Aquifer Research In Action

Have you seen this helicopter with hexagon-shaped equipment and wondered what it is being used for? CPNRD is participating in a project known as the *Advanced Hydrogeologic Frameworks for Aquifer Management in the Platte and Republican Rivers.*

Data is collected by the aerial electromagnetic survey equipment that reads 600-800 feet below the surface. A transmitter and receiver record the geological measurements of the aquifer. The project will provide detailed information of the aquifer conditions and the subsurface hydrogeologic framework to effectively design and apply integrated water management plans.

Nearly 1,400 miles were flown from July 2- July 14 in the Central Platte and Twin Platte Natural Resources Districts. The traditional method of geologic test hole drilling for information regarding the subsurface geology is vital to the understanding of the area, but alone cannot provide enough spatially distributed information to complete a detailed hydrogeologic framework of each NRDs aquifer resources.

This information will allow new infrastructure and future sub-regional groundwater model investigations to be developed for evaluation of proposed management practices.

The project is being funded through a grant from the Nebraska Environmental Trust, the Central Platte and the Twin Platte Natural Resources Districts..

Project SENSE Update

***S**ensors for **E**fficient **N**itrogen Use and **S**tewardship of the **E**nvironment*

Over 30 ag producers attended the July 27th Project SENSE Update at Arnie and Brian Hinkson's shop in Cairo, NE. Representatives from UNL demonstrated SENSE equipment and provided results from 2015 demonstration plots. Results showed that the crop canopy sensor management saved 40 lbs of nitrogen (N) per acre, saving producers $10.35 per acre on average.

Project's high clearance applicator equipped with OptRx Canopy Sensor..

The high tech canopy sensors are able look at the corn canopy every second as it travels through the field and read the reflectance of chloraphyl to determine the proper amount of N needed spacially. The canopy sensors are designed to read a range of three feet above where the sensor is mounted on the sprayer, traveling at a speed of 8 to 10 mph.

OptRx Canopy Sensor allows for sensor-based treatments compared to standard practices.

CPNRD began participating in UNL's Project SENSE pilot program in 2015. The overall goal of the project is to increase the efficiency with which nitrogen (N) fertilizer is used for corn production- minimizing potential leaching loss of N to groundwater.

Other participants include the Upper Big Blue NRD, Lower Platte South NRD, Lower Platte North NRD, Lower Loup NRD, Nebraska Corn Board.

Seeking Representatives for Hazard Mitigation Plan

Central Platte NRD is in the beginning stages of updating the Hazard Mitigation Plan that was first approved in 2012. In 2008, CPNRD was awarded a grant by the Federal Emergency Management Agency (FEMA) to establish the Plan; which identifiies vulnerabilities to natural or manmade hazards within the District. Some common mitigation projects include: backup power generators, storm shelters, stormwater projects, elevation or acquisition of flood-prone structures, and weather radios.

In order to be eligble for emergency funds through FEMA, representatives from communities, schools, fire and police departments, hospitals, and special districts must actively participate in the updating process. To find out if your community is participating in the CPNRD Hazard Mititation Plan go to: **http://jeo.com/cphmp** or contact **Caitlin Olson,** JEO Consulting Group, at **colson@jeo.com** or **(402) 474-8741.**

Nebraska`s NRDs: Protecting Lives Protecting Property Protecting the Future

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In Perspective Newsletter

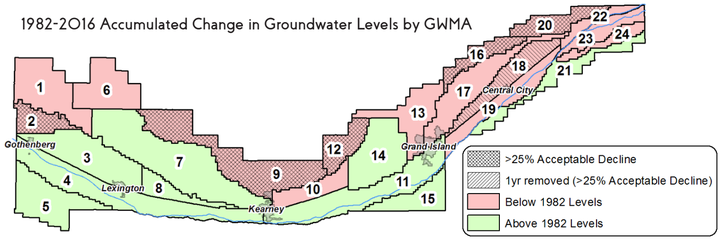
Spring Groundwater Levels Up

Being in the Platte River Watershed, the District's primary surface water feature is the Platte River; however, most farmers rely on groundwater for their irrigation needs since groundwater is abundantly available across the District. Central Platte NRD (CPNRD) staff measures 600 wells, twice a year, in conjunction with the Conservation and Survey Division, UNL and U.S. Geological Survey. Measurements are taken in all 11 counties served by CPNRD to monitor the District's groundwater levels.

