

NDSU Extension assesses quality of livestock water sources impacted by drought

Miranda A. Meehan¹

Providing adequate water to livestock is critical for animal health and production. The goal of this Extension program is to improve the quality of livestock water and reduce losses of livestock due to toxic water conditions during drought. To date, 740 samples have been screened. They displayed high variability in the total dissolved solids (TDS) and sulfate concentrations of the samples, reinforcing the importance of monitoring water quality of water sources. Surface water sources have greater potential to have elevated TDS and sulfate concentrations in comparison with groundwater.

Summary

Extension agents are monitoring the quality of water sources utilized by livestock that may be impacted by widespread drought. To date, Extension agents have screened 740 water samples from 588 locations in 37 counties. Samples were classified based on county, sample date and water source. The TDS and sulfate were screened using an electric conductivity meter and sulfate test strips, respectively. Samples screened displayed high variability in the TDS concentration, ranging from 125 to 16,640 parts per million (ppm,) and sulfates, ranging from less than 200 to 11,626 ppm. The majority of the samples screened were acceptable for livestock consumption, with TDS concentrations below 3,000 ppm (84%) and sulfate levels below 800 ppm (73%). Surface water sources had a greater potential to have elevated TDS concentrations, with 17% of samples exceeding 3,000 ppm, in comparison with only 4% of groundwater samples. A similar trend was observed for sulfates, with 32% of surface water and 18% of groundwater samples exceeding

800 ppm. The variation in the results to date reinforces the importance of monitoring water quality of water sources throughout the grazing season to ensure livestock performance and health are not negatively impacted by water quality.

Introduction

Providing adequate water to livestock is critical for animal health and production. Good-quality water can increase your cattle's feed intake and weight gain. The quality of water accessible to livestock is directly tied to the amount of forage they consume.

Gains can be improved by as much as 0.24 pound per day in yearlings and 0.33 pound per day in calves receiving good-quality water. Providing good-quality water also can improve herd health. Livestock whose primary water sources are ponds and dugouts have a greater risk of contracting illnesses such as giardia, leptospirosis and cyanobacterial poisoning, compared with livestock drinking from a trough.

All natural water contains salts, which are dissolved minerals or solids. Elevated concentrations of TDS and sulfates can be toxic to live-

stock. The concentration of TDS and sulfates is measured in ppm.

Water quality varies depending on the source. When runoff is low in the spring or during a drought, the salts in surface water become more concentrated as water concentrations decline, and can reach concentrations that are toxic. Groundwater tends to be of higher quality than surface water; however, some aquifers in North Dakota have naturally high concentrations of potentially toxic salts, such as sulfate, due to geology.

In response to statewide drought conditions, NDSU Extension is screening the quality of livestock water sources to reduce losses of livestock due to toxic water conditions. NDSU Extension agents are screening the concentration of TDS and sulfates across North Dakota throughout the grazing season.

Experimental Procedures

In response to statewide drought, NDSU Extension is screening the quality of water sources utilized by livestock. To date, TDS and sulfates have been measured at 703 locations in 37 counties. Sites sampled included 98 surface water sources and 29 groundwater sources. Samples will be screened throughout the grazing season from March through October 2021. Extension agents were critical to the success of this effort, with 31 agents screening samples to date.

Water samples were screened for TDS and sulfate using an electric conductivity meter and sulfate test strips, respectively. Samples were classified based on county, sample date and water source. If

¹Animal Sciences Department, NDSU

TDS concentrations were equal to or more than 4,500 ppm or sulfates were greater than 800 at the time of screening, laboratory analysis was recommended. In addition to screening for TDS and sulfates, a visual assessment was conducted for the presence of cyanobacteria blooms.

Results and Discussion

To date, 740 samples have been screened for TDS and samples displayed high variability ranging from 125 to 16,640 ppm (Table 1, Figure 1). The majority of the samples screened (624, 84%) are acceptable for livestock consumptions, with TDS concentrations below 3,000 ppm. At TDS concentrations between 3,000 and 5,000, feed conversion and intake can decline thus reducing livestock performance.

Table 1. Total dissolved solid concentrations of water samples.

Total Dissolved Solids (TDS) in ppm	Groundwater	Surface Water
< 3,000	72	552
3,000 – 5,000	3	65
5,000 – 7,000		30
7,000 – 10,000		14
> 10,000		4

The TDS of 19 samples were between 3,000 and 5,000 ppm. Concentrations of TDS between 5,000 and 7,000 ppm were reported for one sample, and water with this concentration of TDS tends to have a laxative effect. Pregnant or lactating ruminants should not consume water with TDS between 7,000 and 10,000 ppm, and three samples fell in this range.

