

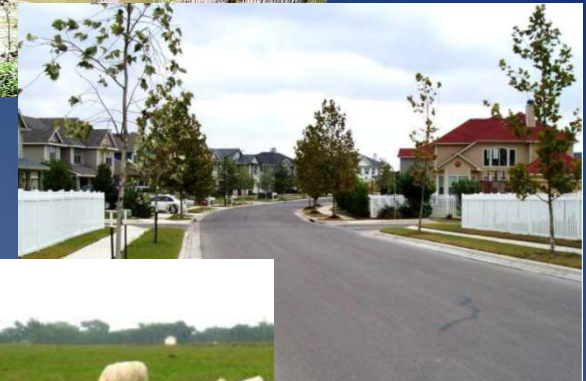
Sources of Nitrate in the Plum Creek and Geronimo Creek Watersheds, South-central Texas

By Rebecca B. Lambert

Prepared in cooperation with the
Guadalupe-Blanco River Authority
Texas State Soil and Water Conservation Board

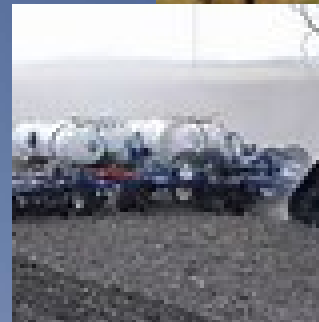
Background

- Plum Creek listed as impaired for bacteria and nutrients (2008 Texas Water Quality Inventory & 303(d) List of Impaired Waterbodies)
- Geronimo Creek first listed in 2000 for concern for nutrient enrichment because of nitrate-nitrogen
- Geronimo Creek listed on the 2008 and 2010 303(d) lists for not supporting contact recreation use because of *E. coli* bacteria.



Sources of Nitrates?

- Possible point and nonpoint pollution throughout watershed
- Mixed land cover with increasing urban development, oil & gas production, and agricultural activities that may contribute nitrate to watershed
- Naturally occurring in groundwater
- Atmospheric deposition



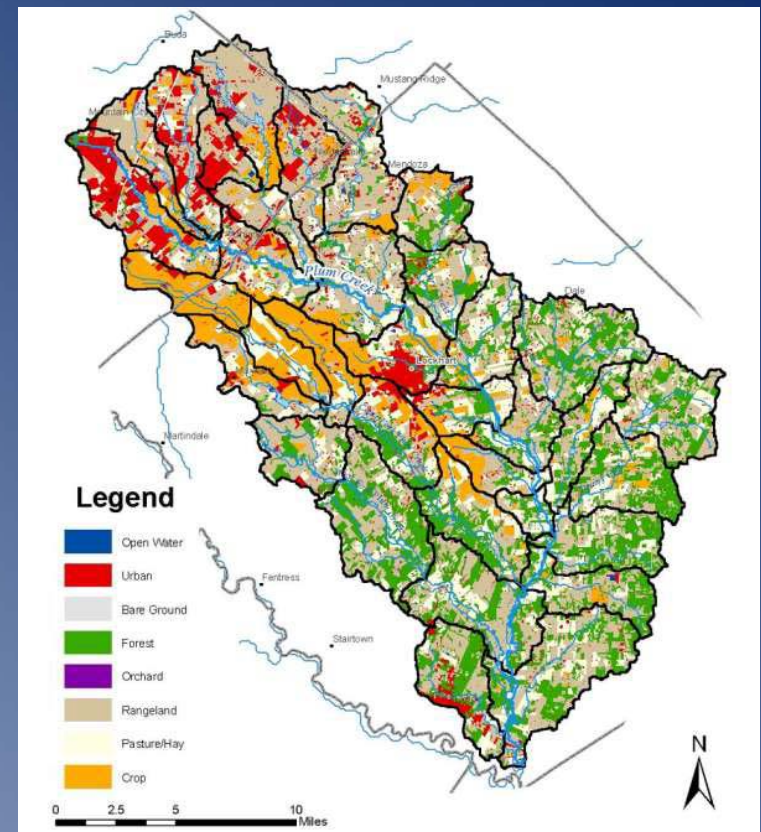
Background

Potential Sources of Bacteria, Nutrients, and other¹ contaminants

Potential Sources	Bacteria	Nutrients	Other
Urban Runoff	X	X	X
Pets	X	X	
<i>Wastewater</i>			
Septic Systems	X	X	X
Wastewater Treatment Facilities	X	X	X
<i>Agriculture</i>			
Sheep and Goats	X	X	
Horses	X	X	
Cattle	X	X	
Cropland		X	X
<i>Wildlife</i>			
Deer	X	X	
Feral Hogs	X	X	
Oil and Gas Production			X

¹Other contaminants may include, but are not limited to, dissolved solids, pesticides, herbicides, and emerging contaminants (D. Magin, GBRA, written commun., Jan. 2014)