The groundwater levels of 1982 are used by the district as the benchmark year to compare groundwater level changes. This was established as part of the 1987 Groundwater Management Plan; which established 24 subdistricts for monitoring groundwater level changes. As of June 2016, accumulated groundwater levels had declined less than one foot since 1982, with the accumulated change from spring 2015 measurements just 0.75 feet below the measurements taken 33 years ago.

As seen in the map below, Ground Water Manangement Area (GWMA) #5, in the southwestern part of Dawson County and northeastern part of Frontier County, had the largest increase of 11.22 feet. GWMA #9 in northern Dawson and central Buffalo County had the largest decrease of -11.46 feet.

1982-2016 Accumulated Change in Groundwater Levels by GWMA



Six of the 24 GMAs will remain at 25% of the maximum acceptable decline established by the CPNRD, and will no longer be allowed to transfer new uses or drill supplemental wells in those areas until the average water level is less than 25% of the allowable decline for two consecutive years. For Phase II and Phase III areas, where landowners are required to document gallons per minute used, CPNRD offers cost share in the amount of $100 per field per landowner to assist with the cost of an ultrasonic flow meter.

The change in level is an average, based on the wells measured in each subdistrict. Aquifer thickness varies from 25 feet to 300+ feet across the district, so a drop of one foot has a more significant impact on some parts of the District than on others.

New farming techniques and practices that conserve water and reduce consumption, like minimum tillage and a switch from high pressure to low pressure sprinkler systems, are credited with the water savings that make the aquifer report so positive despite drought conditions in recent years.

For a more detailed map, visit: **www.cpnrd.org**.

GWMA #	2016 Level	GWMA #	2016 Level
1	-1.41	13	-0.14
2	-5.39	14	3.10
3	5.44	15	7.61
4	3.13	16	-8.71
5	11.20	17	-0.52
6	-2.91	18	-0.43
7	0.95	19	-0.48
8	2.02	20	-4.76
9	-11.45	21	3.74
10	-1.81	22	-0.12
11	4.02	23	-2.47
12	-7.46	24	-2.00

New Requirements For Areas Added to Phase II

In January, southern Hall and northern Hamilton counties were moved from a Phase I to a Phase II Ground Quality Water Management Area due to increasing nitrate levels. CPNRD's Rules and Regulations require areas with nitrate level concentrations of 7.6 to 15 parts per million to be placed in a Phase II area.

With the move from Phase I to Phase II, those landowners that were added into the Phase II area are reminded that they have new requirements to complete for their annual report. Sandy Noecker, data compliance officer, said she wants to remind all Phase II and Phase III landowners that **"groundwater analysis must be taken before you shut your wells off this crop season."**

A deep soils analysis for residual nitrogen (NO3-N) content for each field growing corn, grain sorghum or potatoes must also be taken. Noecker will send a reminder about requirements to landowners in late November, but wanted to stress the importance of getting water analysis taken right away.

Each operator must submit an annual report for the upcoming year: All of the following crops must be reported: corn, sorghum, potatoes, beans, alfalfa, small grains, and any other commodity crop. The form by March 31st. Crops other than corn, sorghum or potatoes do not require soil and water tests.

