



SAVING THE SOIL

When Matt Grosshans started farming seven years ago in Hamilton County, he was interested in regenerative agriculture practices he'd learned about in college, including cover crops, reduced tillage, and rotational cropping systems. However, it wasn't until extreme weather patterns started impacting his operation that he realized these practices weren't just a good idea, they were essential to maintaining his most valuable resource—his soil.

Erosion control was the biggest concern for Grosshans, who was tired of seeing his strip-tilled fields washed out with heavy spring rains. The flooding in 2019 was eye-opening, as his hillier acres saw an unprecedented amount of erosion. Damage from that event is still apparent in some areas. "Last year we got a six-inch rain in early May in like an hour. Extreme heavy rainfall really needs good soil structure or else there's erosion," he said. "I am interested in the long-term sustainability of the soil, especially for fields that I farm that are more challenging."



Grosshans partnered with the Upper Big Blue Natural Resources District and the Natural Resources Conservation Service (NRCS) to take advantage of funding and technical assistance for installing cover crops. He planted 350 acres of rye after corn and beans in fall 2021 and terminated it prior to planting in spring 2022.

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UPPER BIG BLUE NATURAL RESOURCES DISTRICT
BLUEPRINT

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Pollinator Day Activity, page 10

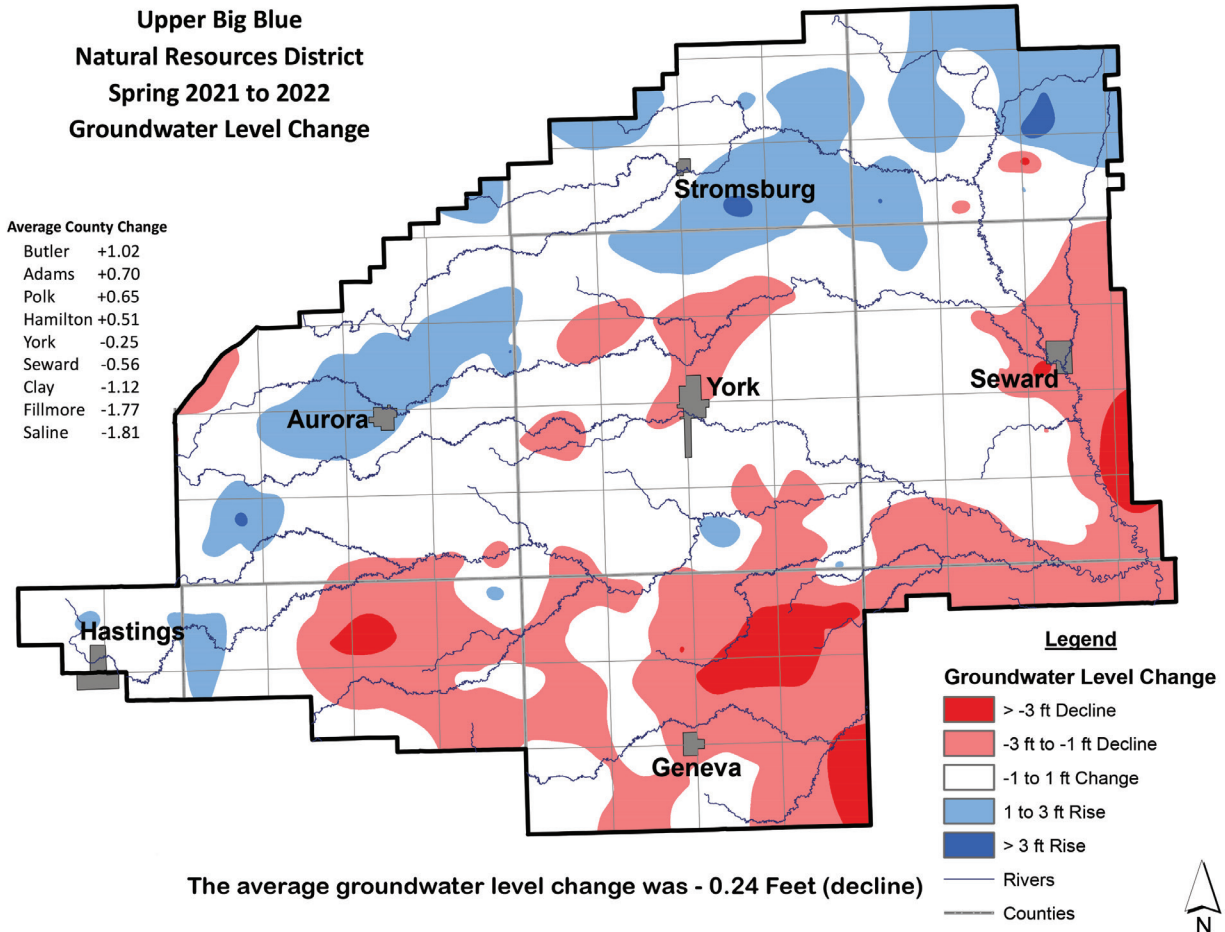
DISTRICT WATER LEVELS DECLINE: NO ALLOCATION

