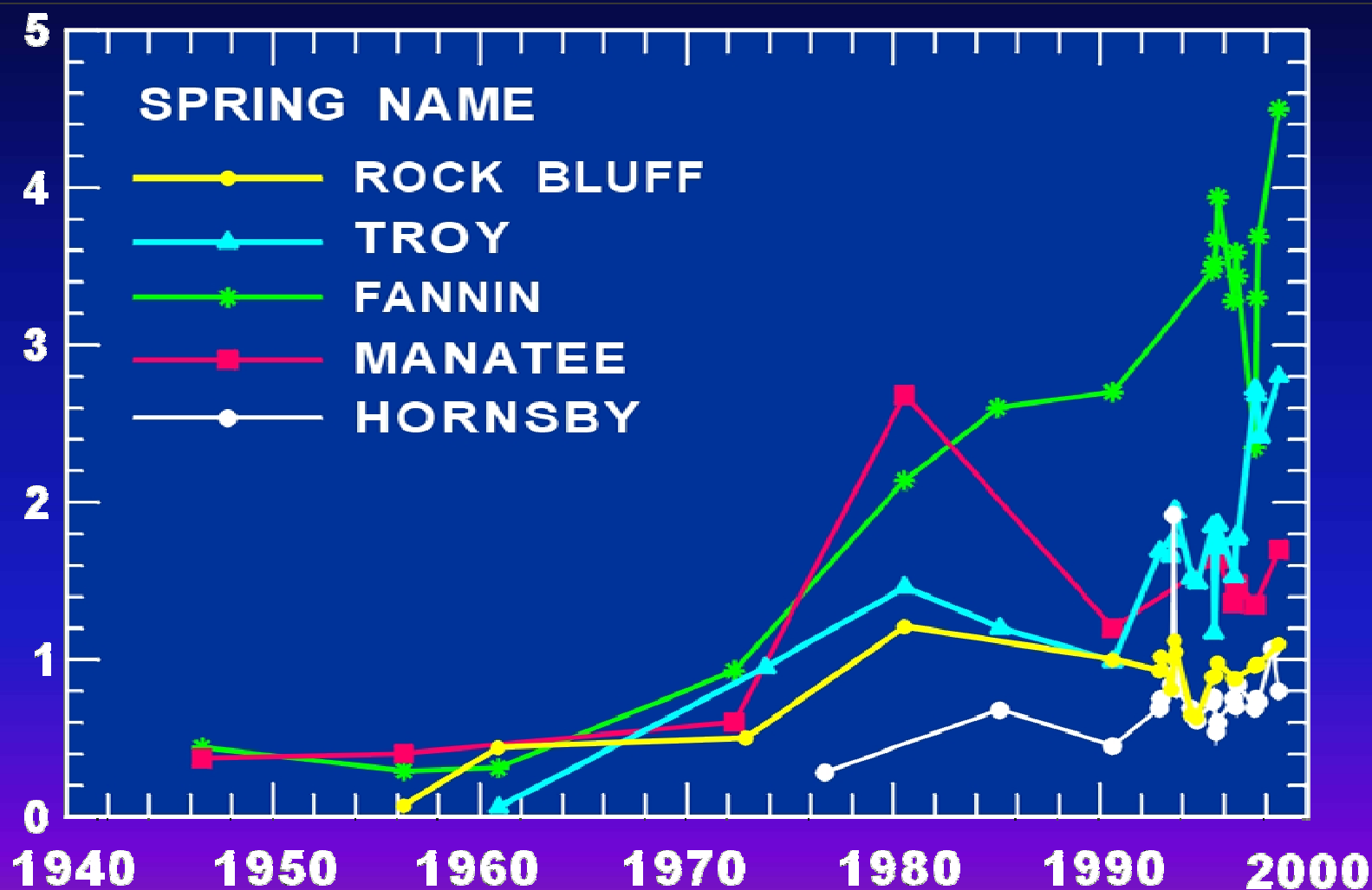
Brian Katz, Rick Copeland, Tom Greenhalgh, Warren Zwanka, and Sam Upchurch