WATER SAMPLES

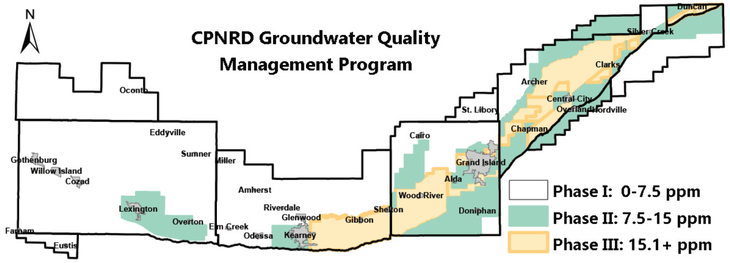
Samples may be analyzed at any reputable laboratory at the operator's discretion. Contact the lab you wish to submit your samples to prior to sample collection to obtain proper collection procedures.

COLLECTION INSTRUCTIONS

1. Use a sample container provided by your local fertilizer dealer, crop consultant or health department; or use a a clean glass jar with a lid. *(One cup of water is plenty.)*
2. Label the sample container clearly using the legal description and well registration number.
3. Let the well run for at least 10 minutes before collecting the sample.
4. Rinse the container three times before collecting the sample.
5. Fill the container approximately 1/2 inch from the top.
6. Rinse the lid and place it securely on the container.

NOTE: The sample must be delivered within 24 hours and must be kept cool during transport to the lab. If you cannot deliver it immediately, it must be refrigerated.

For more information, contact Sandy Noecker at: noecker@cpnrd.org or (308) 385-6282.



Groundwater Exchange to Open After Harvest

Central Platte NRD will continue the Groundwater Exchange as a pilot program for the 2017 irrigation season. The Program will allow producers to buy or sell water on a temporary leasing basis for the upcoming irrigation season. A seller can be anyone with a certified groundwater use on irrigated acres such as pivot corners, irregularly-shaped fields or even full sections. A buyer could be anyone looking to improve or add to their currently certified groundwater use or looking to increase streamflow.

For purposes of the Groundwater Exchange, a 'water right' is the certified groundwater use on irrigated acres. CPNRD has approved permanent water transfers of groundwater for over 10 years. The Groundwater Exchange Program would allow producers to transfer water rights that they do not need in a particular year, rather than permanently transferring them if a match can be made.

Both buyers and sellers will need to be pre-approved by making an appointment with CPNRD staff. During the pre-approval visit, staff will verify the water rights to be sold or bought and provide the buyers and sellers an identification number to be used during the bidding process. We anticipate that staff will meet with landowners for the pre-approval process beginning the first week of October and run through the month of November. The bid window will run during the first part of December. CPNRD board members will approve Groundwater Exchange transactions at their December board meeting. Bidders will then be notified accordingly.

Be sure to check out: **www.market4water.com** for updated details. This website contains more information, documents and links for the Exchange Program; which is managed by NERA Economic Consulting ("NERA") on behalf of the CPNRD. You can also check our website, **www.cpnrd.org** for more information as well.

Life Underground: Effect of Cover Crop Use On Soil Microbe Populations in Crop Fields

by Linda Schott, UNL Graduate Extension Assistant and Mary Drewnoski, UNL Beef Systems Specialist

The soil is a living ecosystem. In fact, there are more microorganisms in a teaspoon of soil than there are people on the earth. These soil microorganisms influence above-ground ecosystems and thus crop productivity by contributing to plant nutrition. Some microbiologists believe that 80% of soil nutrient functions are essentially controlled by microbes. As a part of a Nebraska NRCS funded conservation innovation grant, Nebraska Extension took soil samples from 17 crop fields in south eastern or south central Nebraska that have been managed under no-till for 6 or more years. These fields were predominantly managed in corn-soybean rotations. Cover crops had been planted in 9 of these fields for 4 or more years whereas the remaining 8 fields had no cover crops or had them planted only once. These samples were sent to Ward Lab where Solvita CO2 burst and PLFA analysis were conducted.

Mycorrhizal fungi that was growing in association with some oat and brassica cover crop.

