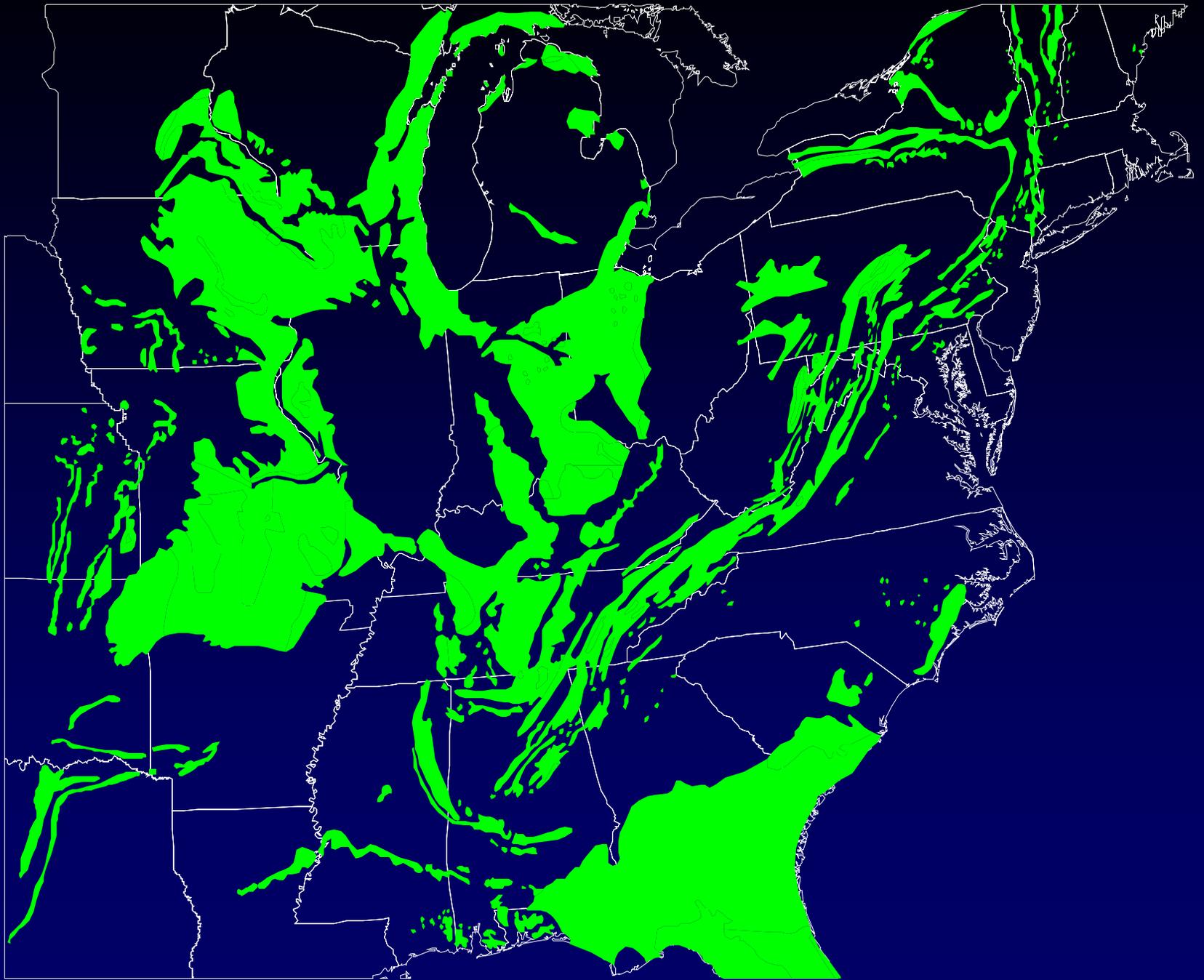


# How Present Land Use Affects Karst

Douglas Boyer, Hydrologist  
Appalachian Farming Systems Research Center  
USDA-ARS  
Beaver, WV

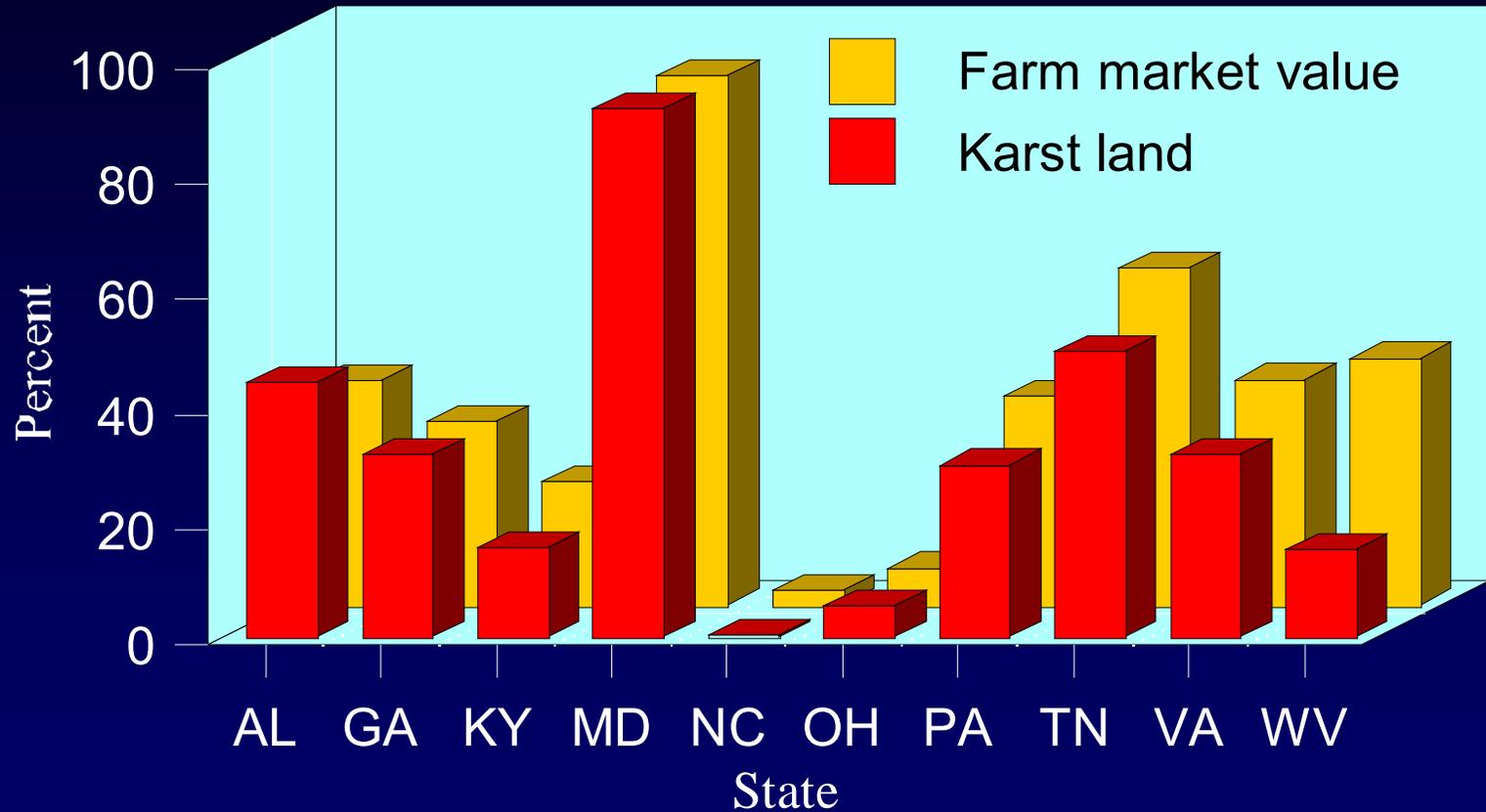
Doug.Boyer@ars.usda.gov  
<http://www.ars.usda.gov/naa/afsrc>