***Suwannee River and Estuary Science Workshop
Cedar Key, Florida,
September 23, 2004***

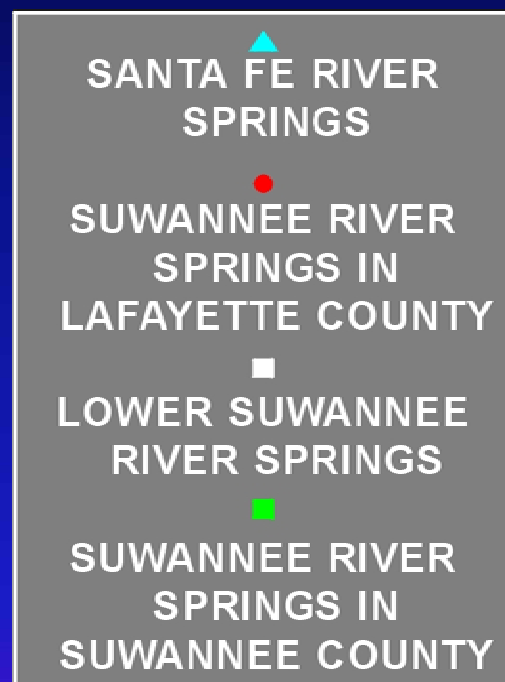
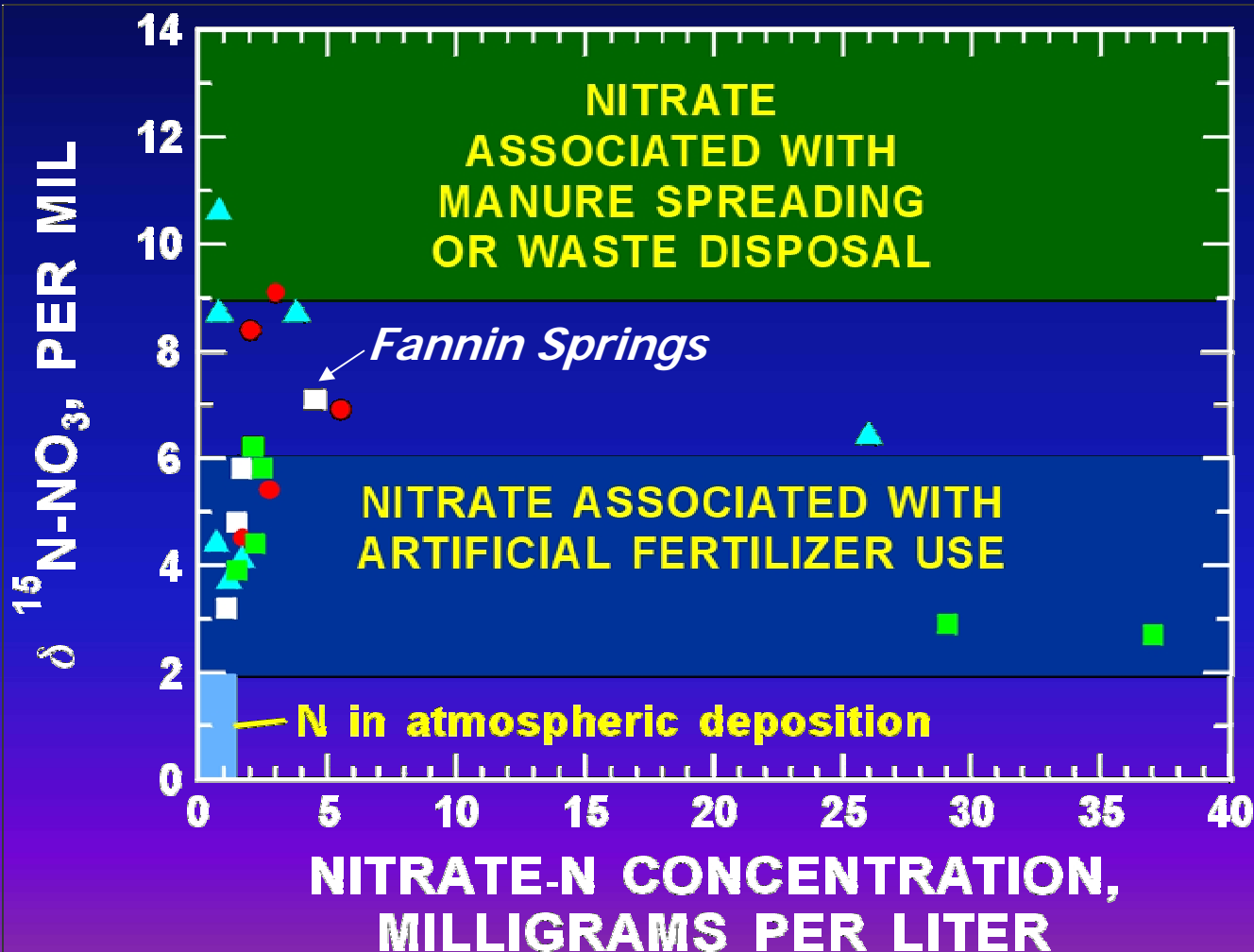