The analysis showed that the producer's fields, which had cover crops planted for four or more years, tended to have an increased Solvita CO2 burst when compared to soils from fields with limited use of cover crops. The CO2 burst test represents carbon that was acted upon by the soil microbes. In general, soils that exhibit greater CO2 production in this test are considered to contain greater microbial biomass due to a more favorable food supply (for the microbes), leading to an increased potential for nutrient turnover and mineralization and thus increased nutrient availability to the crop.

The PLFA test is a way to quantify the microbial community in the soil. Based on the PLFA analysis it appears that four or more years of cover crop use increased the population and diversity of soil microorganisms. Bacteria were increased by over 50%, which can lead not only to increased nutrient availability to plants but also to improved water infiltration and reduced erodibility of soils by improving aggregate stability.

Life Underground *(continued)*

Bacteria were increased by over 50%, which can lead not only to increased nutrient availability to plants but also to improved water infiltration and reduced erodibility of soils by improving aggregate stability.

This is because some bacteria produce gummy substances (polysaccharides, mucilages, etc.) that help to cement soil aggregates. This cement makes aggregates less likely to crumble when exposed to water. Fungi were increased by nearly 160%. Fungal filaments, called hyphae, can also improve aggregate stability. They stabilize soil structure because the threadlike hyphae literally surrounding soil particles like a hairnet. Arbuscular Mycorrihizal fungi (AMF), a specific type of fungi that associate with plant roots were increased by 150%. These mycorrhizae form a dense network of thin filaments that reach far into the soil, acting as extensions of the plant roots. These fungi facilitate the uptake of water and a wide range of nutrients.

The number of protozoa was increased over 200%. Protozoa can only survive in soil where there is an adequate supply of bacteria to consume, and the predatory action of protozoa on bacteria helps release nitrogen into the soil. The diversity index was greater for the fields in which cover crops had been planted for four or more years. What are the benefits of a more diverse community in the soil? While there is still much to be learned about the soil ecosystem, it is thought that the diversity of soil microorganisms contributes to the resilience of the soil ecosystem through functional redundancy. Functional redundancy in this case, means that different species perform the same function, and if one is removed, the function is still carried out by other species. For example, if a soil pathogen invades, the diversity of the microbes should provide an adequate arsenal of defense mechanisms to subdue the pathogen and maintain soil functionality.

Summary

Microorganisms abound in the soil and are critical to decomposing organic residues, recycling soil nutrients, and also impact soil structure. Plants are unable to take from the soil the nutrition they need without microbes working in the soil. Planting cover crops within corn-soybean rotations can increase the abundance and diversity of soil microorganisms. Results of soil analyzed from fields in which cover crops have been planted for 4 or more years compared to fields in which cover crops have not been planted or have only been planted once in the last 10 years.

YEARS OF CROP COVER

	1 OR LESS	4 OR MORE	SEM	P-VALUE[1]
Number of Fields Sampled	n = 8	n = 9	--	--
Solvita CO2 Burst, ppm C	87.0	102.7	6.3	0.11
PLFA Soil Microbial Community Analysis				
Total Biomass, ng/g	1395	2107	205	0.03
Bacteria, ng/g	744	1128	112	0.03
Fungi, ng/g	86	223	33.6	0.01
Arbuscular Mycorrhizal, ng/g	24	62	11	0.04
Saprophytes, ng/g	62	162	26	0.02
Protozoa, ng/g	6	19	3	< 0.01
Diversity Index	1.35	1.56	0.056	0.02
Fungi to Bacteria	0.116	0.194	0.025	0.05

[1]P-value (probability value) refers to the likelihood that the observed differences among means are due to chance. Thus the smaller the P-value the more likely there is a difference among treatments.

Example: P = 0.05 suggests that there is a 5% chance that the differences observed between means are due to random chance. P = 0.10 suggests there is a 10% chance that the differences observed are due to random chance.