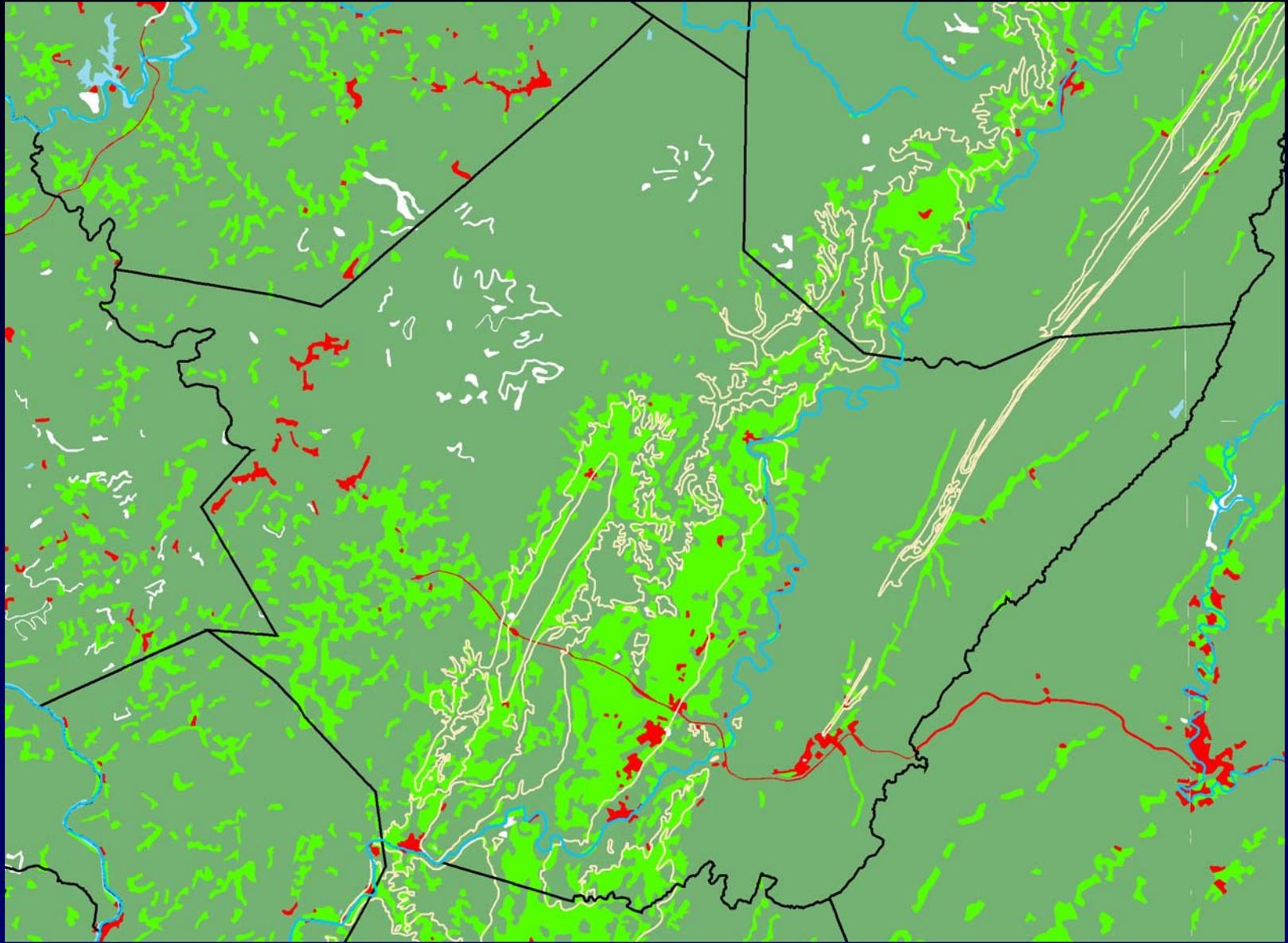




# Karst Land in Appalachia

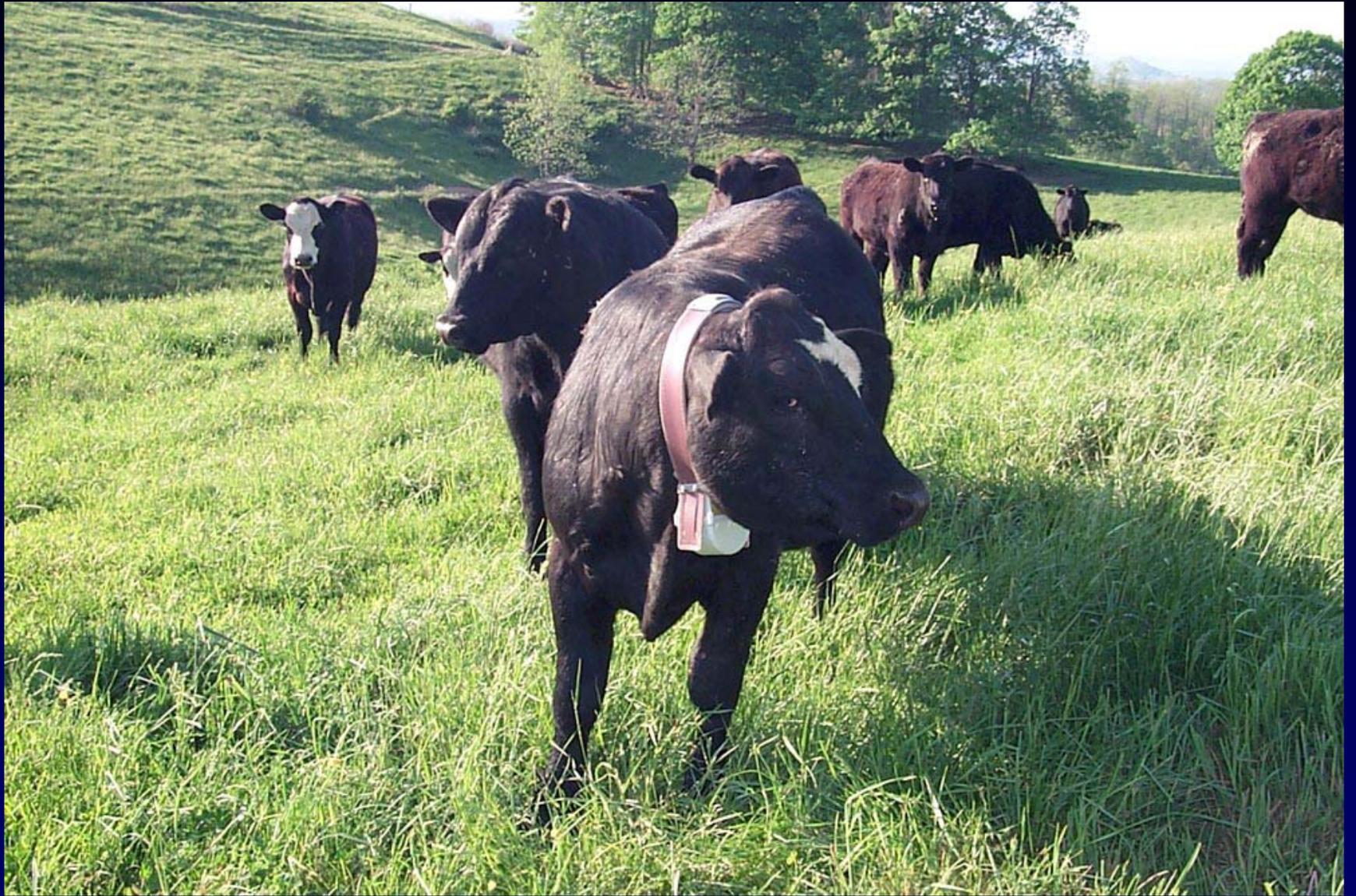
18% land area and 36% market value in karst