NITRATE IN SPRING WATERS, NORTHERN FLORIDA

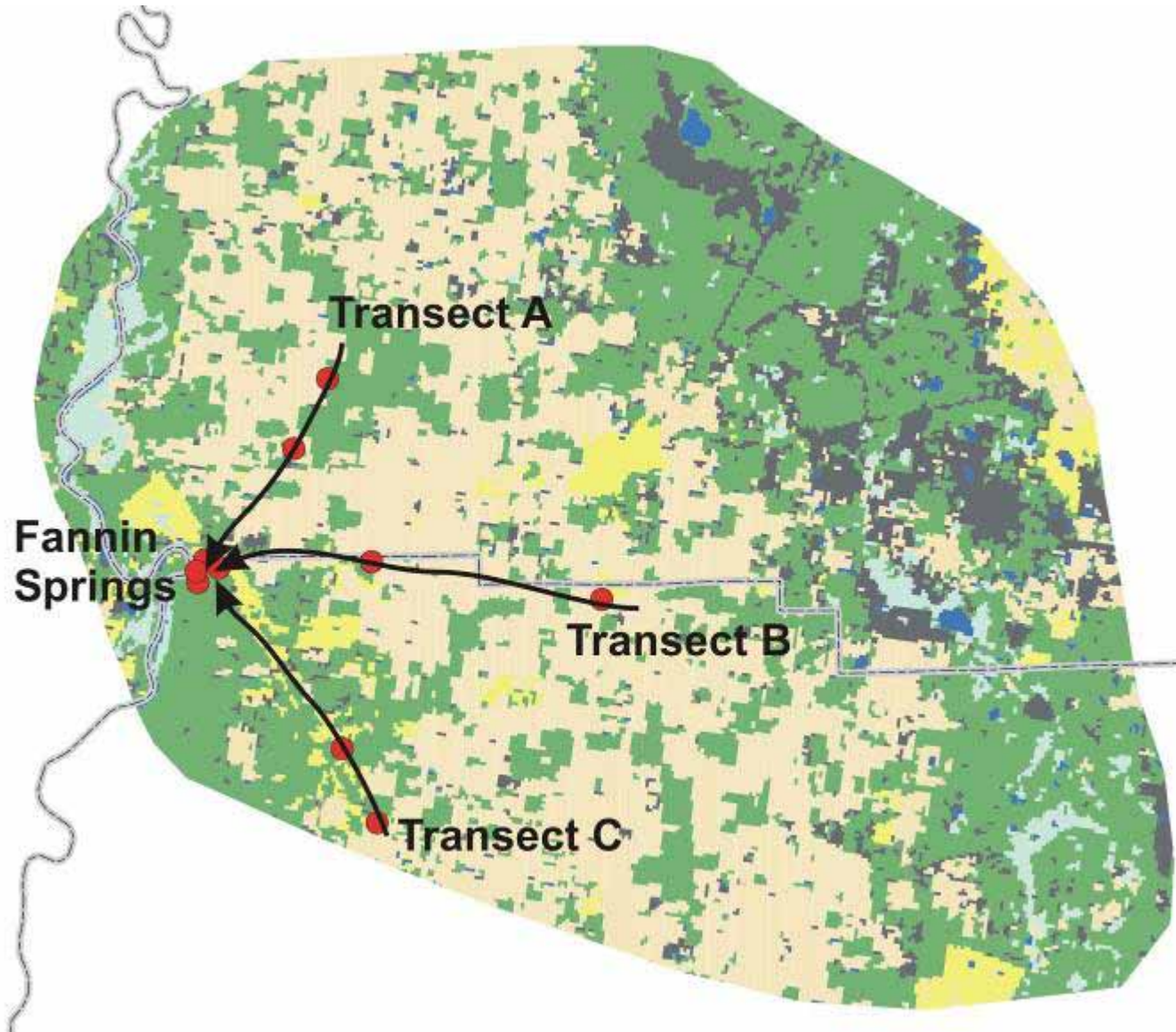
**NO₃-N CONCENTRATION,
IN MILLIGRAMS PER LITER**