Plum Creek Land Cover



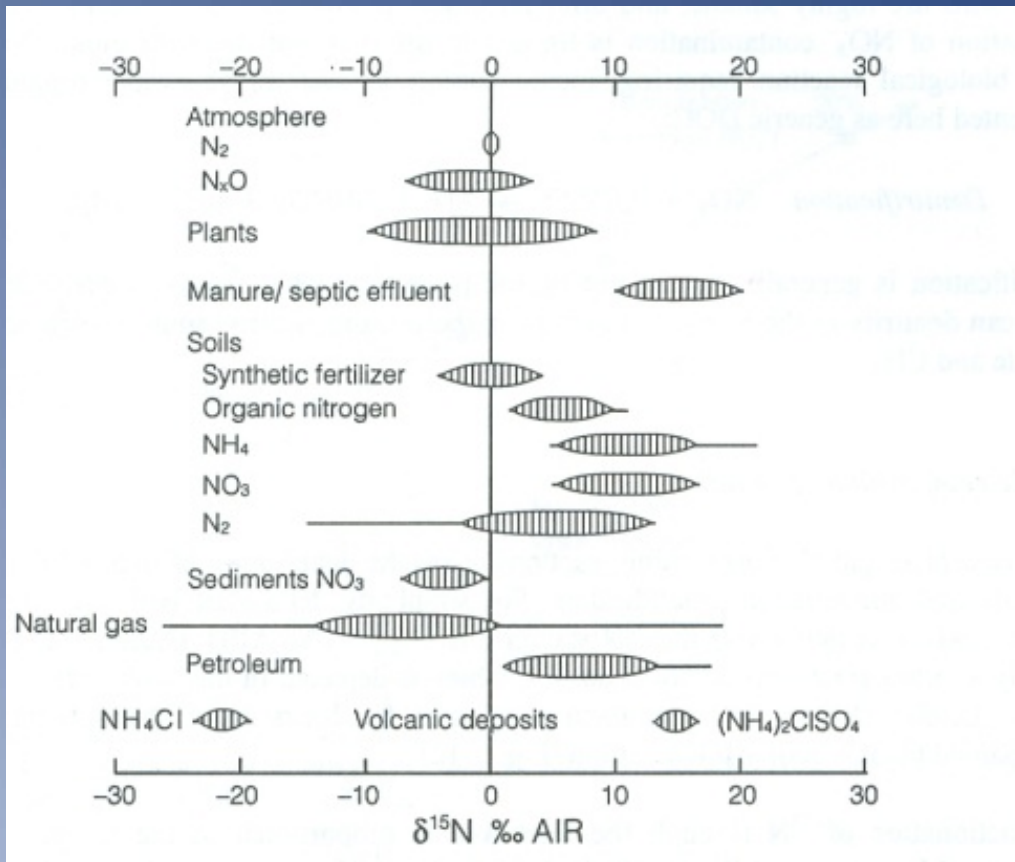
(Berg and others, 2008, p. 30)

Approach



- Four (4) synoptic sampling events—approximately quarterly
- 48 environmental samples total (SW, Spring, GW, Rainfall)
- Samples analyzed for major ions, nutrients, and $\delta^{15}\text{N}$, $\delta^{18}\text{O}$, and δD isotopes
- 6 QA samples (1 SW field blank, 1 GW field blank, 4 replicates – 1 each synoptic)

Why Nitrogen Isotopes?