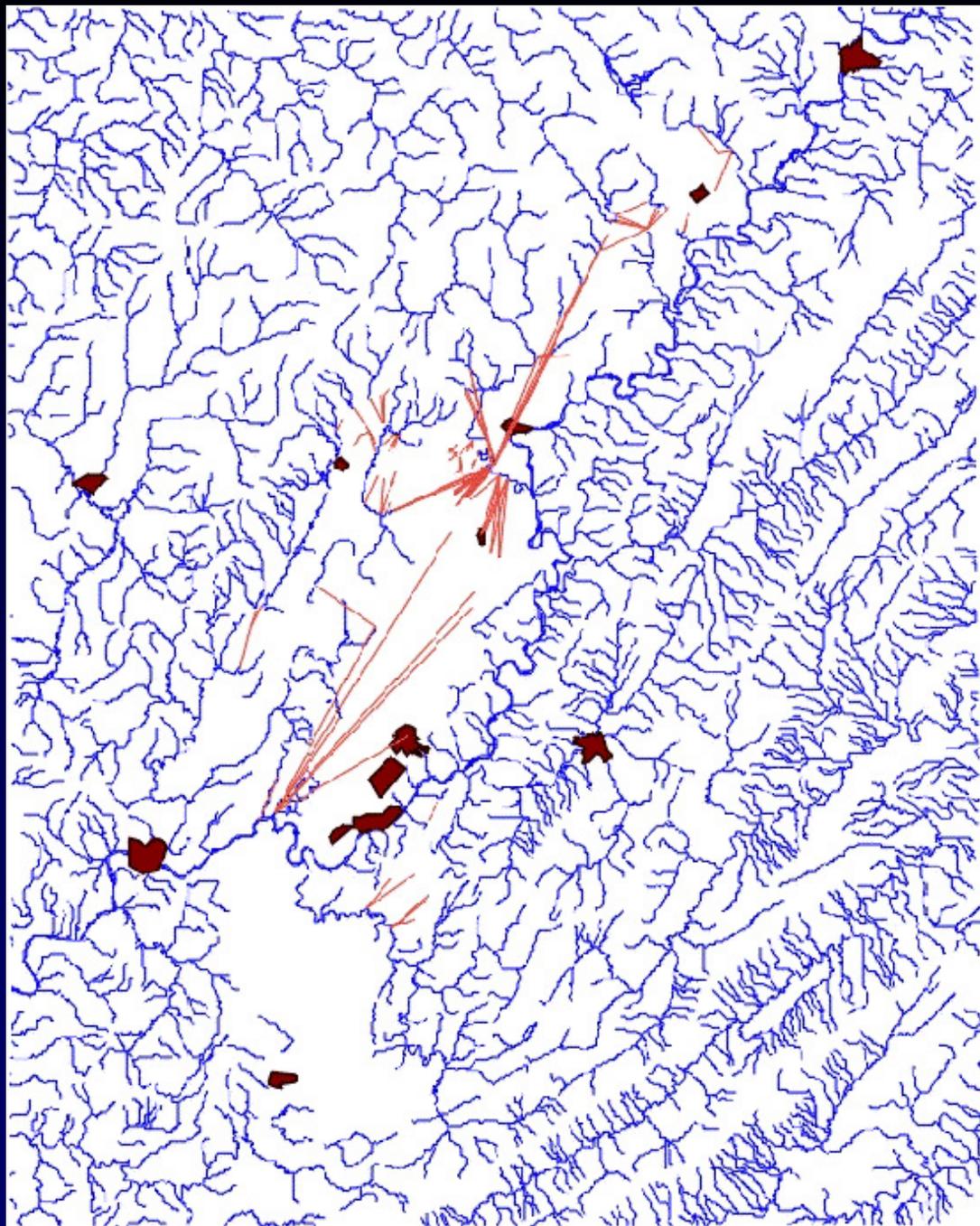


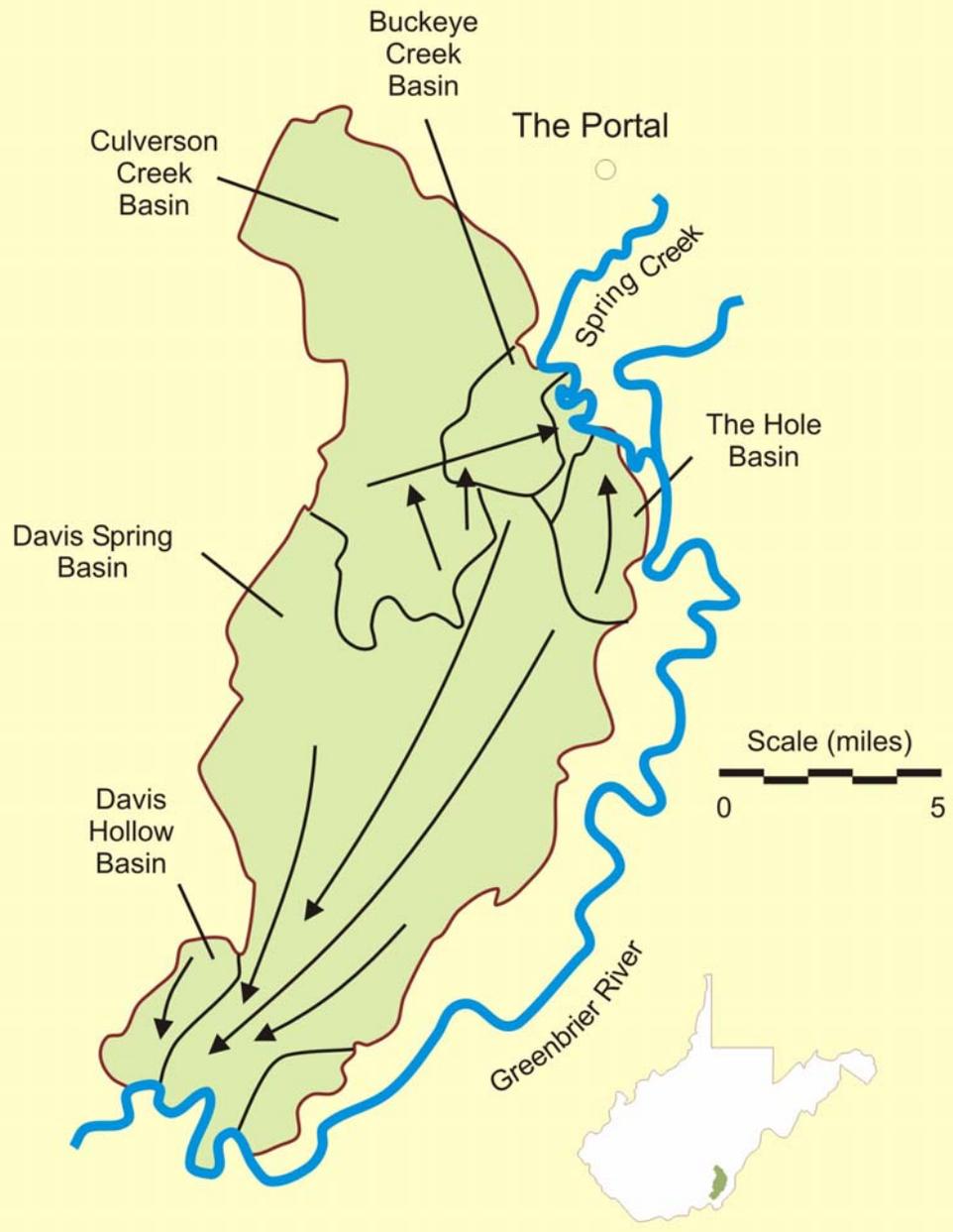






≈ 30,000 cattle and calves on the karst areas  
of Greenbrier County

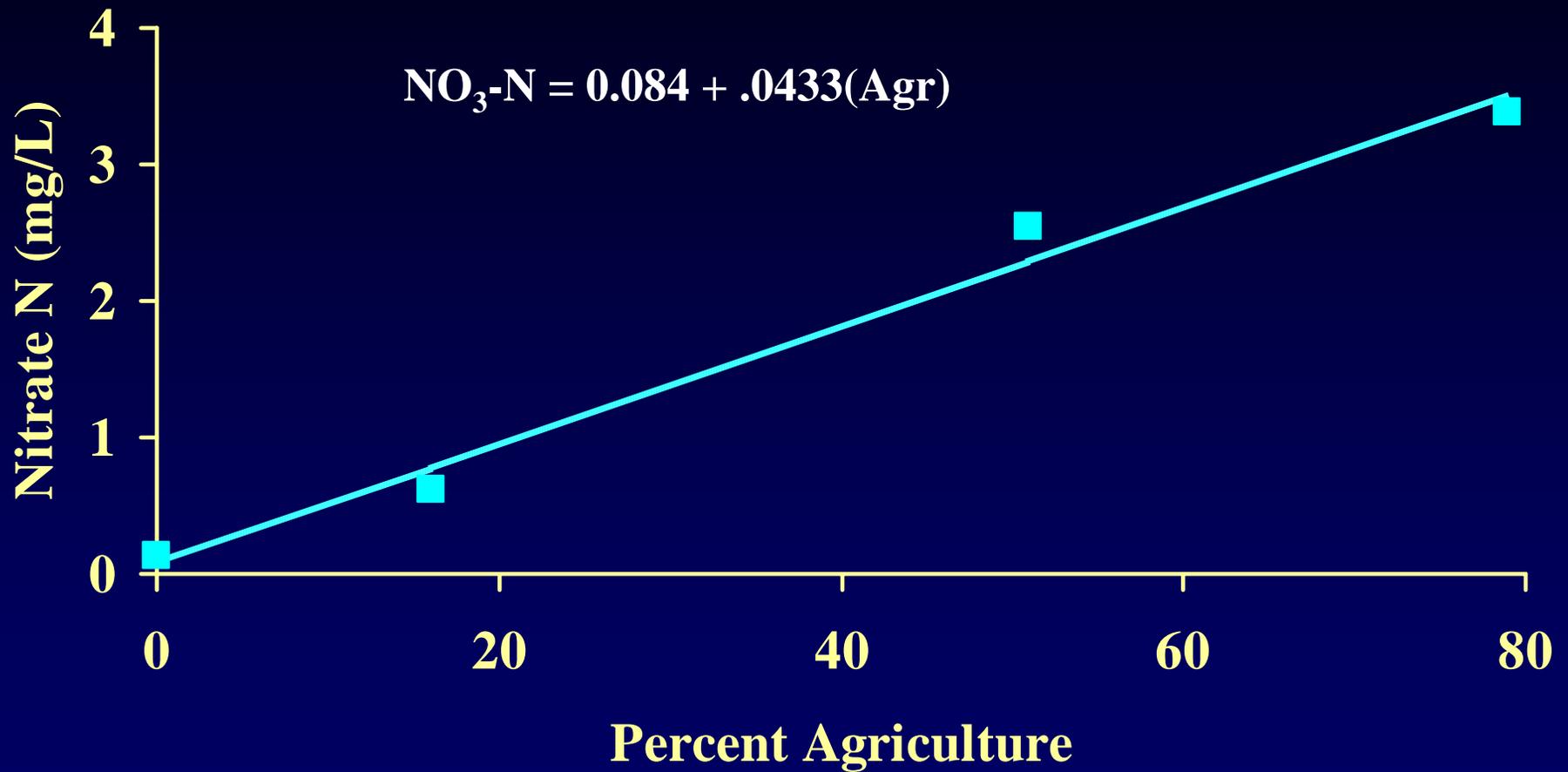