SOURCES OF NITRATE IN SPRING WATERS

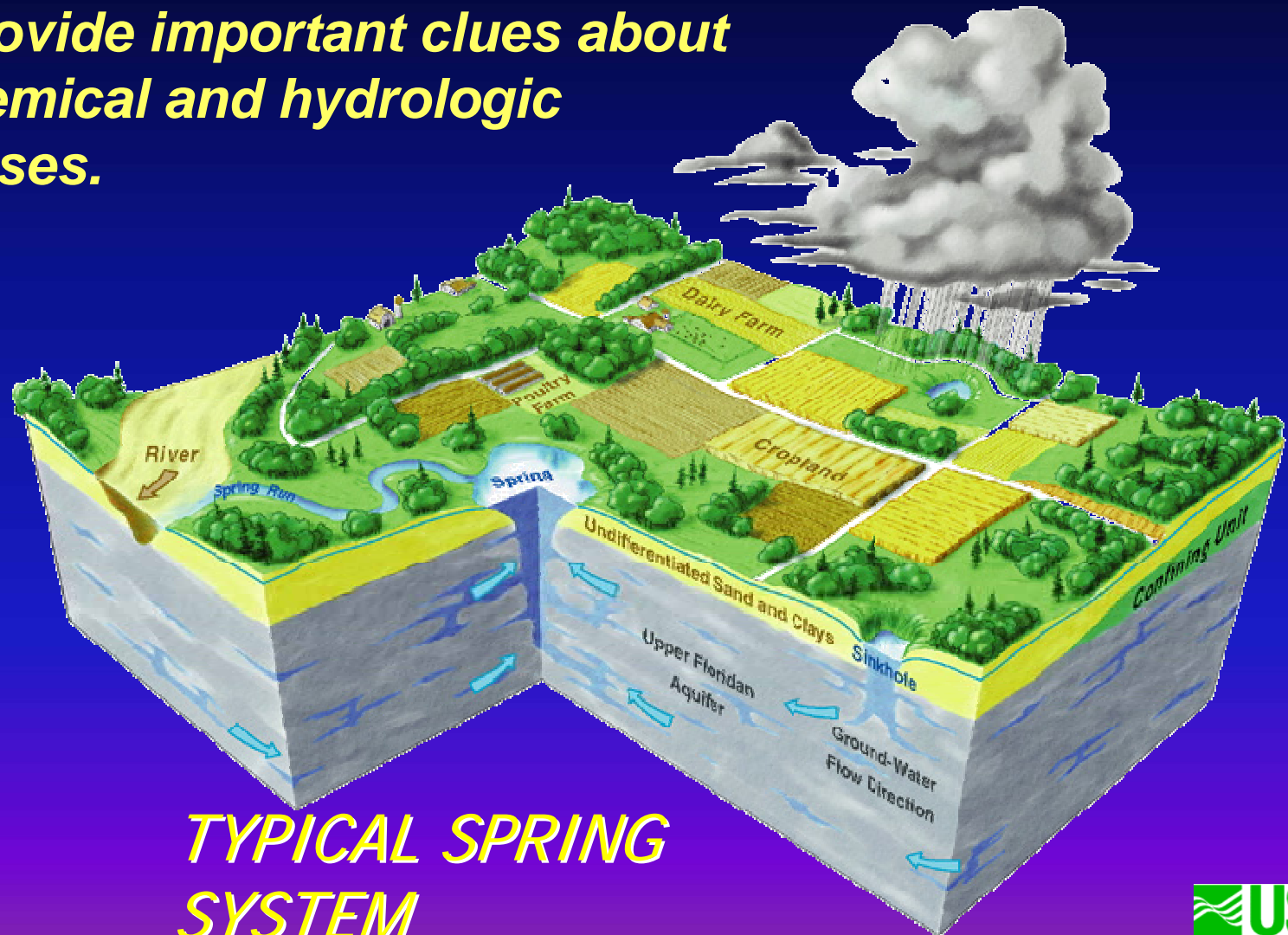


Fannin Springshed Study



Spring-water chemistry— reflects the temporal, spatial, and vertical integration of water from the aquifer system.

Can provide important clues about geochemical and hydrologic processes.



TYPICAL SPRING SYSTEM



MULTIPLE CHEMICAL TRACER APPROACH

SOURCES OF NITRATE CONTAMINATION:

$^{15}\text{N}/^{14}\text{N}$ ($\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ of NO_3)

GEOCHEMICAL PROCESS IDENTIFICATION:

$\delta^{18}\text{O}$, $\delta^2\text{H}$, $\delta^{13}\text{C}$, major ions, nutrients,
dissolved gases, DOC

AGE OF SPRING WATERS:

CFC-11, CFC-12, CFC-113; $^3\text{H}/^3\text{He}$; SF_6



Fannin Springs Study--Source Identification

Cropland farming:

Herbicides and degradates (36 compounds)

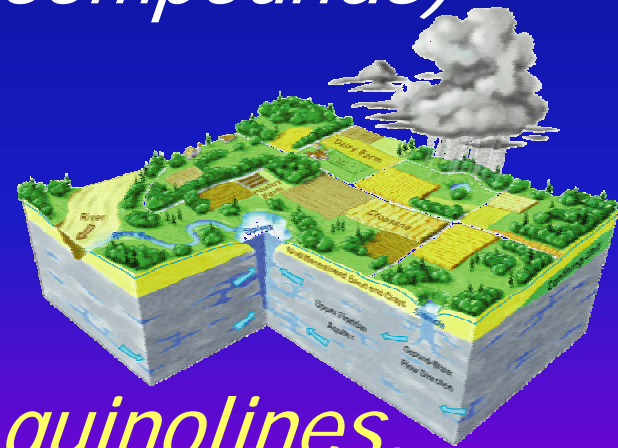
*Triazines, phenylureas, acetanilides,
degradates*

Pesticides and degradates (66 compounds)

Animal wastes

Antibiotics (37 compounds)