During March and April 2022, staff of the Upper Big Blue Natural Resources District measured roughly 500 observation wells throughout the district to determine an average water level change, based on a weighted change from each well. For spring 2022 water level measurements, the NRD has determined that the average groundwater level change shows a decline of 0.24 feet from last spring. The spring 2022 average groundwater level is now 8.89 feet above the “Allocation Trigger.” Thus, there will be no allocation restrictions for the 2023 irrigation season.

Observation wells are measured in the spring of each year, allowing the water table to rebound from the previous irrigation season. The wells that are measured are

spatially distributed throughout the district to provide an accurate profile of the average groundwater level change. Each well measured is assigned an area of the district based on distances from other wells. This method gives the average groundwater level change a weighted average.

In spring 2021, the NRD reported an average increase of 0.35 feet. Spring 2020 showed an increase of 3.67 feet on average. Fluctuations from year to year are common throughout the district. The Upper Big Blue NRD sits above the High Plains Aquifer, which stretches from South Dakota to Texas. This portion of the aquifer is dynamic and different factors like rainfall and pumping affect how the aquifer reacts.

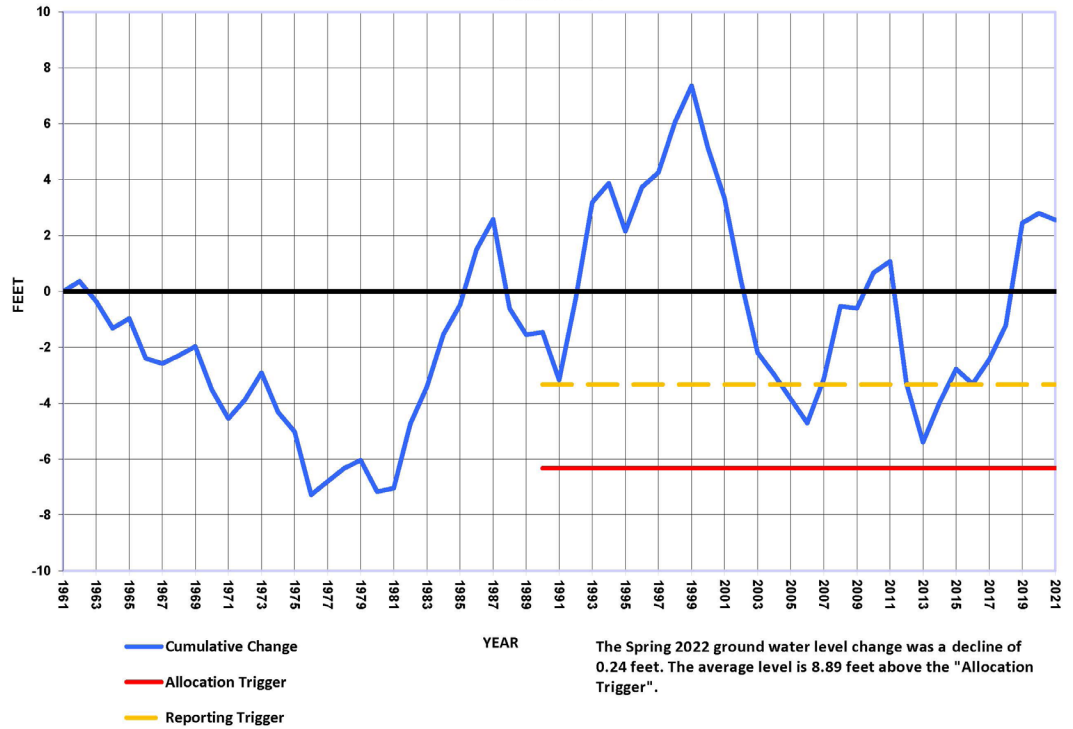


In addition to the average change across the district, the NRD has also provided a more detailed look at water levels across the district. Water levels rose slightly in the north and west parts of the district, including Butler, Adams, Polk, and Hamilton counties. Water levels decreased from 1 to 2 feet in the south and east part of the district, including York, Seward, Clay, and Fillmore Counties. Saline county saw the biggest decline, with a drop of 1.81 feet.