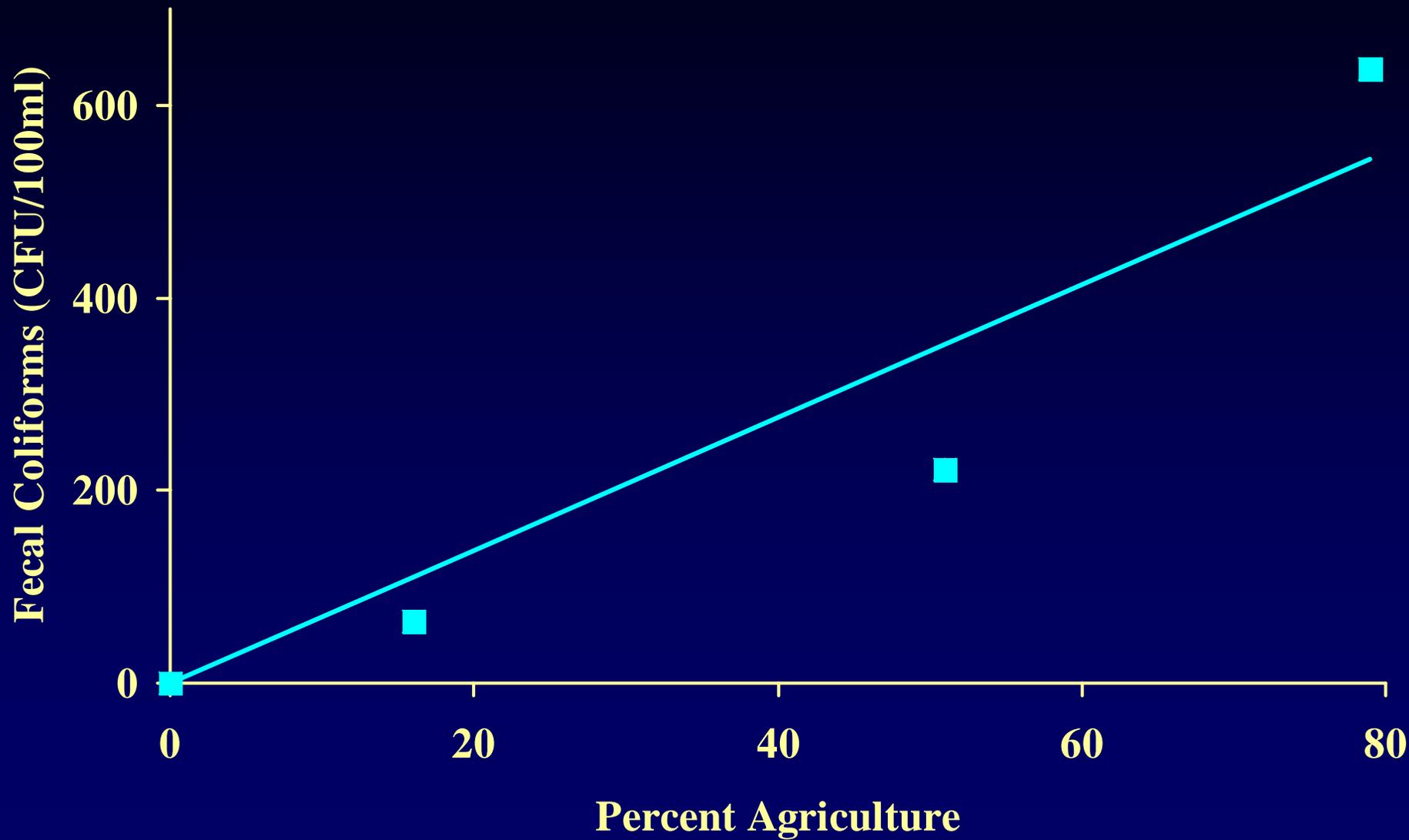


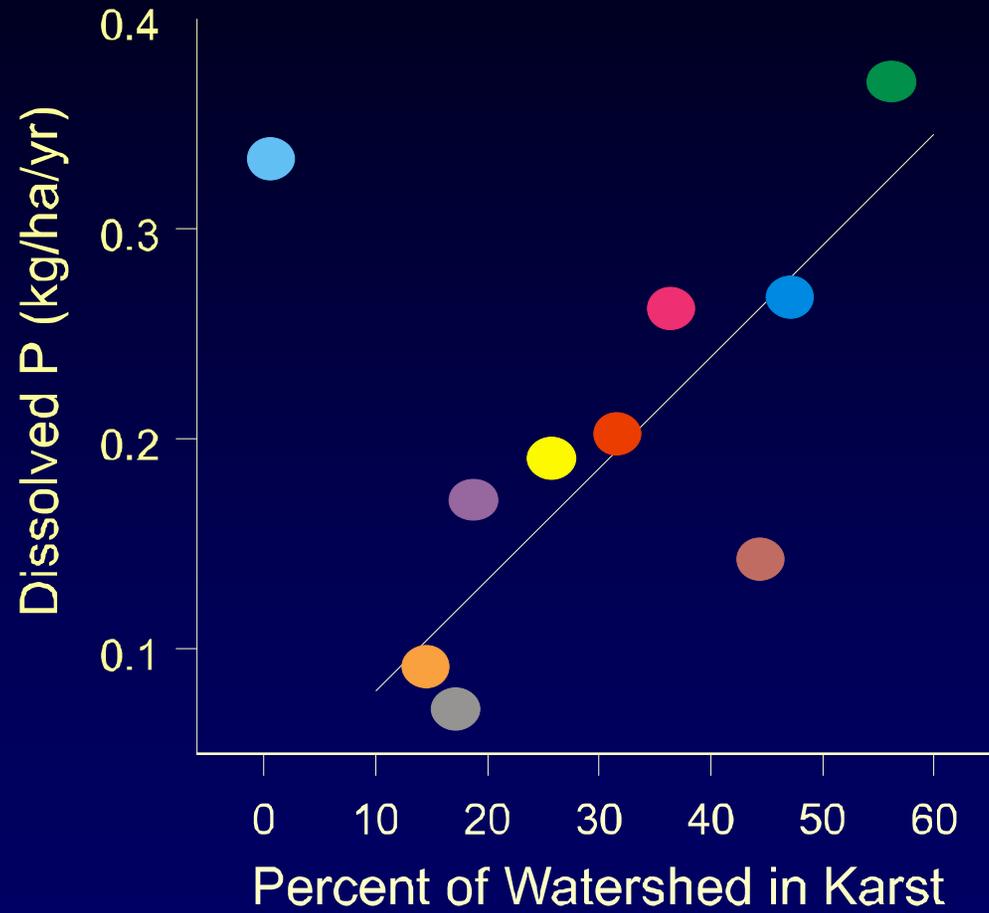


# Basin Attributes

Basin	Area (km <sup>2</sup> )	Agr. Land (%)
The Hole	14.5	79
Davis Spring	191.4	51
Davis Hollow	11.4	16
The Portal		0



