FHSU Western Kansas Regional Water Quality Study

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Introduction

The project's objective is to evaluate the general quality of groundwater and surface water across western Kansas, southern Nebraska, and eastern Colorado. Water quality across the High Plains region is created by complex interactions between natural geology, agriculture, and climate. The quality of this resource is fundamental for irrigation, livestock, and domestic use, making the monitoring of water resources throughout the area crucial. This research will analyze the chemical composition of both groundwater and surface water samples collected from accessible land and participating landowners throughout the region. Field measurements, including pH and ORP, were taken on-site, and laboratory testing conducted for sixteen chemical parameters, including alkalinity, arsenic, lead, nitrate, and others. Preliminary results indicate that most samples fall within expected water quality ranges, though localized spikes in nitrate, lead, and arsenic warrant further investigation. Ongoing analysis aims to refine these findings to create a map of changing water quality parameters across the entire region of study, and promote broader participation in water testing to support sustainable resource management.

This study, conducted by Fort Hays State University faculty and graduate students, aims to analyze water quality through systematic sampling and analysis of wells, ponds, and streams across the region. Each sample is analyzed for a suite of eighteen parameters, such as arsenic, lead, nitrate, etc. By combining laboratory results with spatial data, this project seeks to identify regional patterns, establish a foundation for future monitoring efforts, and provide participating landowners with clear, accessible information about their own water quality.

Figure 1. Hach magnesium content test vial

Field Collection Methods

Water samples were gathered from groundwater and surface water sites across western Kansas and nearby regions. Landowners were contacted to obtain access and identify sampling locations. Surface samples were collected in 500 mL bottles, typically from the center or most active part of streams. Groundwater was drawn from wells or pumps, with pumps run for 2 to 5 minutes to flush the pipes before collection. pH and oxidation reduction potential (ORP) were measured in the field using Hach probes connected to an HQ Series meter. Samples were stored and transported to Fort Hays State University for testing within 24–48 hours of collection. Sampling locations are shown on the accompanying map, with blue markers representing surface water, red markers denoting groundwater, and orange markers designating retested sites.

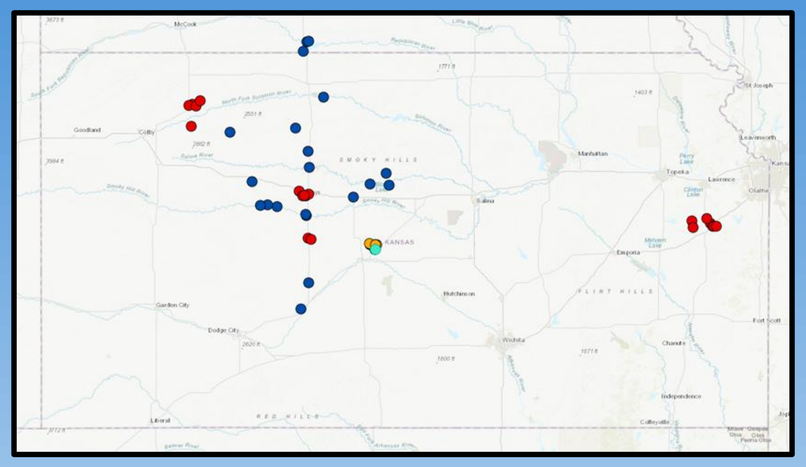

Figure 2. Map of current collection sites. Blue dots denote surface water samples, red dots denote groundwater samples, and orange dots denote resampled sites.

Lab Analysis Methods

Each sample was analyzed for eighteen water quality parameters, including alkalinity, aluminum, ammonia, arsenic, cadmium, chlorine, chromium, copper, iron, lead, magnesium, nickel, nitrate, pH, ORP, phosphorus, sulfate, and total nitrogen. Testing followed Hach protocols using the DR 3900 spectrophotometer (Figure 3), the DRB 200 digestion block (Figure 4), and a dedicated arsenic test kit. Work was performed in small teams under faculty supervision, following all safety procedures and ensuring proper equipment calibration and cleaning between samples to maintain accuracy and prevent contamination.

Figure 3. Hach DRB 3900 spectrophotometer

Figure 4. Hach DRB 200 heating block

Results

A total of 46 water samples were collected across the study region, representing a mix of both groundwater and surface water sources. Of these, 26 samples were obtained from streams, ponds, and other surface waters, while 20 samples were collected from wells and pumping systems. Additionally, five sites were revisited and retested to evaluate temporal consistency and verify laboratory accuracy. Full analysis is still pending, but an example of future data analysis is shown below in Figure 5, with water quality displayed with a blue 3D bar at the area of collection.

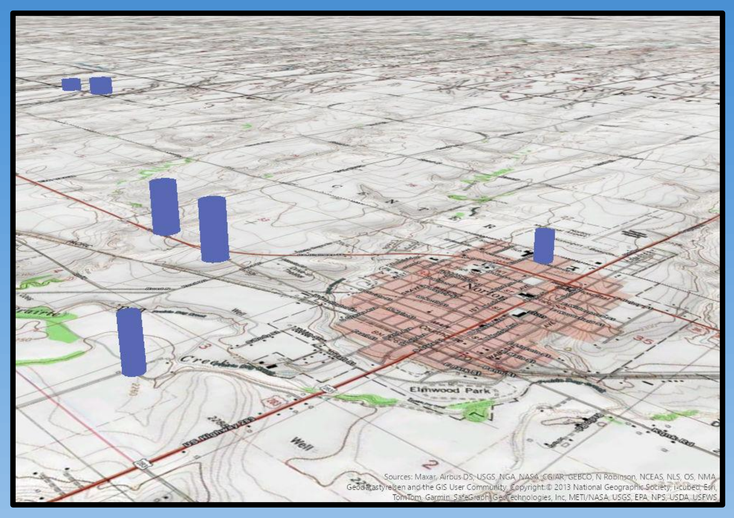

Figure 5. Example of 3D water hardness analysis collected near the city of Norton. Water hardness level is displayed with a 3D blue bar at the collection site.

Discussion

The project is ongoing, with 46 out of 100 samples collected, and full analysis still in progress. Most samples fall within expected chemical ranges, indicating generally stable water quality across the region. However, some results show idiocrasies at this preliminary stage. Cadmium levels remain consistently low, while lead concentrations are higher than ideal, particularly in surface water, where they can more than double the levels seen in groundwater. Arsenic typically measures below 10 ppb but occasionally exceeds 70 ppb in surface samples, often coinciding with elevated levels of lead. Field and laboratory work have established several best practices used in the study. Routes are planned in advance with backup sites to ensure consistent sampling, and time management is prioritized since testing must occur within 24–48 hours. Flexibility in the field allows for efficient adaptation to changing conditions, while standardized testing procedures ensure accuracy and repeatability in a set time frame. Clear communication among team members remains essential to all of these factors.

References/Acknowledgments

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