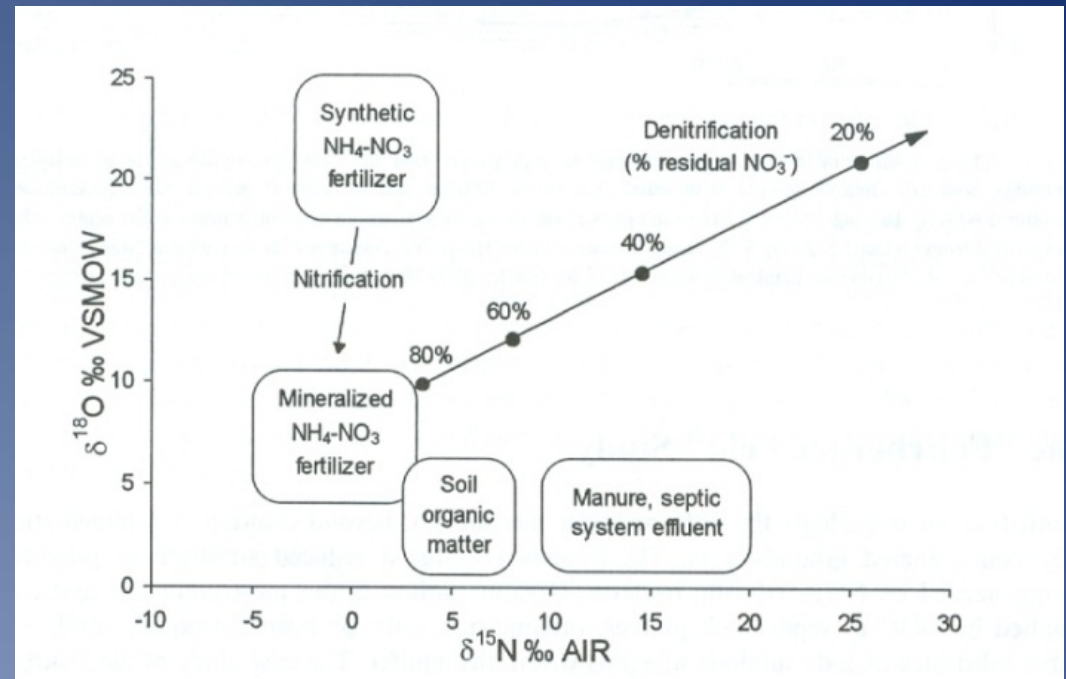


Clark and Fritz (1997)

- Environmental isotopes are naturally occurring in the environment.
- Based on the number of protons and neutrons that make up the atomic mass of an element.
- We look at ratios of abundance of each isotope of an element
- Value of $\delta^{15}\text{N}$ are isotopically distinct and can be used to distinguish possible sources of nitrate.

Sources and Sinks

- Used in association with $\delta^{18}\text{O}$, $\delta^{15}\text{N}$ also can provide information on the kinetic and thermodynamic processes of the nitrogen cycle



Clark and Fritz (1997)

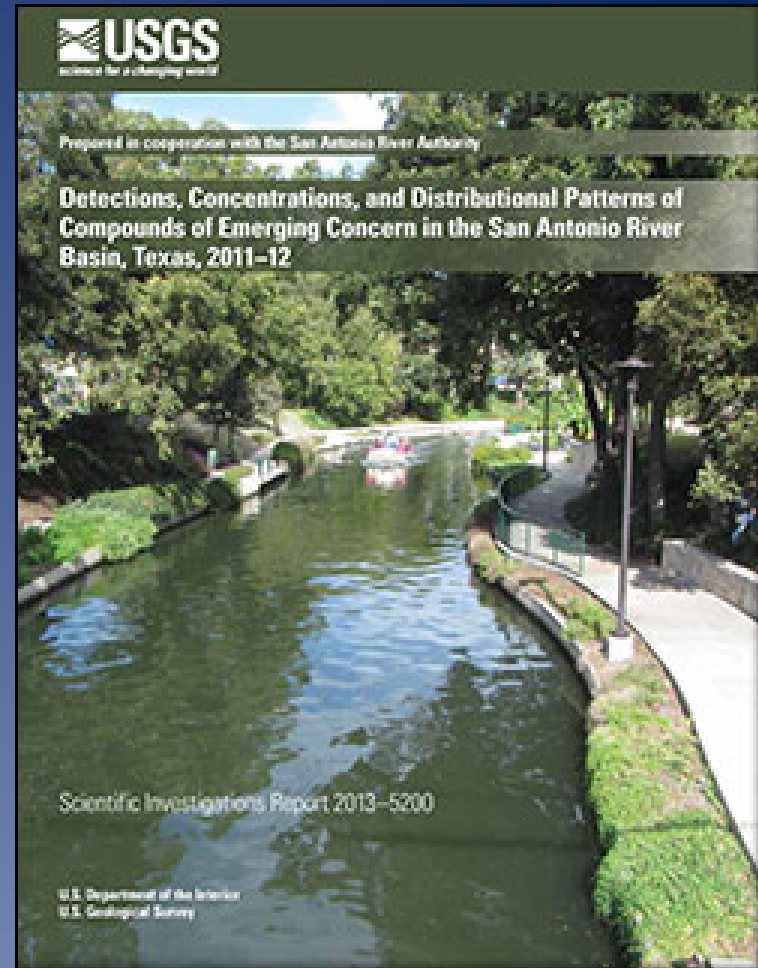
Relevance/Benefits

- Identification of possible sources of elevated nitrates and other nutrients allows Federal, State, and Local agencies to develop targeted mitigation plans while minimizing costs.
- Provides information on the presence and source(s) of nitrates in an area with mixed land cover.
- Provides water managers with valuable water availability and water supply information.



Planned Publications

- A USGS Scientific Investigations Report (SIR) is planned at the completion of the project.



References Cited

- Berg, M., McFarland, M., and Dictson, N., 2008, Plum Creek Watershed Protection Plan: Accessed online on January 13, 2014 at http://plumcreek.tamu.edu/media/4715/PCSPDraft8_7_08.pdf
- Clark, I.D., and Fritz, Peter, 1997, Environmental isotopes in hydrogeology: CRC Press LLC (Lewis Publishers), Boca Raton, Florida, 328 p.
- Ling, W., McFarland, M., Magin, D., Warrick, L., and Wendt, A., 2012, Geronimo and Alligator Creeks Watershed Protection Plan: Accessed online on January 13, 2014 at <http://www.geronimocreek.org/Plan.aspx>