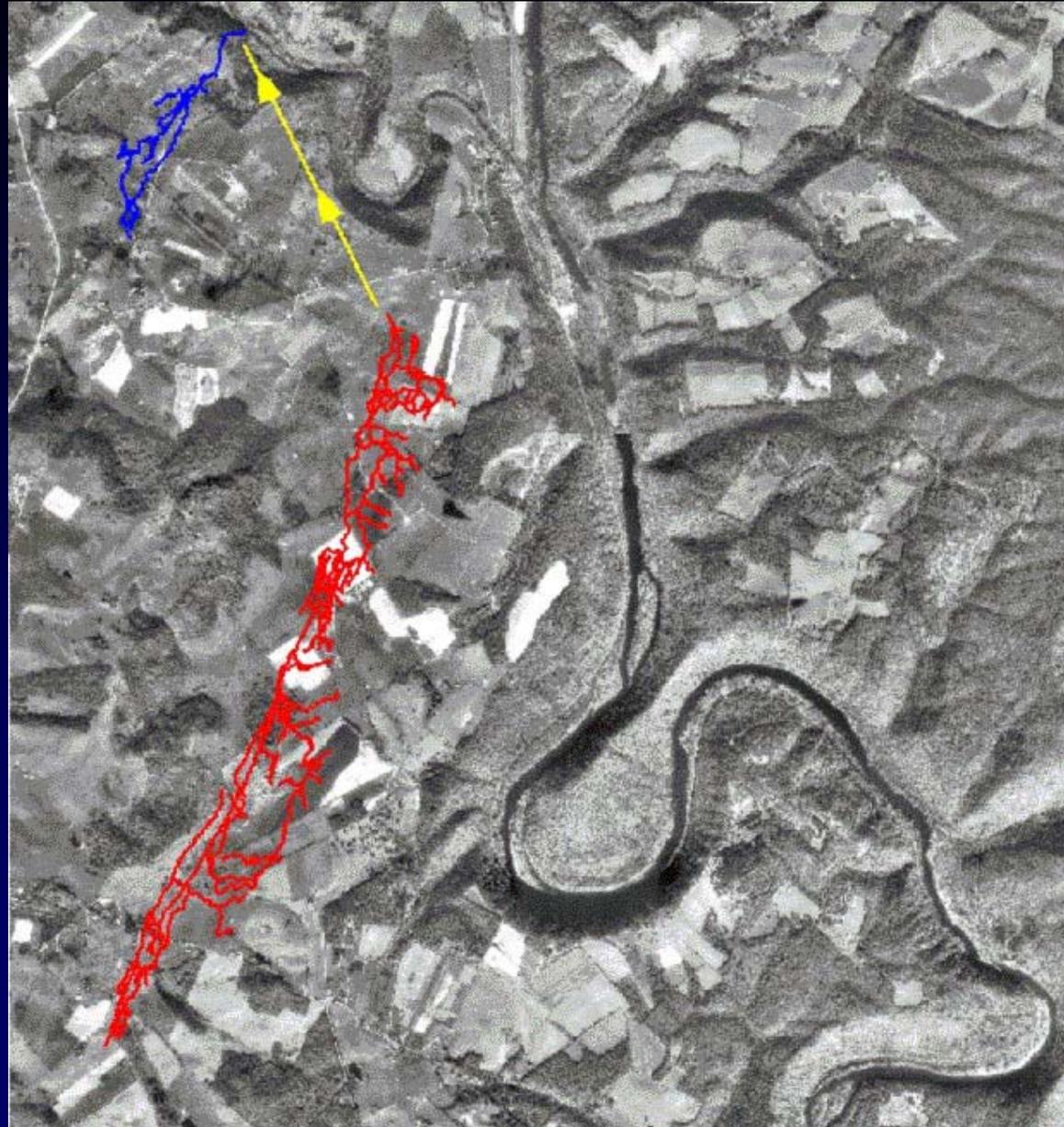


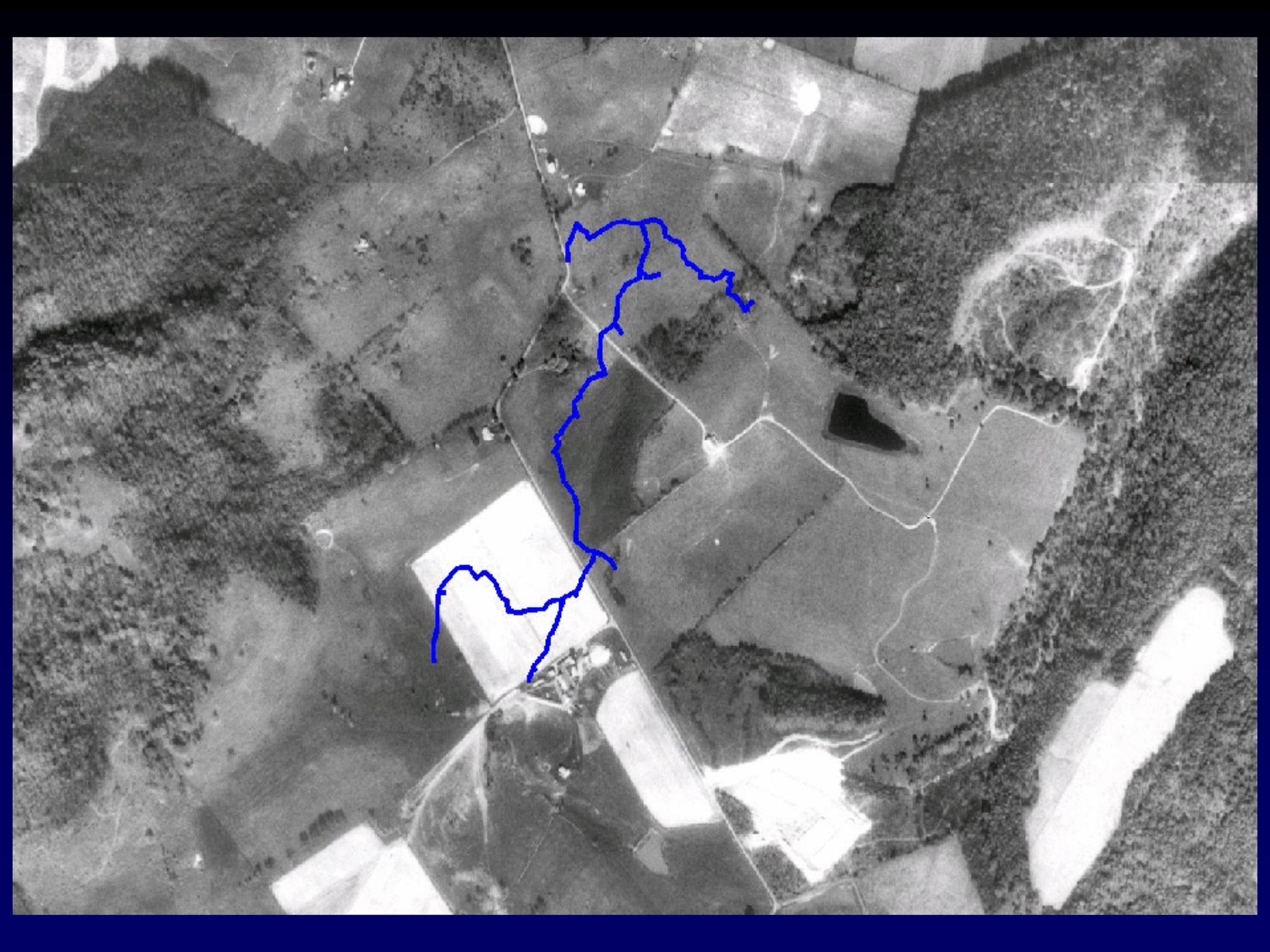




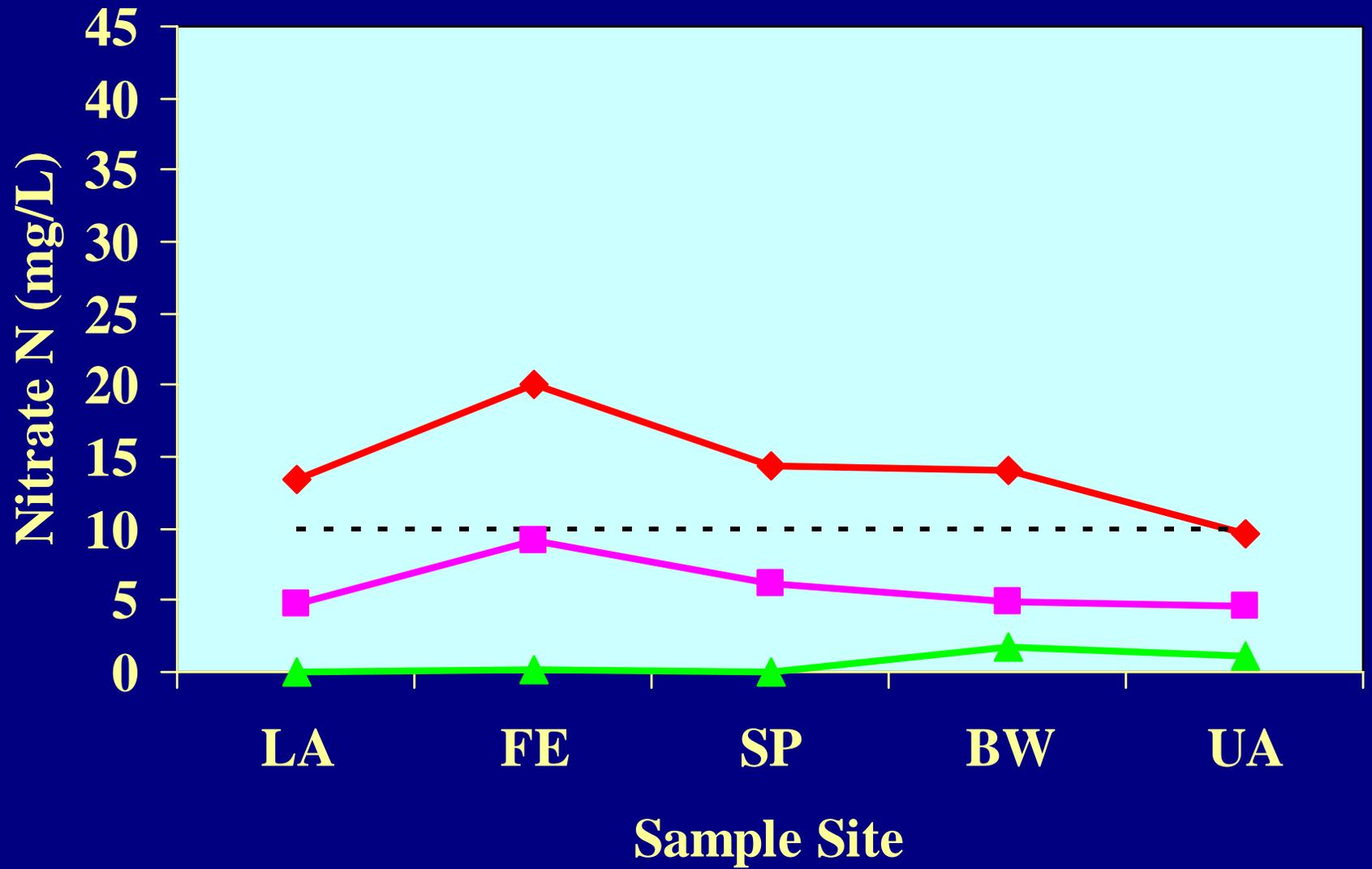
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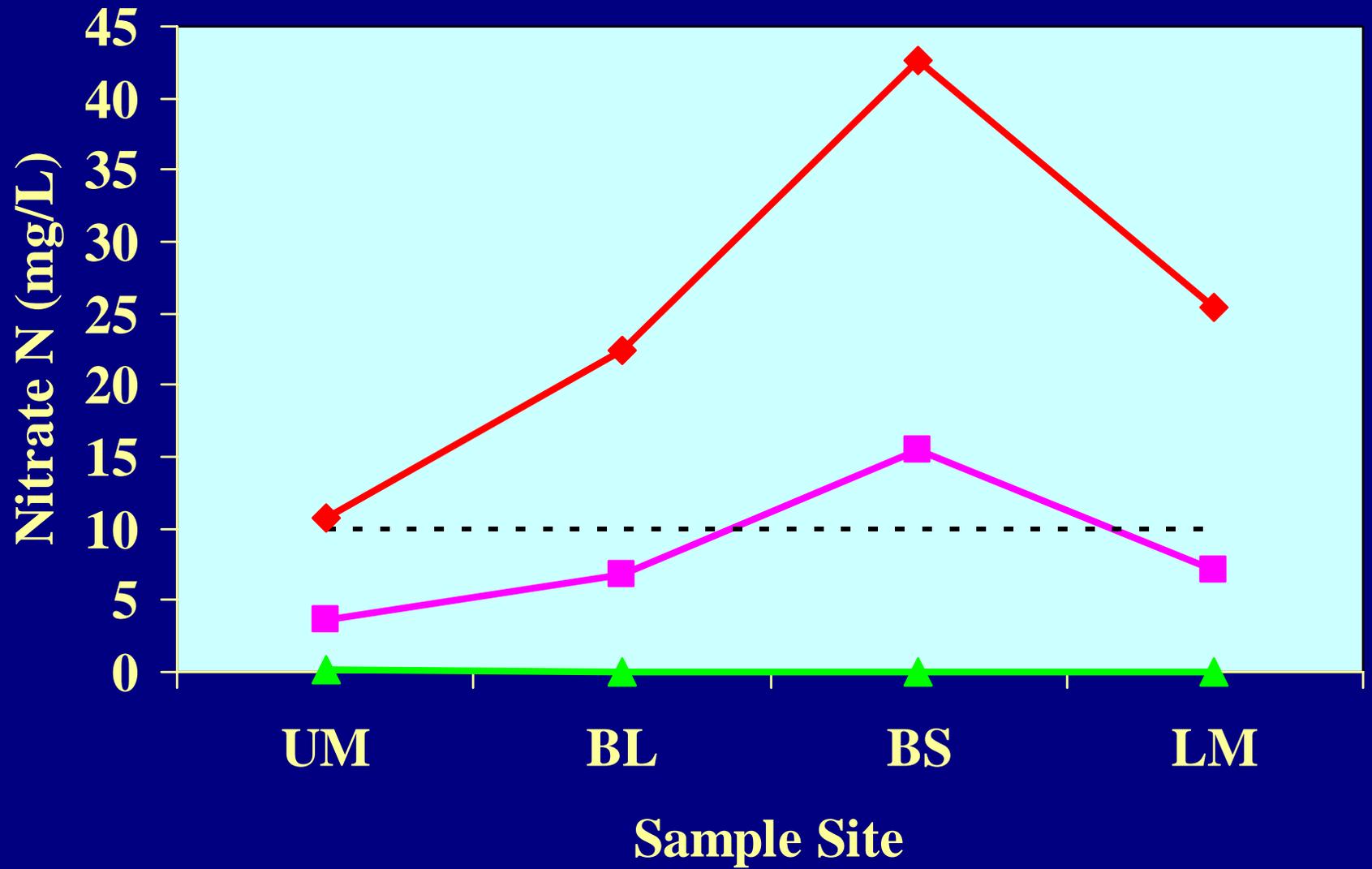