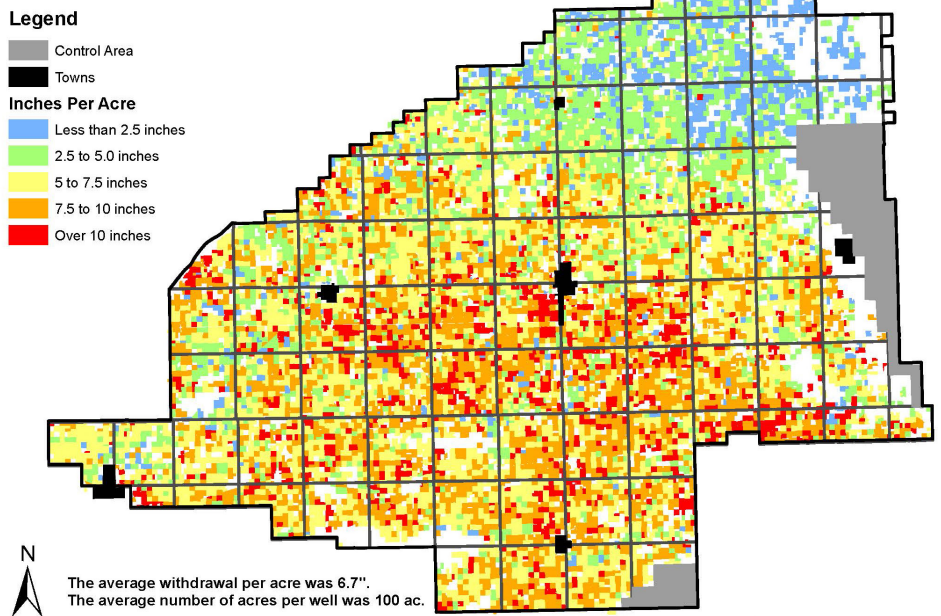
In recent years, producers have done an exceptional job of managing use of district water resources and cooperating with the NRD on conservation activities and monitoring. Along with NRD staff measuring observation wells, all groundwater users are required to annually report their water use. This is how the NRD maintains records on historic groundwater usage. Groundwater use records are very important to the district for making informed management decisions. The 2021 district average groundwater usage was 6.7 inches/acre. The district average groundwater usage is 5.9 inches/year since 2007.

The district's goal is to hold the average groundwater level at or above the 1978 level. In 2005, the district average groundwater level reached the "Reporting Trigger", initiating mandatory reporting of annual groundwater use to the district and certification of irrigated acres. If the district average water level falls below the 1978 level ("Allocation Trigger"), groundwater allocation will begin. ♦♦♦

UPPER BIG BLUE NRD - AVERAGE GROUNDWATER LEVELS TRIGGERS COMPARED TO HISTORIC LEVELS SPRING 2022



Upper Big Blue NRD 2021 Irrigation Withdrawal



Multiyear Study Examines Nitrogen Load In Local Soils

Fertilizer pricing is top-of-mind for many involved in agriculture in Nebraska, so it is a great time to ask: are corn growers getting the maximum for nitrogen use efficiency? Are there management practices that could reduce nitrogen leaching, and thereby save farmers money as well as safeguard the groundwater supply? A research project from the University of Nebraska Lincoln in partnership with the Upper Big Blue Natural Resources District is looking for insights on nitrogen use in the past and present in the district and its long-lasting impact.



It's a chilly spring morning in a cornfield near Bradshaw, where Jacob Maslonka, water resources technician with the Upper Big Blue NRD, picks his way through the corn stubble to meet with a pair of researchers from the University of Nebraska. A motor rumbles loudly as the team drives collection tubes into the soft soil of the field. The plastic tubes are encased in a metal sheath that is pressed into the

ground with a drill rig mounted on the back of a pickup. When each sample tube is drawn back up, it's full of dark earth—and information. The tubes are removed from the metal casings, capped, and labeled with collection data for later analysis of chemicals present, as well as soil type and other characteristics.