*Beta lactams, macrolides, quinolones,
sulfonamides, tetracyclines*



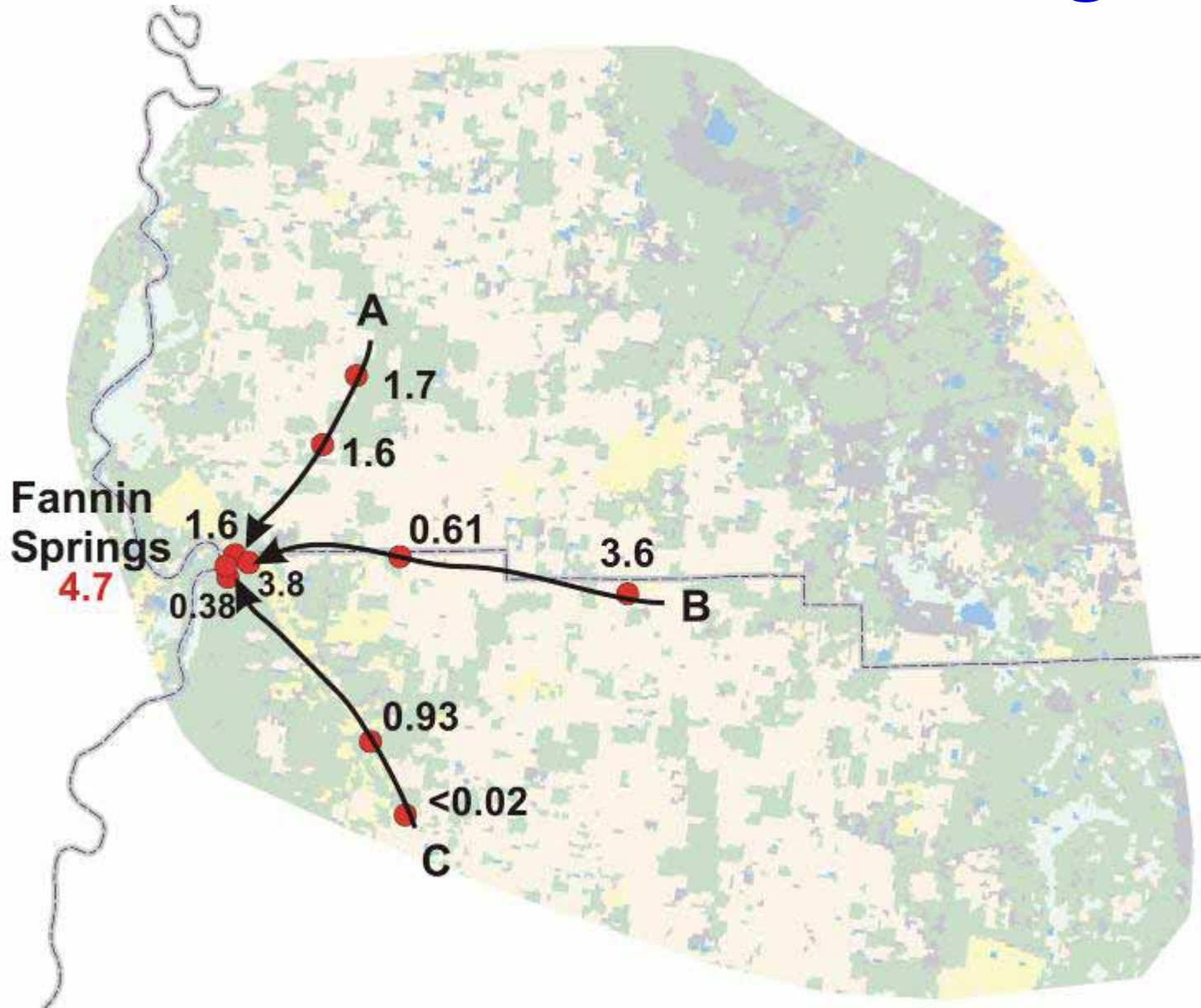
Fannin Springs Study--Source Identification

Human wastewater compounds (67):