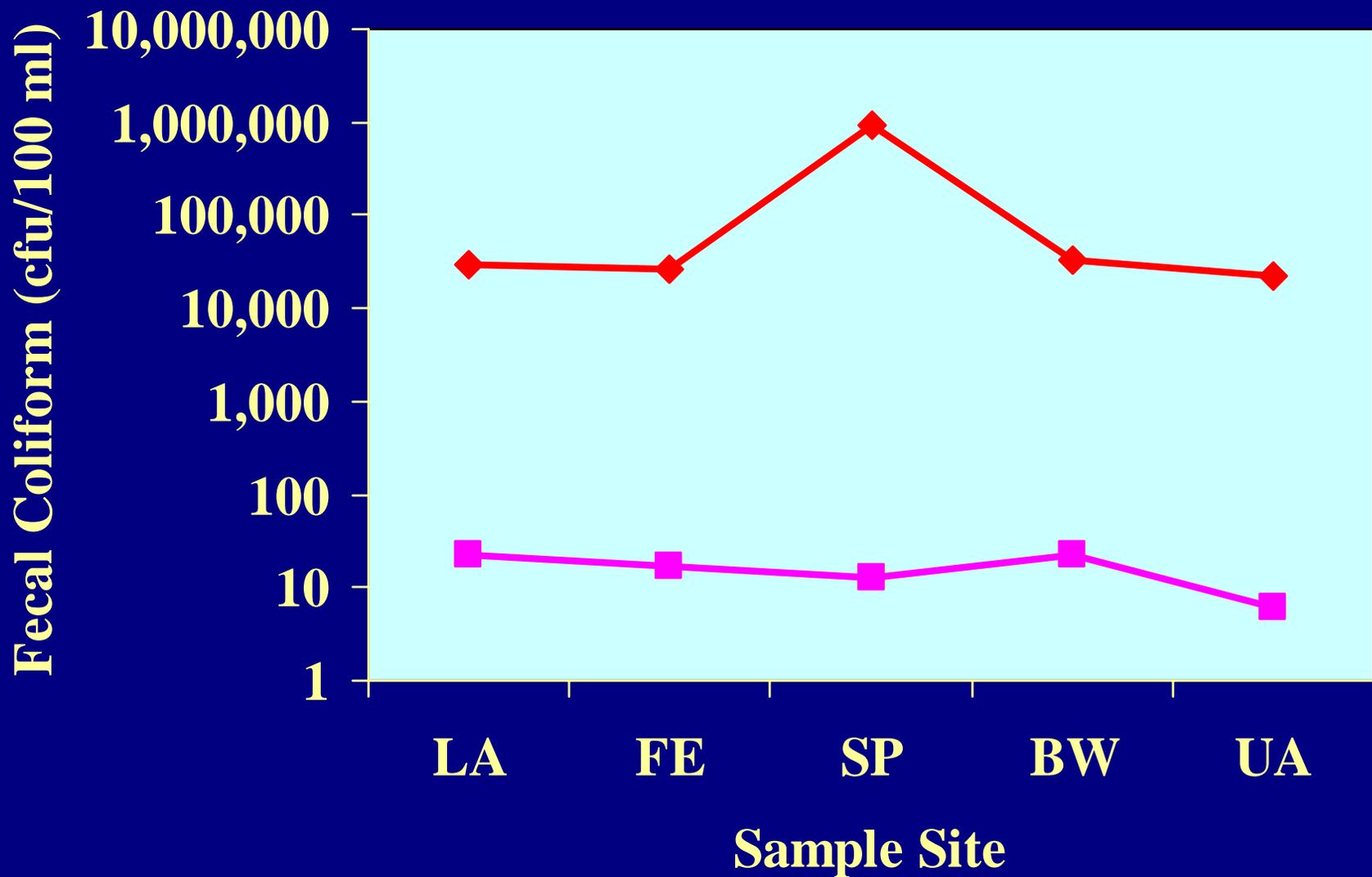


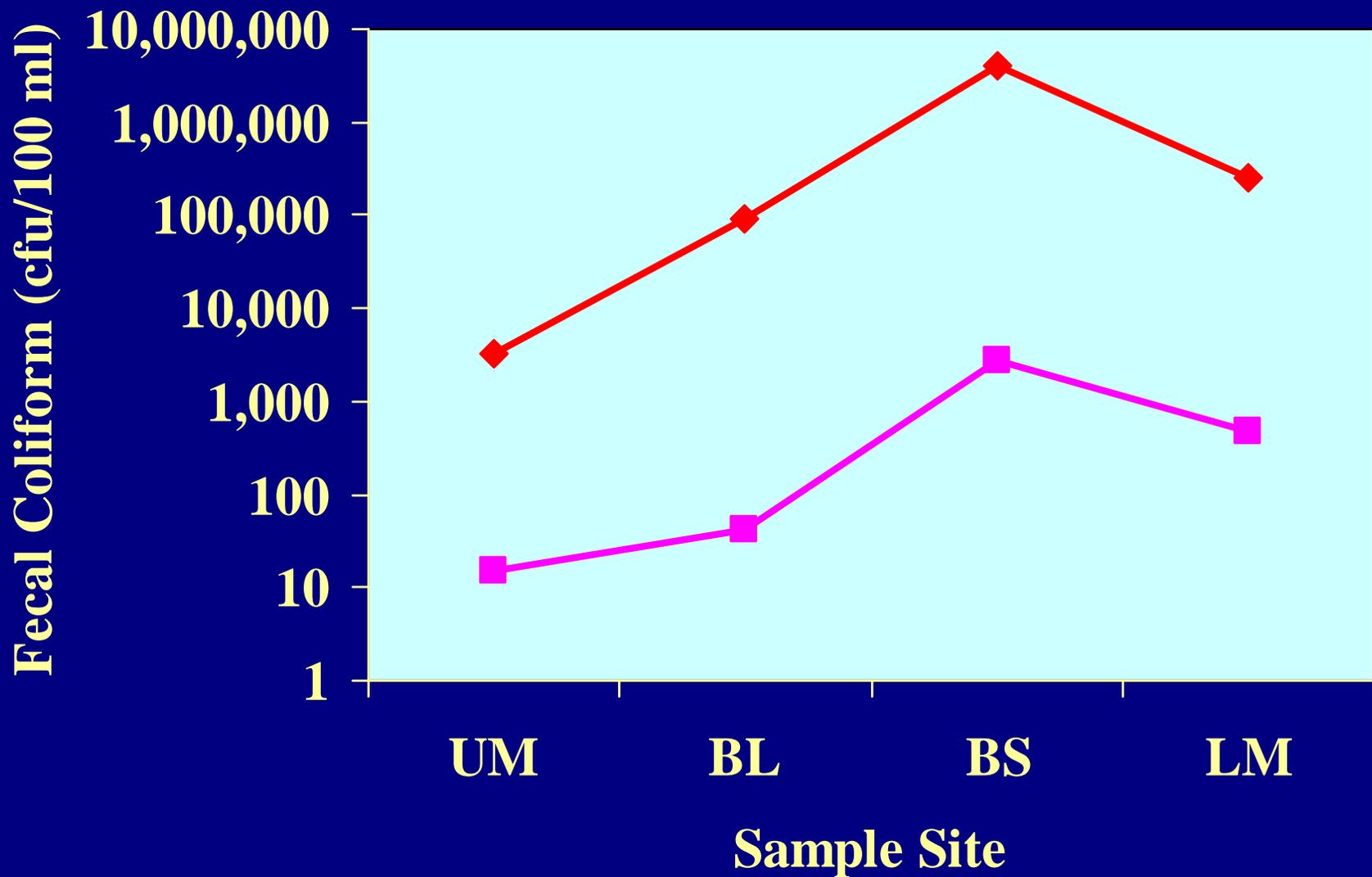






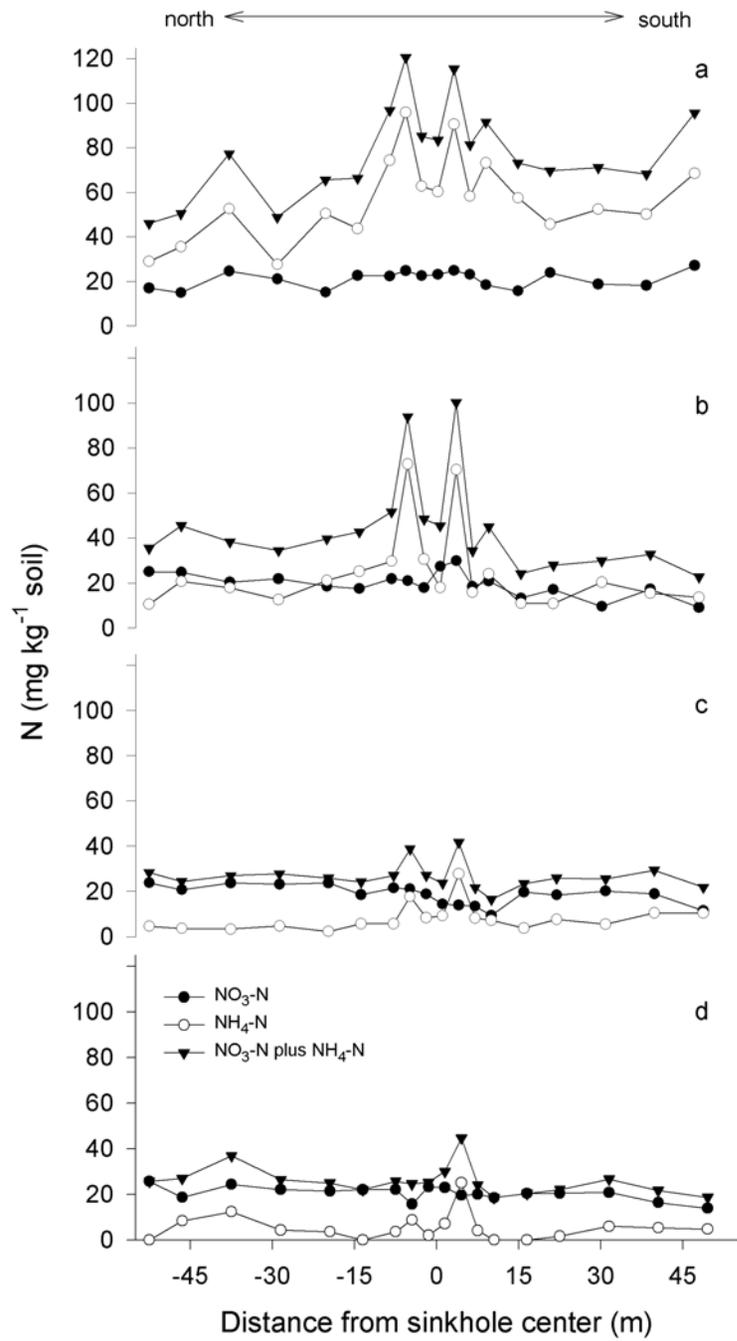


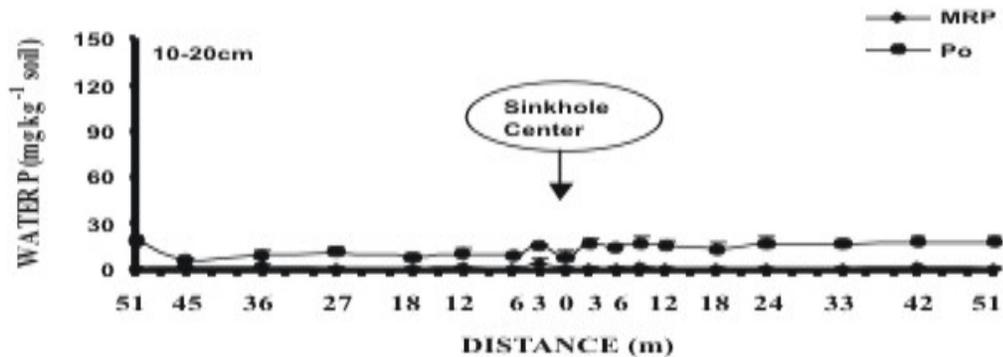
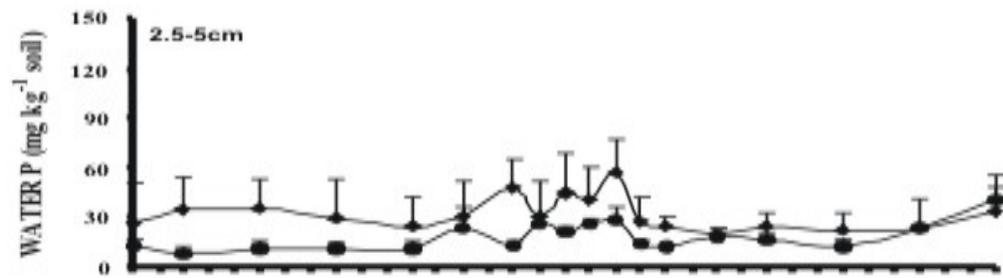
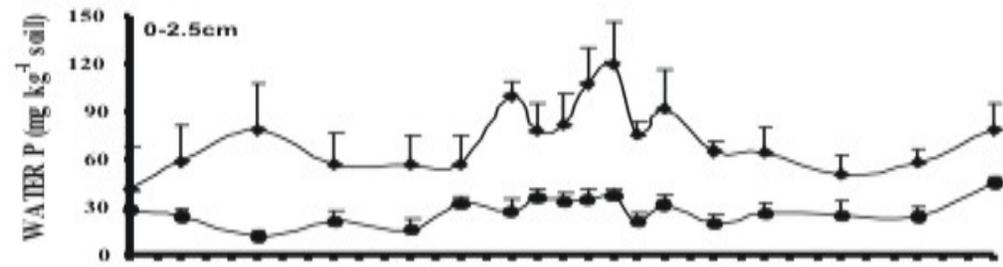