The cropland where Maslonka and the others are standing is the property of a cooperating producer who is part of a study that will examine the nitrate load in the vadose zone across the district. The project will involve collecting samples at a variety of depths from up to 120 locations across the district over the next three years. These samples will be compared to samples from a similar study of the district conducted in 1998. That data collected will be coupled with reporting from the participating producers about historic and current land management practices in the fields where the samples are collected. The results will give researchers insight into current nitrate levels, the movement of nitrate in the vadose zone, practices that are impacting nitrates in the vadose zone, and the future of groundwater quality in the district.

The vadose zone, also known as the unsaturated zone, is the soil between the crop root zone and the water table. Nitrogen from fertilizer can leach below the root zone beyond the usable range for crops to absorb, accumulating in the vadose zone. This is particularly true in instances of over application of fertilizer. When more fertilizer is applied than is needed by the crop or is applied too early to be used fully by the crop, the situation is primed for leaching. Over time, that nitrogen moves through the soil profile and ends up in the groundwater. The time it takes the nitrogen to reach the groundwater supply varies, based on soil type, precipitation/irrigation, and depth to water.

Not only does leaching represent a lost investment for the producers, but it also creates a contamination challenge for residents, as most Nebraskans' drinking water comes from groundwater sources. Remediating for nitrogen in groundwater is becoming an expensive problem for many rural Nebraskans. The cost for nitrogen remediation in drinking water is disproportionately high for rural residents, who may have a lower median household income in addition to a small population base to defray the cost of municipal water improvements. In small towns, improved water systems can cost hundreds of dollars per person per year if new water treatment facilities must be constructed or additional wells drilled.

According to a 2019 study published by UNL faculty members on nitrogen use efficiency in Nebraska corn production, nitrogen leaching occurs more frequently when corn is grown continuously, rather than in rotation with other crops; where soils are sandier; where less efficient methods of irrigation are used; and when fertilizer is applied 100 percent preplant instead of 50 percent or more applied in-season.

In the Upper Big Blue NRD area, a few of these factors loom large. Many acres are farmed continuously with corn and a significant percentage of producers in Phase II & III management areas, where nitrate levels in water are higher, apply all of their nitrogen pre-plant (though this number has decreased somewhat in the last two years). On the plus side, soils tend to be less sandy than other parts of the state and more than half of irrigators utilize center pivots (instead of less efficient methods

of irrigation such as furrow). The Upper Big Blue NRD recommends a number of practices that can improve producers' nitrogen use efficiency including chemigation and split application of fertilizer, as well as soil health practices such as no-till, crop rotations, and cover crops.



The current vadose zone study will provide valuable insight to the movement of nitrate through soils in the district and into the water supply, as well as which practices are working when it comes to best managing this problem. It's a matter of human and environmental health, as well as one of financial health. Better practices will reduce the amount of nitrate in drinking water; they will also benefit producers, who may lose part of their return on investment due to leaching. While high fertilizer prices and supply chain challenges are causing added stress for the ag community, it's the opportune moment to equip producers with information regarding nitrogen use as well as soil health practices that could reduce dependence on conventional inputs.

A vadose zone study was recently conducted in the Hastings area by the same team from UNL that is conducting the current study in the Upper Big Blue NRD. The Hastings study drew samples from 32 locations and tested them against samples from the same locations five years earlier to see the rate of change of nitrate levels in the soil. The conclusion of that study was that current management practices in the Hastings area are not slowing the rate of increase of nitrate in the vadose zone. Lead researcher Dr. Dan Snow reported that while some samples reflected declines in soil nitrogen over that five-year period, most saw an increase. The average change across all locations was a 30 percent increase in nitrate-nitrogen in the soil. The highest level of increase was beneath gravity irrigated cropland. Increases were also seen in high density livestock feeding operations.

These findings suggest that the problem is not only historic overuse of fertilizer but continued need to improve nitrogen use efficiency and nutrient management in the Hastings area.

Beyond the Hastings area, there has been a steady increase in nitrogen concentration in groundwater samples, across the district. While there have been decreases or plateaus in some areas of the district, there has been an overall increase of 54 percent across the district in the last 20 years. Half of the district is now in a Phase II or Phase III management zone, meaning additional management is required due to the increased level of nitrogen in the groundwater.