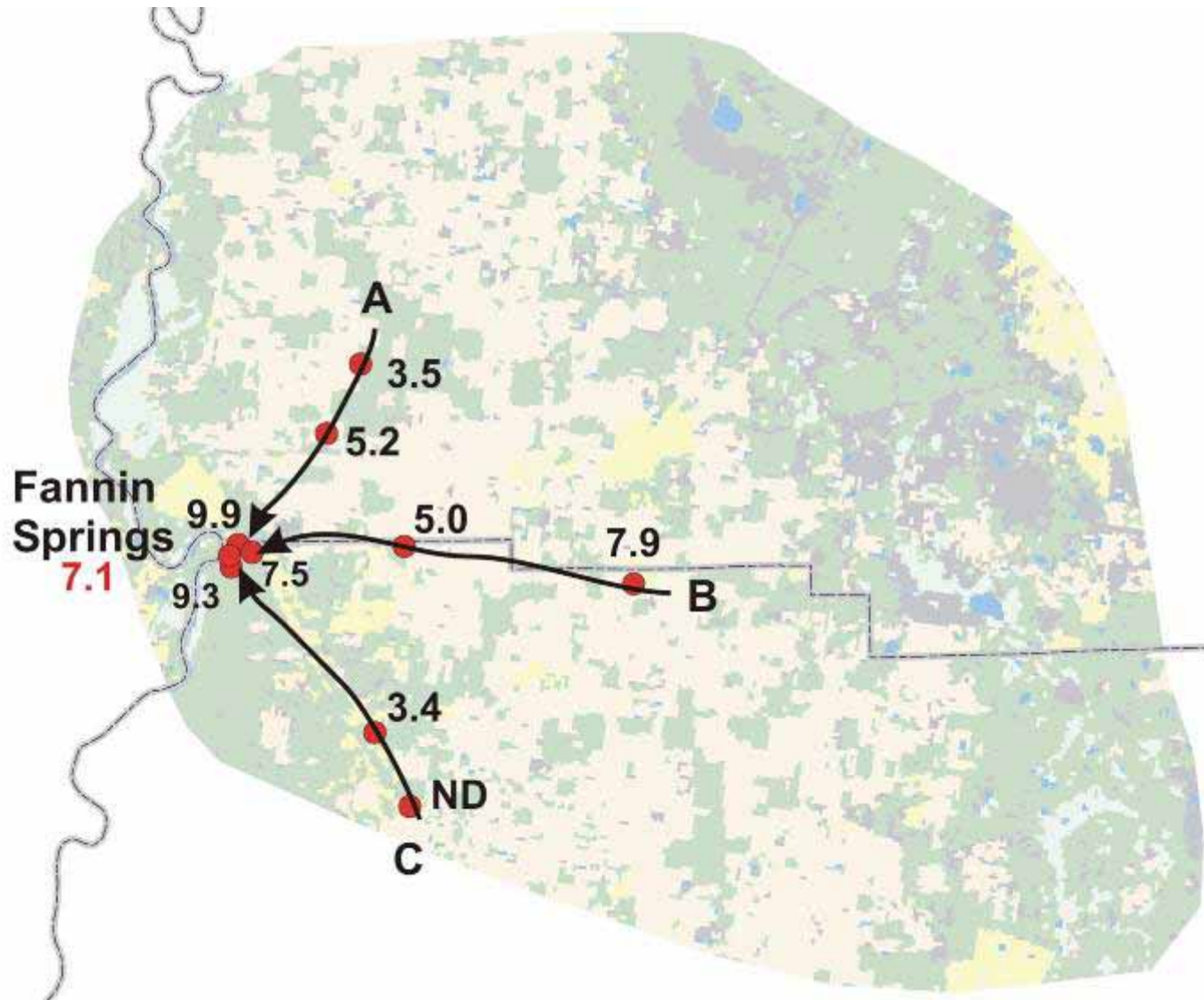
Alkylphenol ethoxylate nonionic surfactants and their degradates, food additives, fragrances, antioxidants, flame retardants, plasticizers, industrial solvents, disinfectants, fecal sterols, polycyclic aromatic hydrocarbons, high-use domestic pesticides