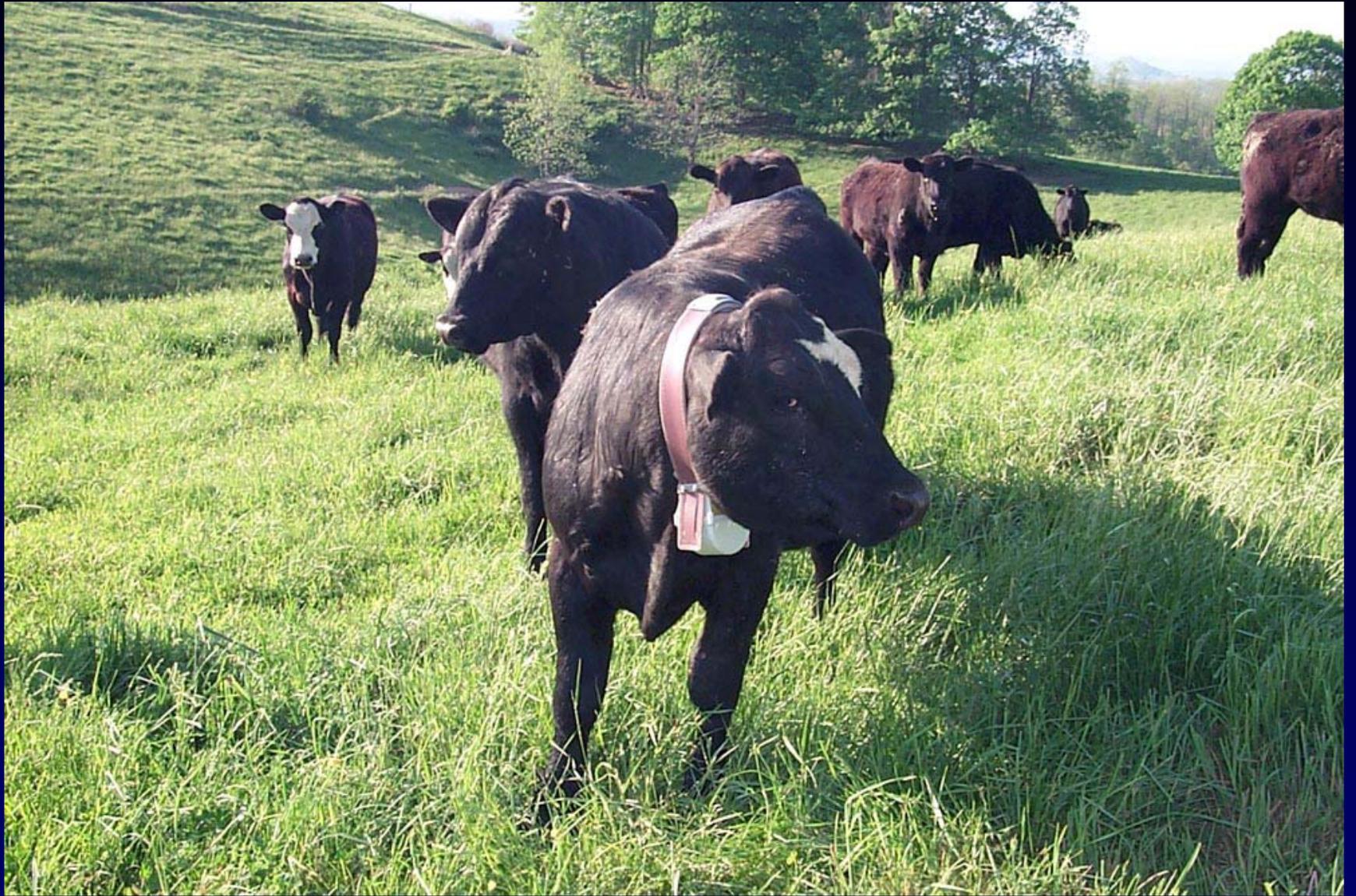


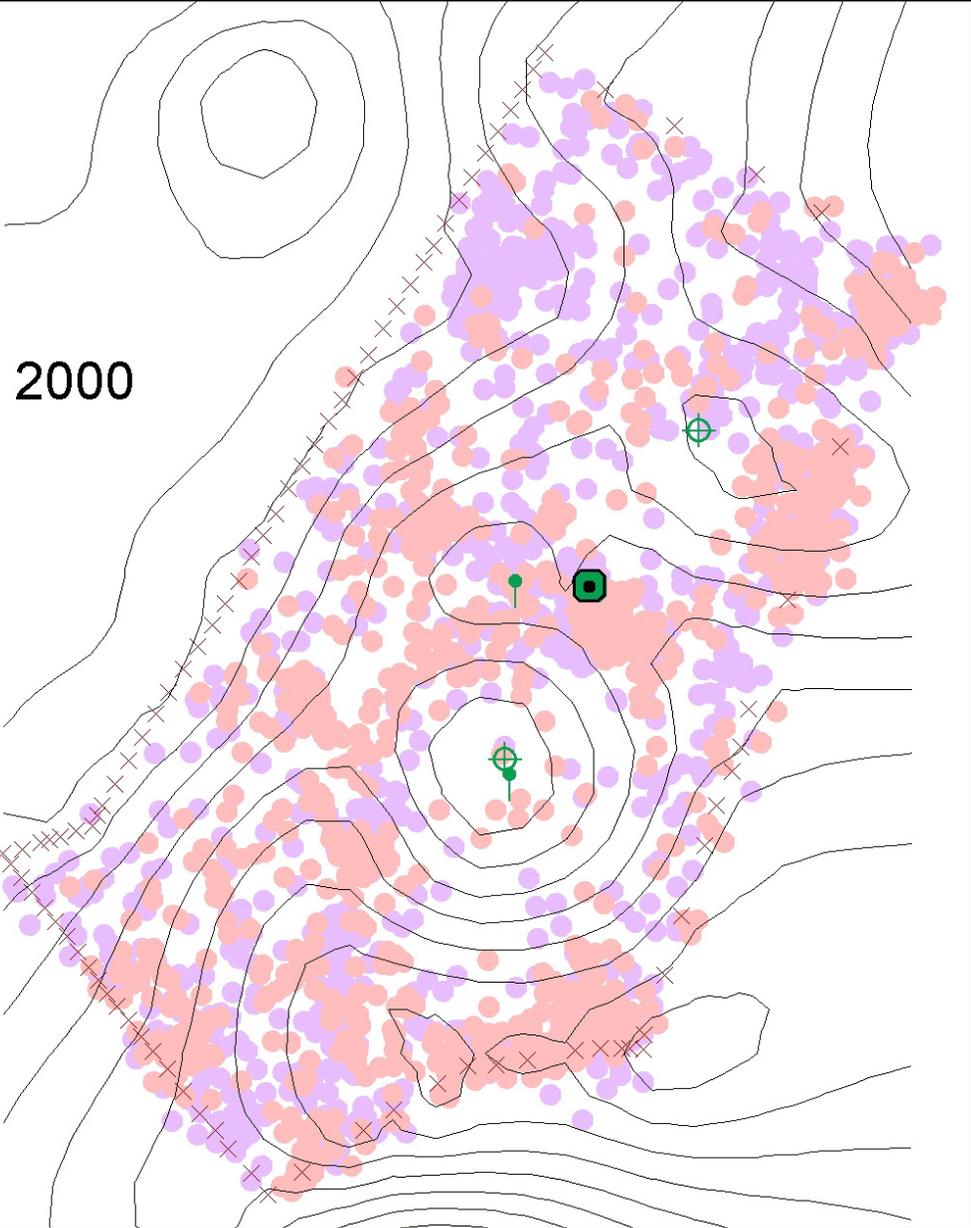


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2000





**“The limestone areas are rather subject to typhoid fever, the underground drainage appearing to scatter the germs of the disease, which, however, is largely a preventable ailment.”**

*A History of Monroe County, West Virginia" by O. F. Morton. 1916*

In the Greenbrier karst springs we have found *Cryptosporidium parvum*, *Giardia lamblia*, and *E. coli* O157:H7 (Jack-in-the-Box bacteria). All of these pathogens are zoonotics meaning they can pass from animals and infect humans.

It has been shown that there is a higher incidence of human *E. coli* O157:H7 infections in areas with high cattle densities.

e. g.,  
*Michel et al., 1999 and*  
*Valcour et al., 2002*

The 30,000 cattle and calves on the Greenbrier karst areas produce about 71,500 tons of manure annually and excrete about 130 quadrillion ( $1.3 \times 10^{17}$ ) fecal coliform bacteria.