Researchers with the current study of the vadose zone will collect samples for the next three years. Results will be analyzed throughout that time and will be first communicated to individual landowners. The aggregated information will be released to the public in 2024 and beyond. "This study is not meant to further regulations about nitrogen use," said Maslonka. Instead, he hopes the study will examine if there are strategies for stopping or reversing the problem. "This study is an update on previous research but taking a current look at what the nitrate situation is in our district." The study will also look at the concentrations of manganese, uranium, selenium, and arsenic in the soil, which could be indicative of a water quality problem in the future.

"It's nice to know if your practices are working or not," Maslonka added, noting that his hypothesis is that good management practices have slowed the rate of nitrogen contamination in the vadose zone and groundwater supply locally. "Management practices are better today than they were 50 years ago, but we need to continue to improve and be vigilant," he said. "I hope this study will help farmers see the benefits of good management practices and it will encourage them to try new things on their land in the future... We don't want to mess up their yield goal or balance sheet, but we want to show the value of the adoption of practices that reduce or reverse the rate of nitrogen leaching into the soil." ♦♦♦

(SOIL...continued from page 1)

“For a few years, I’ve been interested in trying cover crops, at least prioritizing heaviest need acres,” Grosshans explained. “This was the first year we got our ducks in a row, enrolled in the program, got the seed and the application ironed out, and made it happen.”

There has been a learning curve, but Grosshans says the practice has been worthwhile and he plans to expand use of cover crops to include more acres this fall while further reducing tillage. He acknowledged that making these kinds of management changes is challenging, but he recommends that other producers consider adding practices strategically where it makes sense for them. “Pinpoint acres that you feel would really benefit and then just jump in and try it on a small scale, one field or two fields, something that’s easily manageable that’s not going to get away from you,” he advised. Every farm operation is different and there are many variables to consider. For Grosshans, a strategic approach included identifying the acres where practices would have the biggest immediate impact. “The farms that are susceptible to eroding, those are the ones we are working to convert to a minimum or no till, or spot tillage, and add cover crops. Reducing erosion, that’s the end goal.”

The funding Grosshans receives via the NRD and NRCS offsets costs for five years while the practices get established. “Without having financial assistance, it would be really hard [to implement cover crops],” he said, when you consider seed, application, and termination. With chemical and fuel costs rising, it’s too expensive for most

farmers to do it without help. “You need to see a major benefit on soil health and soil productivity.”

For more information on financial assistance for cover crops and other practices, visit www.upperbigblue.org/incentiveprogram or call your local NRCS office. An extended version of this article with more info on outcomes is available online.



Right: Matt Grosshans fills a planter with soybeans.
Below: A cover crop of rye grass on Grosshans’ field, spring 2022.



You want to improve your soil’s health. We want to help you do it.

Funds are available for cover crops, no-till, and diverse crop rotation, up to \$45/acre, through the Nebraska Soil Carbon Project. Start today!

upperbigblue.org/SoilCarbonProject

Producer-Reported Data Analysis Shows Less Fertilizer, Similar Yield

According to data reported to the Upper Big Blue Natural Resources District, some district corn growers are not seeing maximum return on their fertilizer investment. This conclusion is based on information provided by corn growers in Phase II and Phase III management areas, which reveals that those who are growing continuous corn and those using a corn and bean rotation are using similar quantities of nitrogen, meaning those growing soybeans may not be taking a full legume credit on their nitrogen calculations. On average those growing beans in their rotation only applied 15 pounds less nitrogen than those growing corn. While this shows a certain level of nitrogen use efficiency, there is still room for improvement.

The graphs provided by the NRD (available at www.upperbigblue.org/NUE) that chart this data show that producers in Phase II and III areas growing corn on corn from 2017-2021 applied between less than 50 pounds and over 350 pounds of nitrogen per acre, with the bulk of producers falling in the 150 to 250 pounds per acre range. Similarly, yields for that group ranged from less than 50 to over 300 bushels per acre, with the majority falling