Concentrations of TDS exceeding 10,000 ppm consumption can result in brain damage or death, and three sample exceeded 10,000 ppm. Of the samples collected, 48 ex-

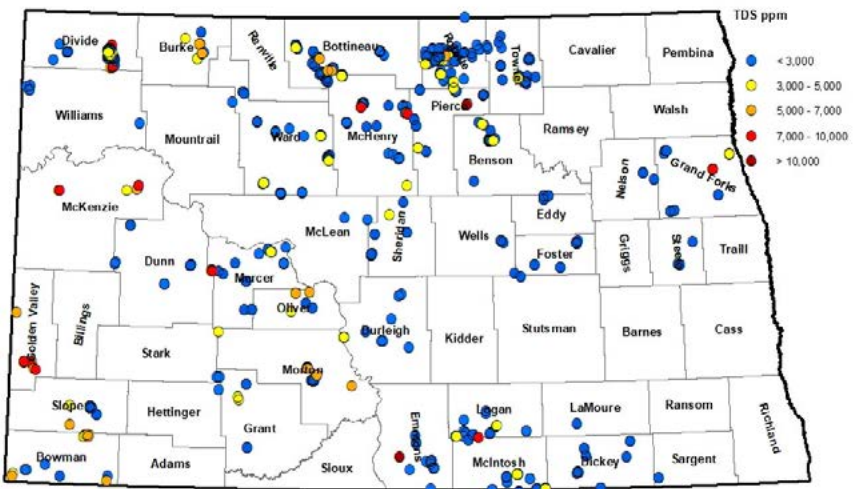


Figure 1. Total dissolved solids (TDS) in ppm of water sources screened in 2021.

ceeded 5,000 ppm and were recommended to be sent to a laboratory for additional analyses.

To date, 671 samples have been screened for sulfates and samples displayed high variability ranging from less than 200 to 11,626 ppm (Table 2, Figure 2). Negative impacts to livestock health can occur when concentrations exceed 1,000 ppm for mature animals and 500 ppm for calves. Concentrations above 2,000 ppm in forage-based diets and 600 ppm in high-concentrate diets (equal to or greater than 85%) pose a risk of central nervous system

disorders and death. Of the samples collected, 182 exceeded 800 ppm and were recommended to be sent to a laboratory for additional analysis.

Table 2. Sulfate concentrations of water samples.

Sulfates in ppm	Groundwater	Surface Water
< 200	42	269
> 400	12	146
> 800	9	90
> 1,200	3	31
> 1,600		50
> 2,000		20

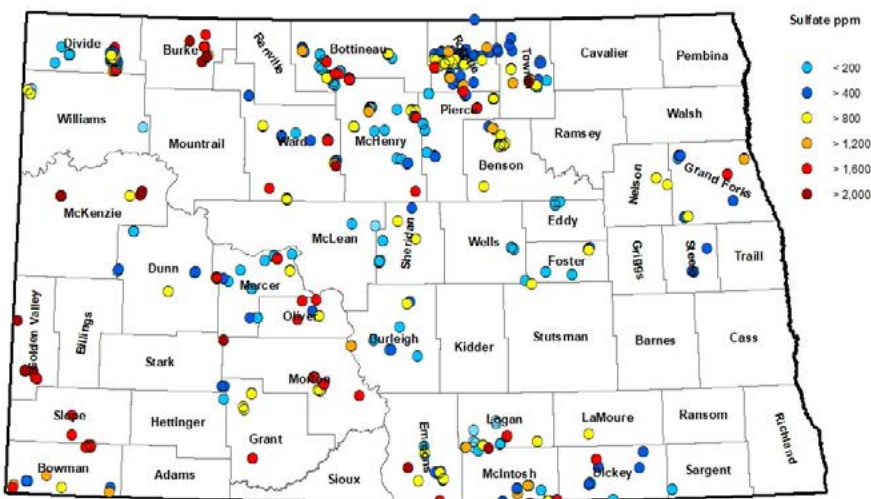


Figure 2. Sulfates in ppm of water sources screened in 2021.

Variability was observed between and within groundwater and surface water sources. Overall, groundwater had less variability and was higher quality than surface water sources (Figures 3 and 4). The average TDS and sulfate concentrations of groundwater sources was 1,315 ppm and 361 ppm, respectively. The majority (85%) of groundwater samples screened were acceptable for livestock consumption.

