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Tri-Basin Topics

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Why Does Groundwater Nitrate Vary?

By Troy Gilmore-Assistant Professor UNL School of Natural Resources

Have you ever wondered why groundwater nitrate maps show so much variation across Nebraska? Or why wells near to your own tested well have such different nitrate levels? The answer has three parts. Nitrate in groundwater varies from place to place because of differences in:

- the amount of nitrate that travels below the root zone and toward the water table;
- the natural processes in the aquifer that remove nitrate from groundwater; and
- the length of time for nitrate to reach wells of a different depth or construction standard.

In the following, we'll break down those three pieces and

as with intensive row crop production, although animal agriculture can also contribute. There are cases where nitrate is naturally released from subsurface sediments, but these are relatively rare and localized.

Naturally Breaking Down Nitrate

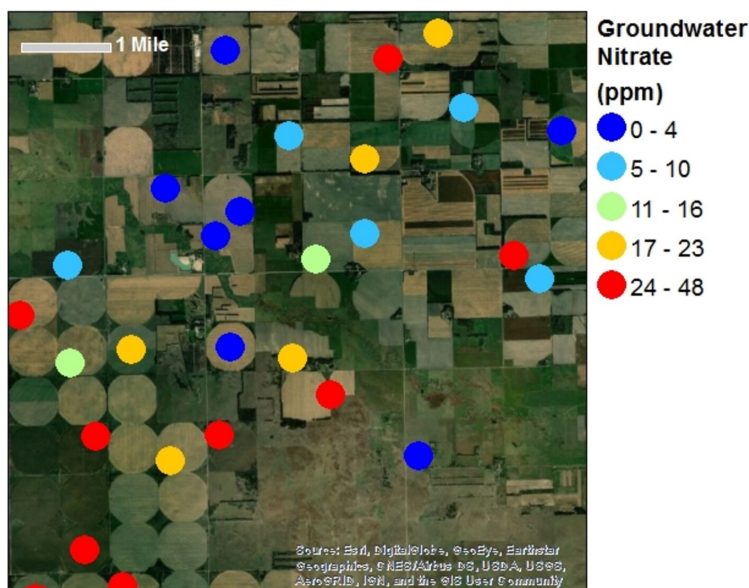
Since nitrate tends to stay dissolved in water, it moves along with groundwater through the aquifer. Once in the aquifer, nitrate can only be removed in two ways. One way is removal of nitrate-laden groundwater from the aquifer through pumping or through natural seepage into streams or springs. The second way nitrate can be removed is through natural removal processes within sediments. The primary natural process is denitrification, where bacteria in the aquifer sediments consume nitrate. Denitrification only occurs in low-oxygen environments, which does not occur everywhere in the unsaturated layer or groundwater system. In Nebraska, it is possible that groundwater flowing to one well will undergo denitrification and therefore have low nitrate concentration. Meanwhile, a nearby well might receive groundwater that has undergone minimal denitrification and still has high nitrate concentration. Even though these two wells might be located on the same farm, they can have very different nitrate concentrations.

Distance from the Source

Wells that are very shallow and close to a major source of nitrate are viewed as especially vulnerable to high nitrate concentrations. One reason is that nitrate can arrive at the well relatively quickly because it does not have far to travel in the soil profile. In fact, two wells installed at the same location but at different depths may have very different nitrate concentrations. The shallower well is more likely to have high nitrate, while the deeper well may have low nitrate. This is possible because groundwater, and the nitrate dissolved in it, moves slowly downward below the water table. In many locations groundwater moves only a few inches of feet downward vertically in a given year depending on geology and the rate at which groundwater is being replenished by recharge. So it is not hard to imagine that it could take many years for groundwater nitrate to reach a well installed deep in the aquifer. It is possible that the deep well will have high nitrate at some point in the future, but on current nitrate maps, these two wells would have very different nitrate concentrations even though they are in close proximity.

Sources: <https://water.unl.edu/article/groundwater/why-does-groundwater-nitrate-vary-so-much-across-nebraska/>
<https://storymaps.arcgis.com/stories/65762333cd404806bdf964f439abfed4>

An example of groundwater nitrate variability in Nebraska



explain how they affect nitrate levels.

Nitrate Seeping Underground

Nitrate reaches the deeper unsaturated subsurface regions - below crop root zones, for instance - due to application of fertilizers, mineralization of organic matter, and/or movement of animal or human wastes into the ground. The rate at which this occurs is highly dependent on local soils and the amount and timing of precipitation or applied water in the area. Once nitrate has moved below the root zone, where it can be utilized by plants, it will easily move downward toward the water table and into the groundwater system. Most high-nitrate groundwater (e.g., > 10 ppm) is located near are-

2025 to 2026 District Water Levels

Tri-Basin NRD staff measured groundwater levels in over 90 irrigation wells this past spring. Additionally, TBNRD operates over 140 dedicated observation wells across the district are equipped with water level sensors and data loggers that record readings twice a year. We also cooperate with Central NE Public Power and Irrigation District (CNPPID) to share groundwater level data. They measure about 60 observation wells in the irrigation district's service area in the Platte River basin.