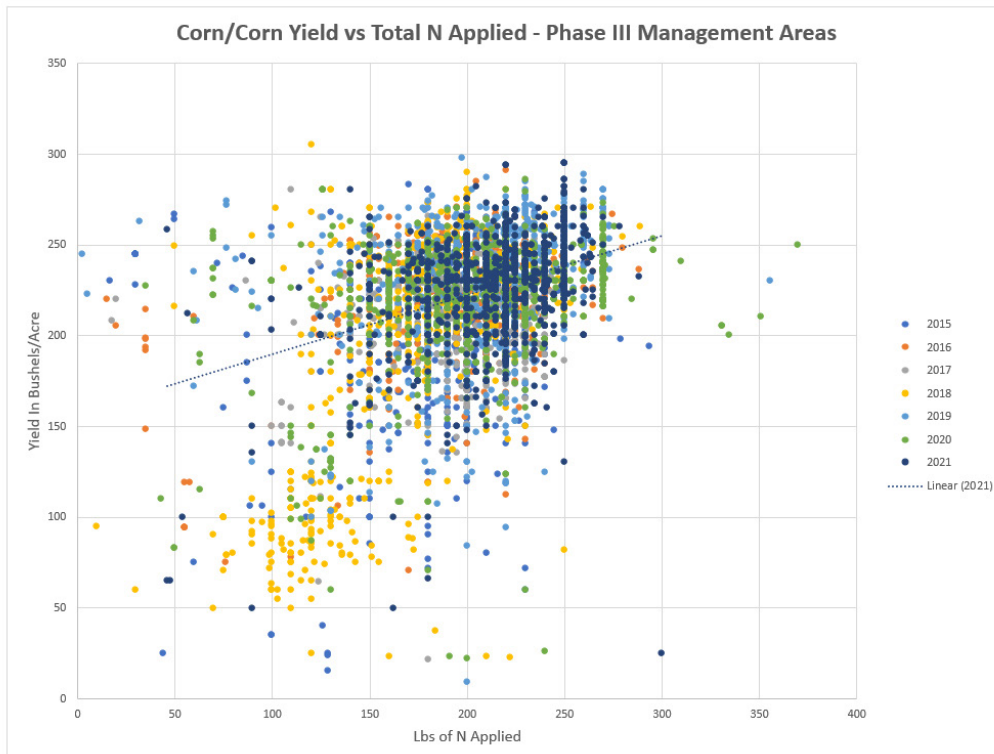
between 200 and 250 bushels per acre. For the corn/bean rotation fields for the same period, the numbers are remarkably similar. Producers applied between less than 50 and up to 400 pounds per acre, with the majority applying between 150 and 250 pounds per acre. Yields ranged from less than 50 to over 300 bushels per acre.

The nitrogen use efficiency numbers reported in this period ranged from 0.61 to 1.61. The majority of years in this period showed NUE of less than 1, however the trend line has continued to increase over this period.

“Our concern is that producers aren’t taking enough credit for their residual nitrogen and legumes in their nitrogen calculations,” explains Dan Leininger, NRD water conservationist.

Additionally, Leininger says throughout the 2017-2021 period, the rate of nitrogen applied to all fields in Phase II and III areas increased, while yields did not. This continued increase in fertilizer use without a corresponding yield increase means there is likely nitrogen over application.

This wasted fertilizer is left over in the field after the growing season—which directly impacts the quality of the water in the district.



“Every year, if you over apply nitrogen by even 30 pounds, it adds up in the system,” said Leininger, who recommends producers split apply fertilizer rather than apply 100 percent preplant to increase efficiency. “Soil isn’t a good storage place for fertilizer. As much as you can, apply fertilizer in season.”

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See additional charts and information on this topic at www.upperbigblue.org/NUE.

Irrigation Notes



Flow Meter Check Up

Be sure to check that your flow meters are functioning properly before you start irrigating. A properly functioning meter should not have condensation inside. If your meter has been serviced over the winter, make sure you check your bolts for proper tightness before starting up your system. Irrigators in the district can now take advantage of an increase in the amount of cost-share funds available for flow meter repair. Thanks to a program change, the cost-share funds are now offered at a maximum of 50 percent not to exceed \$300. Previously, the funds allowed for 50 percent up to \$150 for flow meter repair.

To access these funds, irrigators should complete forms on the NRD website to ensure that they qualify prior to completing the repairs. The maximum cost-share per landowner for flow meter repair is \$1,000 per fiscal year. The minimum cost-share payment is \$100.

Irrigation Scheduling Equipment

If you operate irrigated crop land in an area of the district designated as Phase II or Phase III or in the Hastings Wellhead Protection Area, you are required to have soil moisture sensors or capacitance probes in AT

LEAST one field and to report your sensor readings to the NRD annually.