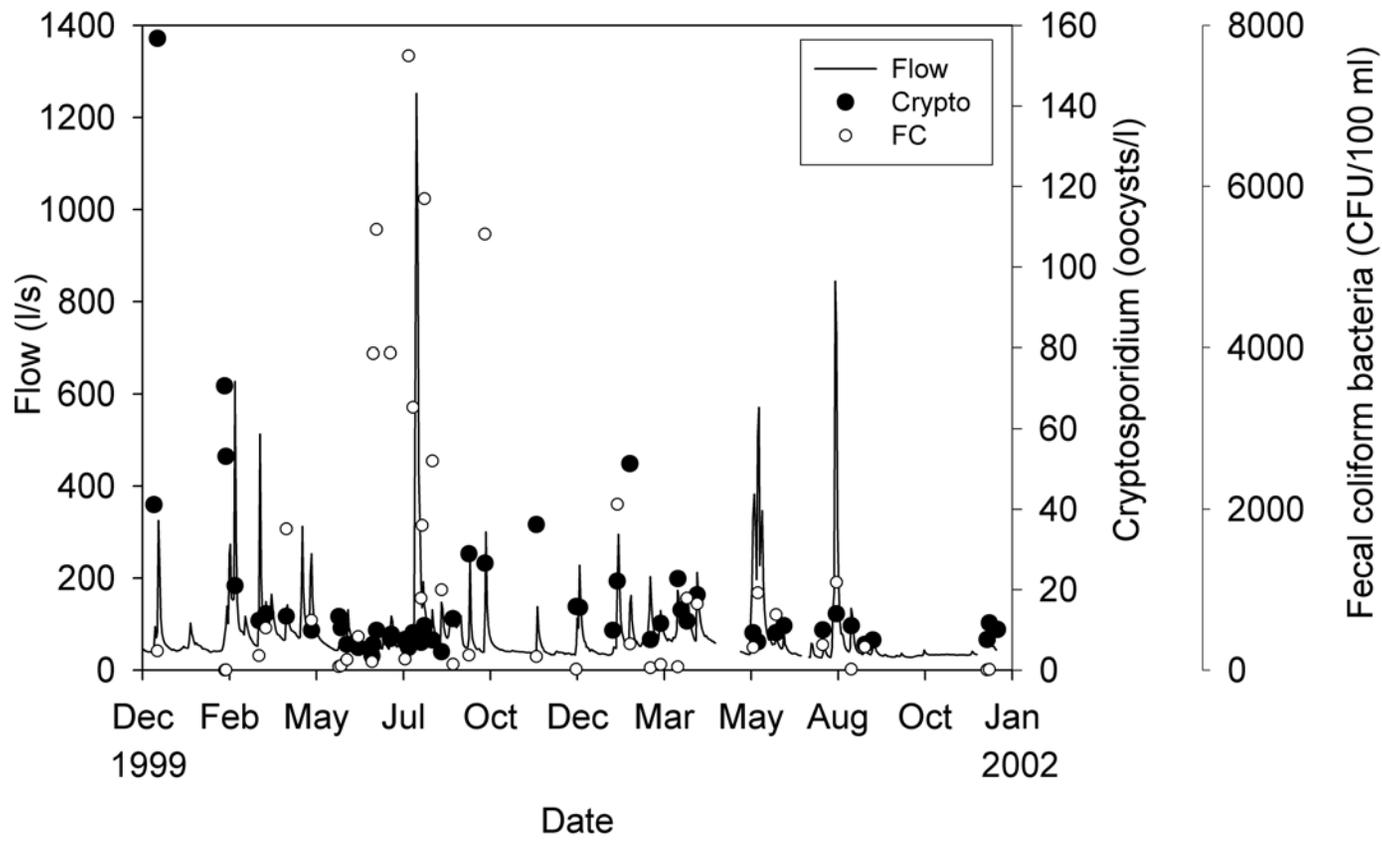
# *Cryptosporidium parvum*

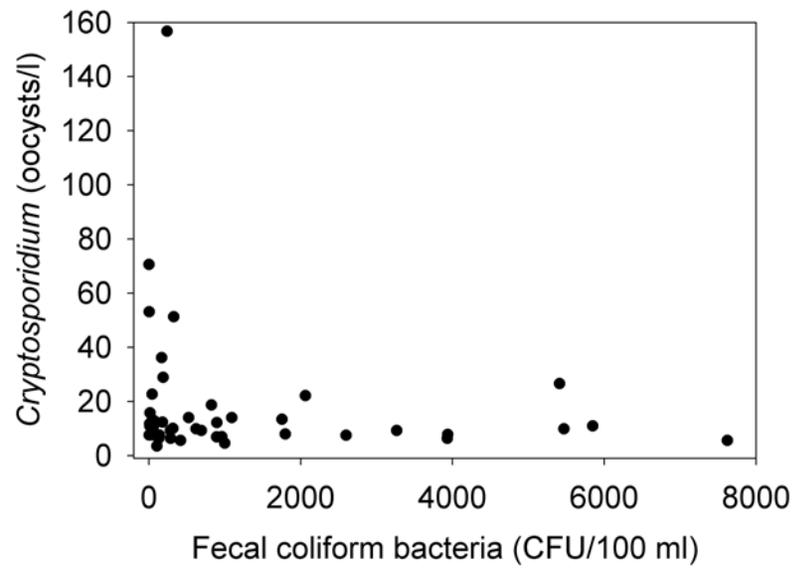
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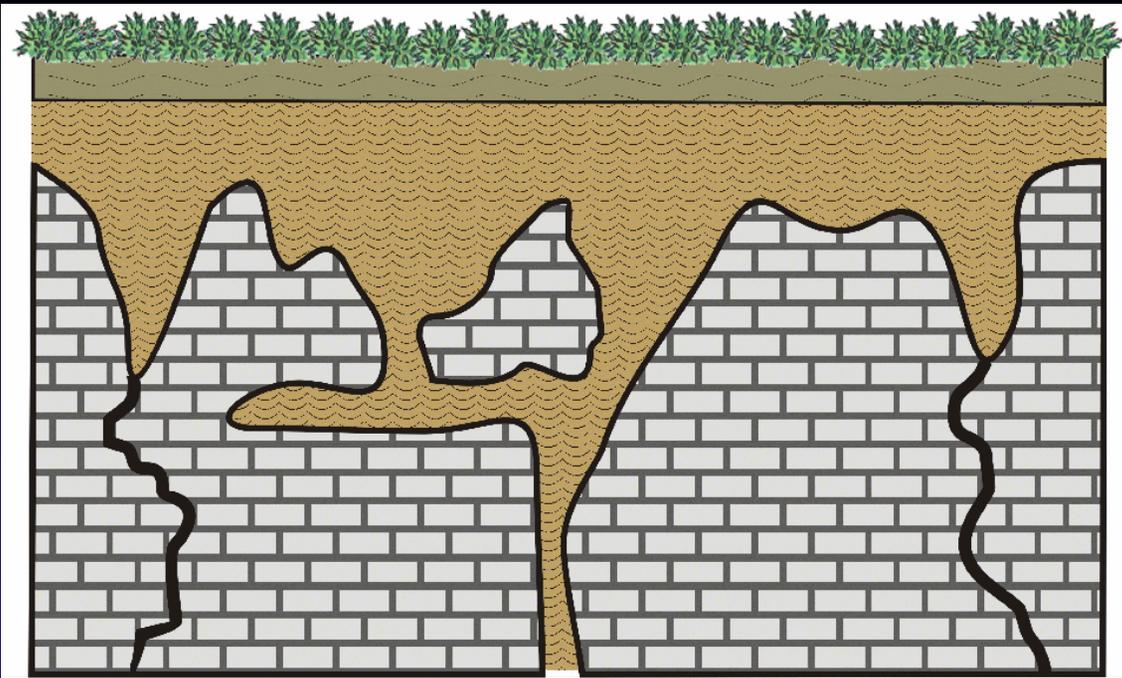
**Cryptosporidium can cause gastrointestinal disorders (cryptosporidiosis) in humans.**

**The disease is characterized by symptoms that include diarrhea, stomach cramps, fatigue, and loss of appetite.**

**Cryptosporidiosis can be life threatening to immunocompromised individuals including cancer patients, organ transplant patients, and HIV positive patients, among others.**



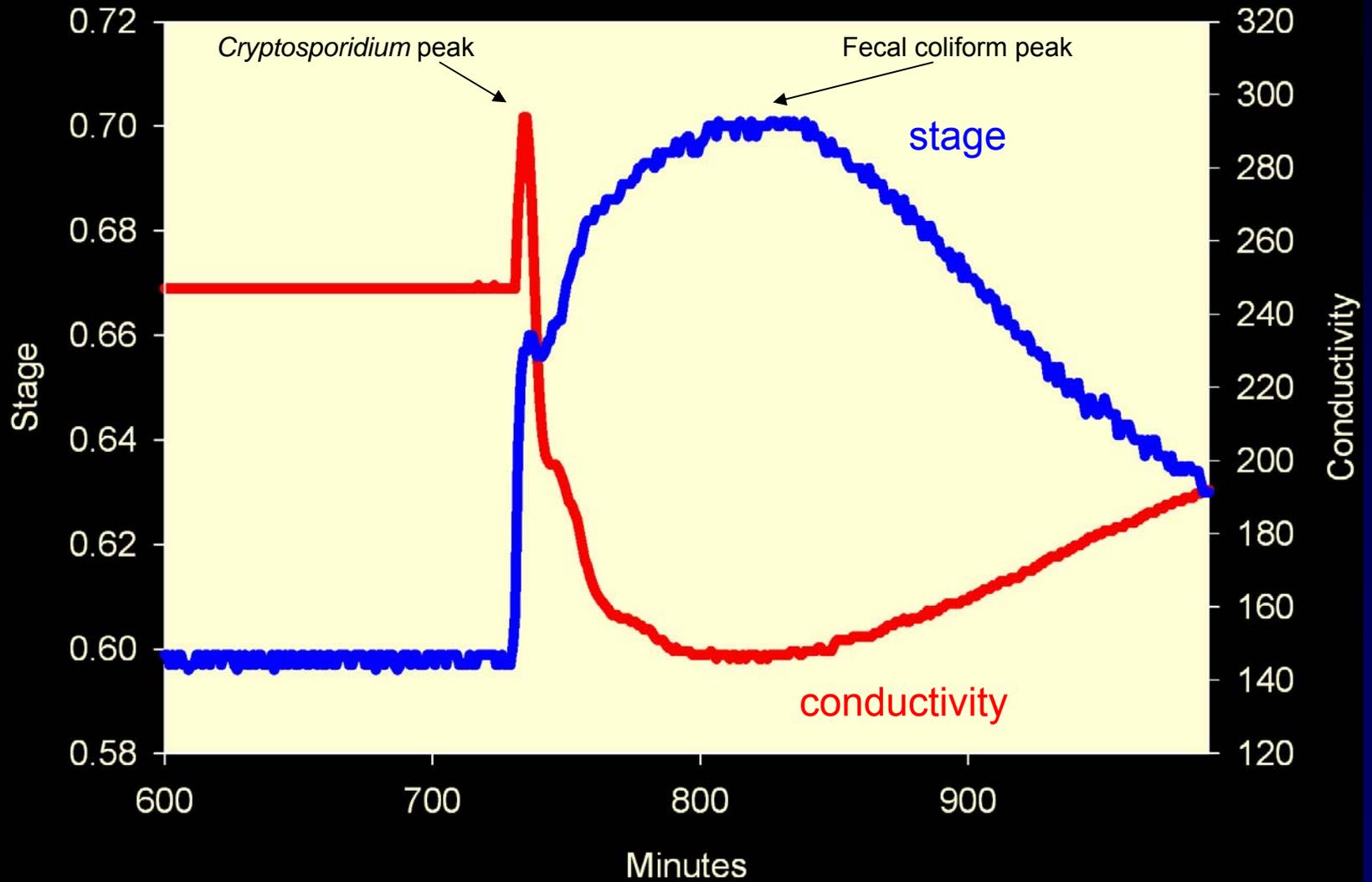




Epikarst



Barefoot Creek  
July 10, 2003



“Multiple transport mechanisms may necessitate various agricultural land management and livestock health maintenance practices to control movement of pathogens to karst groundwater.”

*Boyer and Kuczynska, 2003*

“Water appearing at the springs is an integrator of all impacts within the basins. Voluntary programs might not be reaching some of the ‘worst offender’ sites within the basins thus inadvertently sabotaging attempts at water quality improvement at the watershed scale. In order for water quality improvement programs to have sustainable positive impacts at the watershed scale, it might be necessary to target specific sites rather than relying solely on voluntary cost-sharing efforts. A careful analysis of the balance between agricultural production goals, water quality goals, and inherent environmental sensitivity is necessary in order to maintain an economically viable agribusiness while protecting water quality in karst areas.”

*Boyer, 2005*

# Thanks

Douglas Boyer, Hydrologist  
Appalachian Farming Systems Research Center  
USDA-ARS  
1224 Airport Rd  
Beaver, WV 25813

Doug.Boyer@ars.usda.gov  
<http://www.ars.usda.gov/naa/afsrc>