A dry winter and spring led to an early start to the irrigation season in 2025. The result is that groundwater levels declined across Tri-Basin NRD. Conditions were driest in Kearney County, which led to declines of more than a foot. We received higher than average rainfall in June and July, which provided some recharge to our aquifers and allowed farmers to curtail irrigation somewhat. We are fortunate to receive supplemental groundwater recharge in the Platte Basin portion of the district from CNPPID deliveries of irrigation water to customers, these farmers'

use of surface water for irrigation and diversion of excess flows from the Platte River.

Annual Basin Comparison Spring '25 – Spring '26	
Republican:	-1.26'
Platte:	-1.01'
Little Blue:	-1.33'
District:	-1.18'

Free ET Data Texting

ET Data (Evapotranspiration Data) texts go out Monday through Friday from June through August.

To subscribe:

- Scan the **QR Code** below, or
 - text **START** to **308-216-8188**
- Call Sasha at 308-995-6688 with any problems or questions.



Texts contain:

Daily (D) and Future 3 Days (F3d) estimated water use for both Corn and Soybeans (Beans) at three locations across the district: Holdrege 5N (Hld), Axtell 5NE (Axt) and Smithfield 2E (Smfld).

Additional Weekly Text includes:

Weekly Precipitation (Wk Precip), Corn Growing Degree Days (Corn GDD), and Beans Growing Degree Days (Beans GDD) for all three locations.

Introducing our Newest Team Member

In May, Jamie Johnson joined our team as the new Field Office Secretary at the Holdrege NRCS office. A graduate of National American University in Rapid City, South Dakota, Jamie holds a degree in Paralegal Studies.

Jamie and her husband, Mike, reside right here in Holdrege. Outside of the office, she loves diving into a good book and spending quality time playing with her dogs. We are incredibly grateful to welcome Jamie to the team, and we look forward to working alongside her!



Hands-On Experience Shaping the Next Generation

Tri-Basin is excited to welcome three summer interns to the team: Caty, Liz, and Rodney. Each brings a strong interest in natural resources, agriculture, and the outdoors, along with their own unique experiences and talents. We're looking forward to having them with us this summer and are pleased to introduce them to our community.



Originally from Watertown, Wisconsin, we are glad to have Caty Kaczmarek with us. She is a sophomore studying Rangeland, Wildlife, and Fisheries Management at Texas A&M University in College Station, Texas. On campus, Caty is actively involved with her local church choir and the student Christian organization, Cru. Outside of her classes, Caty loves staying active playing pickleball, swimming, just being outdoors, and weight lifting, baking sourdough, and working on various embroidery projects.

A Nebraska native from Wymore, Liz Bohlken, will finish her senior year at the University of Wyoming this fall. She will graduate with a degree in Animal Science focusing on Range Livestock and Livestock Production. On campus, Liz has stayed busy as part of the UW Range Club, UW Food Science Club, and 2025 UW Meat Judging Team. When she is not studying or competing she enjoys spending time with family and friends, attending concerts, and being involved in her local church community. Much like Caty, Liz loves the outdoors—especially hiking, fishing, and working with livestock.

Last but not least, Rodney Hanson joins us from Elbert, Colorado. He is a student at the University of Wyoming. He is majoring in Environment and Natural Resources with a focus on Environmental Systems Science and a minor in Rangeland Ecology and Watershed Management. Outside the classroom, Rodney keeps busy as an assistant coach for UW's Women's Club Hockey team and as a member of the Geology Club. In his free time, he enjoys getting outdoors to hike, fish, hunt, and look for shed antlers.

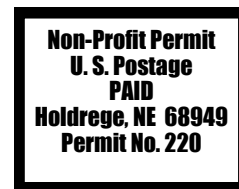
Throughout the season, the team has been on the ground collecting and testing groundwater quality samples, monitoring local wildlife habitat, testing irrigation system efficiency, and helping maintain drainage Improvement Project Areas (IPAs). Beyond their core duties at the NRD, they also collaborated with the USDA Natural Resources Conservation Service (NRCS) and toured the Central Nebraska Public Power and Irrigation District, gaining a broader perspective on regional water management.

Internships frequently serve as a springboard for future careers. This is the 27th year Tri-Basin has offered summer internships, giving college students a chance



to earn some hands-on experience. Many of our alumni are employed across the agriculture and natural resources sectors, working with agri-businesses, NRDs, the NRCS, and various state agencies. In fact, our very own Land Resources Manager, Dalton Refior, got his start right here, as a Tri-Basin NRD intern!

We are incredibly proud of the hard work and dedication Caty, Liz, and Rodney have shown this summer, and we look forward to watching them advance in the field of natural resources.



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RETURN SERVICE REQUESTED

Nebraska's NRDs: Protecting Lives, Protecting Property, Protecting the Future

CALENDAR

July 22 NRD Board Meeting, 1:30 p.m.
August 19 NRD Board Meeting, 10:30 a.m.
 UNK Regional Engagement Center, Kearney, NE
August 28-September 7 Nebraska State Fair
September 7 NRD Closed for Labor Day
September 16 NRD Board meeting, 1:30 p.m.*
September 15-17 Husker Harvest Days,
 Wood River, NE
September 24 Rainwater Basin Conservation Day
 Sacramento-Wilcox WMA, Wilcox, NE
October 12 NRD Closed for Columbus Day
October 14 NRD Board Meeting, 1:30 p.m.*
* Times are tentative. All meetings are at TBNRD office in
Holdrege unless otherwise noted.

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