The NRD offers the Nebraska Agricultural Water Management Demonstration Program to encourage producers to improve irrigation scheduling using ET gauges and Watermark sensors to determine crop water needs. The ET gauge simulates crop water use through evaporation through a ceramic and green canvas membrane. Watermark sensors are used to measure soil moisture in a nearby field to confirm the ET gauge's accuracy. This program began in the UBBNRD in 2005 with a collaborative effort with the University of Nebraska Extension and 18 collaborators. The program is now being implemented in several NRDs and over 2,000 collaborators. The district sells this equipment to irrigators at a reduced cost to encourage adoption of the scheduling practices.

Visit www.upperbigblue.org/groundwater-programs for details on the discount program or call the office at (402) 362-6601.

Stop Uncontrolled Runoff

It is illegal to operate an irrigation system that contributes to wasting groundwater. State law prohibits uncontrolled irrigation runoff. The NRD is responsible for enforcement of this law.

Need help controlling irrigation runoff on your land? As part of the NRD Land Treatment Program, you can access cost-share funds to improve your irrigation system through sub-surface drip irrigation. Technical assistance is available from the NRCS for solving runoff problems. For more information contact your county NRCS office or call us at (402)362-6601. ◆◆◆



Testing Reveals Economic Impact of Soil Health

A side-by-side comparison of soils from the NRD's Project GROW (Growing Rotational Crops on Wellfield) site and an adjacent field that is conventionally farmed shows the difference practices like no-till, cover crops, and rotational cropping can make.

In early May, NRD staff collected soil samples from two fields owned by the City of York that surround the city's wells. One of the fields is managed by the NRD as a demonstration site for soil health practices and profitability over maximum yield, while the other field is farmed conventionally and represents the agricultural norm for the area. The 0-6" soil samples were sent to Ward Laboratories of Kearney for a Haney Soil Health Analysis. This test offers a more comprehensive look at the nutrient needs and overall health of a soil system. The Haney Test differs from traditional soil tests in that it also evaluates some soil health indicators such as soil respiration, the water-soluble fractions of organic carbon and organic nitrogen and the ratio between them. Finally, a soil health score is calculated based on a combination of these different soil health indicators.

The test results were straightforward—the Project GROW field reported a soil health measurement twice as high as the conventionally farmed field.

Additionally, measurements of soil respiration and microbially active carbon were more than three times higher in the Project GROW field compared to the conventional field. These numbers reflect the biological activity present in the soil. This is significant, as greater biological activity leads to greater mineralization of soil organic matter, which essentially means free fertilizer. When there are more naturally occurring nutrients available in the soil, less inputs are needed to maintain fertility, meaning an increase in overall profitability. The test results showed a nutrient value of \$153.46 per acre for the Project GROW field, while the conventional field had a nutrient value of only \$98.68. Thus, to have the same measure of fertility, the conventionally farmed

field would need to add approximately \$54.78 per acre in fertilizer inputs.

When it comes to residual nitrogen in the soil, the Project GROW field had half as much as the conventional field. This is an important finding, as residual nitrogen if not utilized by a growing crop can leach below the root zone into the water supply and causes contamination that is costly to remove. Consuming water that is high in nitrate-nitrogen has been linked to many negative health outcomes. This type of contamination is a major problem for communities across the Midwest.

The 160-acre Project GROW site has been managed by the NRD for the past five years. Previously, it was conventionally farmed by others with no soil health emphasis. These Haney test results show how much improvement can be made in a soil system in a relatively short amount of time by implementing soil health practices. The benefit of this improvement in soil health is a greater measure of protection for the drinking water supply for the residents of York. ♦♦♦

Interested in improving the health of your soil? Give us a call! We have funding available for producers to implement some practices. Call (402) 362-6601 and ask for Dan Leininger. Photo: Leininger gives a soil health demonstration to area college students in fall 2021. As a simple way to measure soil microbial activity, Leininger buried a pair of cotton briefs in the Project GROW field in June and exhumed them in October to allow students to see evidence of the nutrient cycling provided by microorganisms.



Education Quick Clips

Keeley Conrad (1) and Matt Mittman (2) have been selected as the 2022 recipients of the NRD's Burke Scholarships. Conrad and Mittman are both from York and are students at the University of Nebraska. Conrad is a horticulture student with an emphasis in entrepreneurship, with ambitions of one day owning a greenhouse business. Mittman is majoring in agronomy and plans to be a crop consultant. Remi Christensen (3) of Seward has been selected as an alternate for the scholarship. She will be a student at UNL this fall, studying agronomy with plans to pursue a career as a research agronomist.