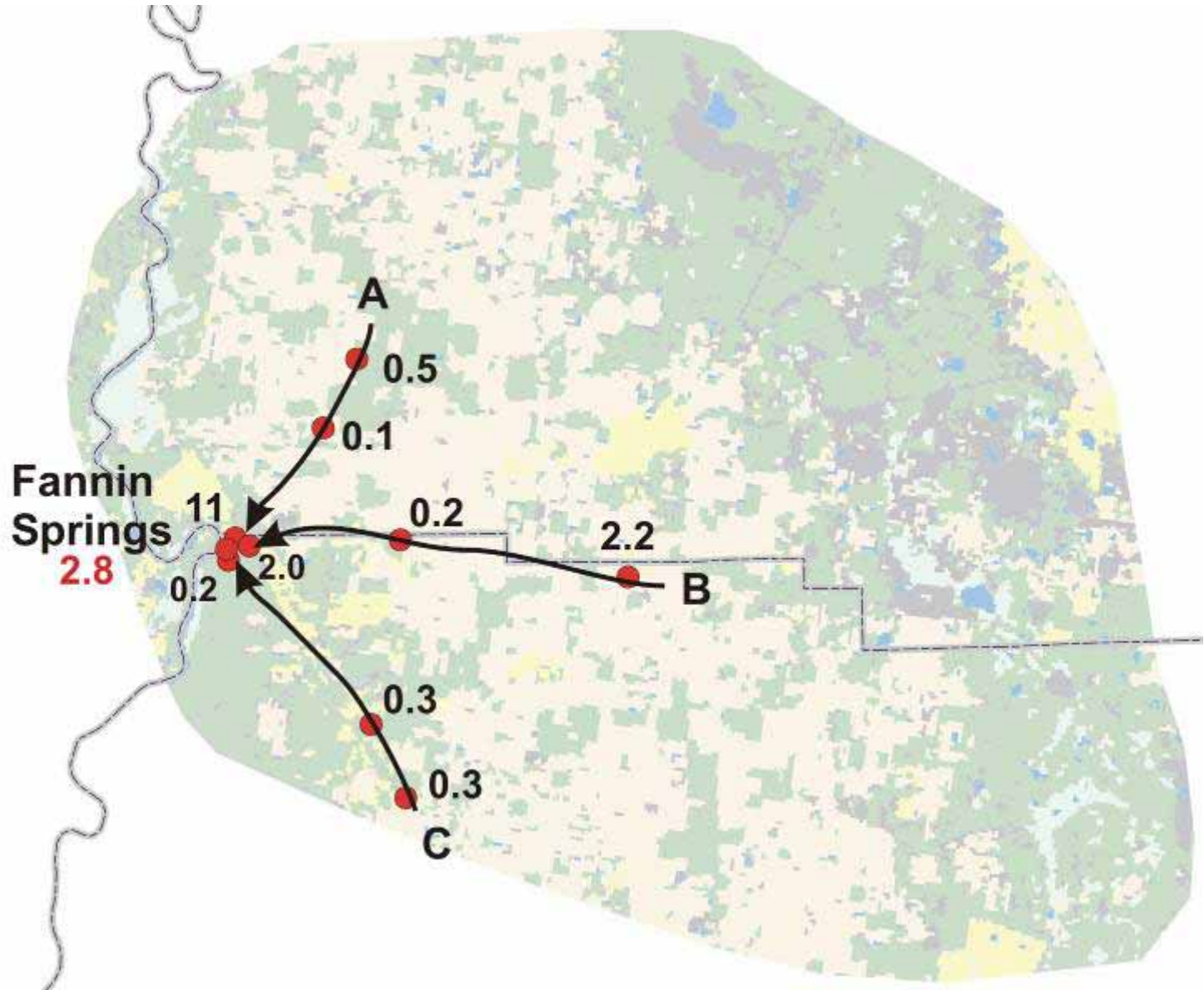
Nitrate Concentration, mg/L



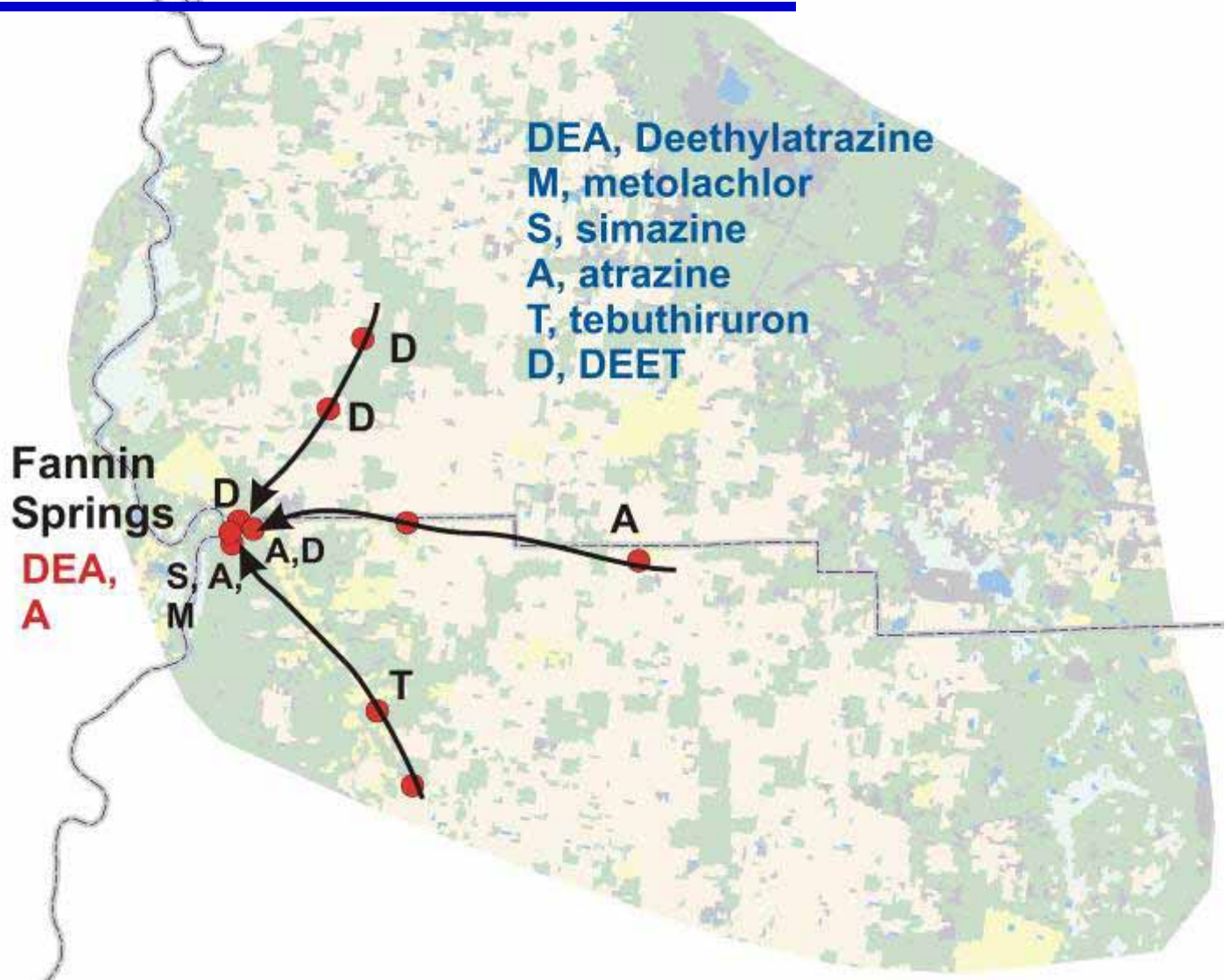
$^{15}\text{N}/^{14}\text{N}$ of Nitrate, per mil