The TDS of surface water varied in quality ranging from 125 to 16,640 ppm, with an average of 2,074 ppm. The sulfate concentration of surface water varied in quality ranging from 100 to 11,626 ppm, with an average of 748 ppm. The TDS concentration was considered acceptable for 83% and the sulfate concentration was considered acceptable for 68% of surface water samples.

To understand the variation in water quality during the grazing season, samples were divided by month (Figures 1 and 2). Typically, TDS and sulfates tend to increase in surface waters as the grazing season progresses because of increased evapotranspiration rates in the summer months. However, fall drought and low spring runoff can influence this trend. In addition, waters with extremely high TDS and sulfates documented in March and April were not monitored in May and June because livestock no longer were allowed to access these sources.

Water quality screening and analysis of livestock sources allows ranchers to ensure water quality is not impacting livestock performance and/or health. It also can aid in making management decisions such as when livestock should be removed from a pasture or when an alternative water source should be used or developed. Installing a water development plan can help ensure that livestock have access to good-quality water throughout

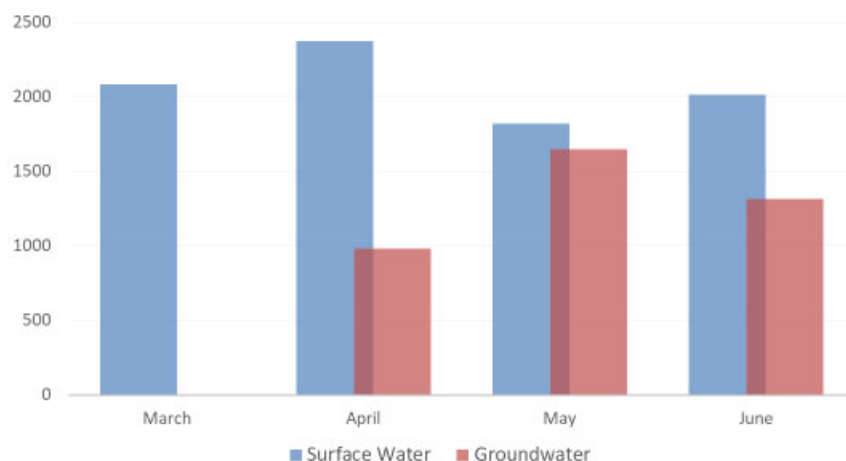


Figure 3. Average total dissolved solids (TDS) in ppm of water sources by month in 2021.

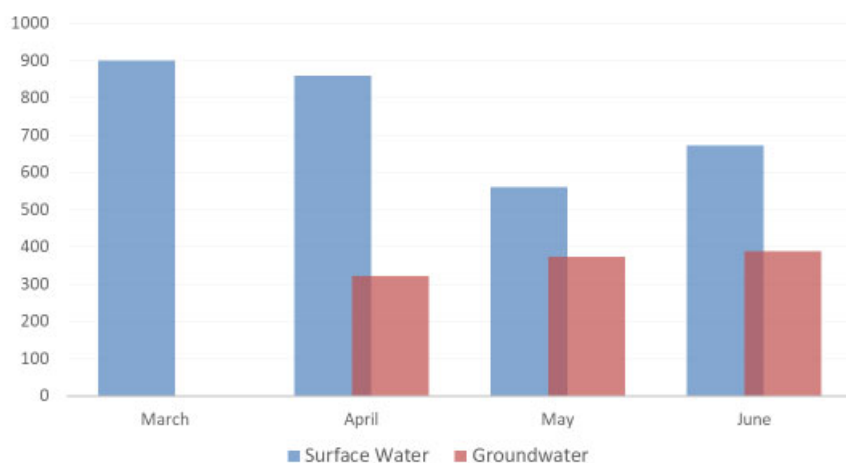


Figure 4. Average sulfates in ppm of water sources by month in 2021.

the grazing season and increase a ranch's drought resilience.

Results of these screenings will help us understand and demonstrate the variability in water quality and factors that may influence variability, including location, source and climate. The variation in the results to date reinforces the importance of monitoring the quality of water sources throughout the grazing season to ensure livestock performance and health are not impacted by water quality. If you are concerned about water quality, contact your local NDSU Extension agent and that person can conduct a screening and/or assist with sample collection and submission for laboratory analyses.

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