Lily Houston (4) takes notes during a birding event at Teal View Wetland Education Area near Hampton in March. Zander Stoy (5) will attend Adventure Camp About the Environment this summer in Halsey, supported by a scholarship from the Upper Big Blue NRD in June. Cole Vernon (6) participated in a Pheasants Forever sponsored Pollinator Day event in late April. He and other students improved the pollinator habitat at Project GROW in York. Marie Krausnick (7) talks to local producers during a tabletop training exercise at the NRD office in March. The water department is exploring new ways to present information about fertilizer application and timing as well as soil health during their regular training events. ♦♦♦



Recognitions & Promotions

Marie Krausnick was promoted to the position of assistant general manager in April. Krausnick has served in the water department of the Upper Big Blue NRD for 21 years, the last seven of those as department manager. As water department manager, she has managed a staff of ten employees and an annual budget of close to \$1 million. Krausnick has had direct oversight of public facing projects such as Project GROW, walk-in water testing, certification of irrigated acres, well monitoring, water use reporting, and annual water quantity measuring, among others. “Marie has done a tremendous job in leading the water department,” said David Eigenberg, general manager. “This promotion will retain her many years of experience and water knowledge in our organization.”



Nebraska Ducks Unlimited presented the 2021 and 2022 Nebraska Wetland Partnership Awards to Mark Brohman and David Eigenberg (respectively) at its state convention in Lincoln in March. Since 2016, DU has bestowed this award to a single individual from other organizations who were crucial in helping DU achieve its wetland conservation missions in Nebraska. Eigenberg and the Upper Big Blue NRD were recognized for their partnership in the Teal View Wetland Education Area near Hampton. ♦♦♦

Pictured: General Manager David Eigenberg and Board Chairperson Lynn Yates

BLUEPRINT



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Nebraska's NRDs Plant 100 Millionth Tree

Since their inception in 1972, Nebraska's Natural Resources Districts (NRDs) have been planting conservation trees and shrubs for windbreaks, erosion control, wildlife habitat and other conservation purposes. This spring, the NRD Conservation Tree Program planted their 100 millionth tree – that's approximately 50 trees for each Nebraskan.

“Nebraska has a proud history of planting trees, and putting the 100 millionth tree in the ground reflects Nebraskans' willingness to invest in the future,” said Dr. Orval Gigstad, Nebraska Association of Resources Districts president. “Our tree planting success is owed to the forward-thinking vision of landowners.”

Each year, the NRD Conservation Tree Program provides hundreds of thousands of low-cost, bulk trees for planting across the state. Districts collect orders for trees between November and March, then trees are distributed in April in time for spring planting. A majority of NRD conservation trees are sourced from the U.S. Forest Service's Bessey Nursery in Halsey, Nebraska.

Gigstad noted that extreme weather events, diseases and invasive insects have impacted Nebraska's tree population, but recent public-private partnerships demonstrate Nebraska's tree planting spirit.

According to recent data released by the U.S. Forest Service, Nebraska's trees and forests are experiencing steady declines. However, a newly formed partnership to reverse this trend has gained significant momentum with the announcement of a \$4.3 million grant from the U.S. Department of Agriculture's Natural Resources Conservation Service. The Nebraska Forest Restoration Partnership brings together the Nebraska Forest Service, the state's NRDs and the Nebraska Game and Parks

Commission to address declines in the state's forests and windbreaks. Using the award, partners will work directly with landowners to increase the scale and pace of forest restoration statewide. This includes planting 1.5 million trees, providing new management of 30,000 acres of declining forests, increasing the health and resiliency of 7,000 acres of vulnerable forests and restoring 250 linear miles of agricultural windbreaks.

In December, Executive Travel also announced a partnership with Nebraska's NRDs to plant 1 million trees over the next five years through the ETGreen campaign, starting with 50,000 trees in 2022. This partnership gives Executive Travel the opportunity to assist local landowners in planting all 1 million trees in Nebraska.

“When Executive Travel was building the ETGreen initiative, we wanted to partner with a local organization dedicated to a sustainable future and a beautiful Nebraska,” said Steve Glenn, Executive Travel chairman. “This great network of local landowners who plant hundreds of thousands of trees through the NRD annually guarantees trees are planted and cared for.” ♦♦♦



NEBRASKA'S NATURAL RESOURCES DISTRICTS

PROTECTING LIVES. PROTECTING PROPERTY. PROTECTING THE FUTURE.