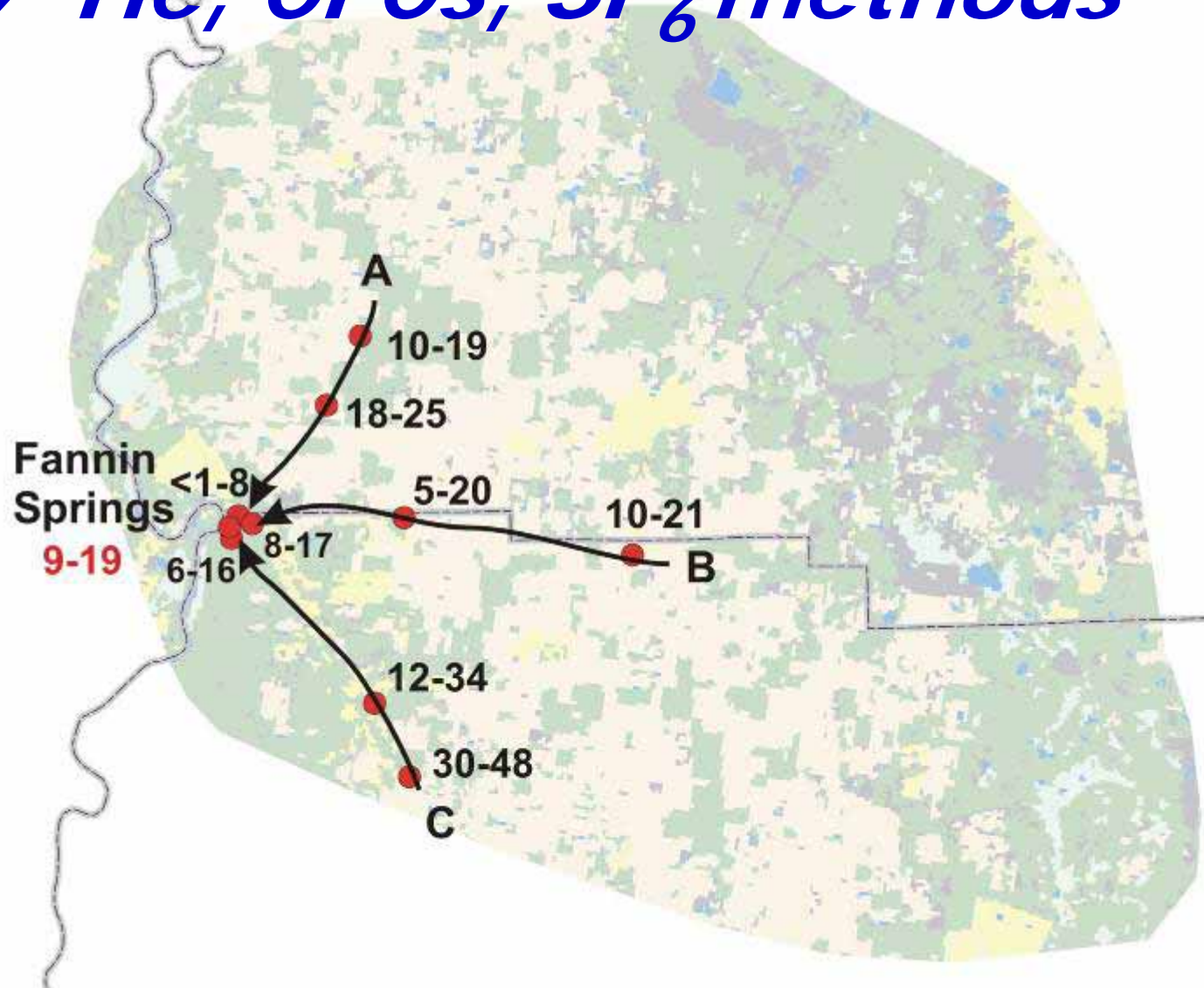
Potassium Concentration, mg/L



Pesticides, emerging contaminants detected:



Ground-Water Age (yrs). *$^3\text{H}/^3\text{He}$, CFCs, SF_6 methods*



Conclusions

- *Predominant sources of nitrate contamination in the Fannin springshed appear to originate from agricultural activities, based on the detection of elevated potassium, herbicides and their degradates, and nitrogen isotope ratios.*
- *However, other sources such as animal wastes, and or septic tank effluent may account for elevated nitrogen isotope ratios in some wells and Fannin Springs.*

