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University students help reduce nitrate levels at Kansas site

Kansas State University students are helping protect the environment and reduce public health risks.

Students across academic disciplines will monitor a two-acre site in Sylvan Grove in north central Kansas after former students cleaned nitrate contamination from soil and groundwater. They characterized the extent of contamination and developed remediation plans.

Students in agronomy, biology, engineering, geography and geology joined forces as part of course projects in Water Resource Geochemistry, or GEOL 711; Introduction to Geochemistry, or GEOL 605; and Natural Resources and Environmental Sciences Capstone, or DAS/DEN/GENAG 582.

"We found high levels of nitrate, which is commonly used in fertilizer," said Nathan Nelson, associate professor of agronomy. "Nitrate supplies an essential nutrient -- nitrogen -- to plants and is important for food production, but too much nitrate in water can have an adverse effect on humans, animals and the environment."

High nitrate levels in drinking water can cause methemoglobinemia, a potentially fatal blood disorder in infants younger than six months. Commonly called blue baby syndrome, the disorder limits how much oxygen infants pass through their blood. Rain can leach nitrates from soil to groundwater.

It's unclear how the Sylvan Grove site became contaminated. The site, which houses a grain elevator today, once stored dry and liquid fertilizer. Manure from local feed yards also produces nitrate, which can contaminate the groundwater.

Students worked with environmental lawyer Chris Steincamp, a Kansas State University geology alumnus; landowners; and officials from the Kansas Department of Health and Environment to characterize contamination on the site, identify potential sources of contamination and develop a plan to clean the site.

"Students followed the professional standards of a real government agency," said Saugata Datta, associate professor of geology. "They worked with clients and state officials to complete a successful project in a limited amount of time. The rate of turnaround by our students was simply amazing during this exciting, hands-on experience."

Geology students, under the direction of Datta, performed the latest water isotope analysis to track the possible sources of nitrates at the Sylvan Grove site.

Students collected soil and groundwater samples, determining that the best method to clean the site would be through phytoremediation, which uses plants to remove contaminants and reduce their mobility. They recommended removal of the most highly contaminated soil for use as a fertilizer on nearby cropland. Native grasses and trees helped remove remaining nitrate.

"Students selected grass and tree species that need a lot of nitrogen and water," Nelson said. "This protects the groundwater by removing nitrate and by reducing the amount of water that can leach nitrate out of the soil."

The Kansas Department of Health and Environment approved a remediation alternative that students recently implemented.

"It's exciting to see the students' ideas taking shape on the landscape and improve the Kansas environment," Nelson said. "It's not often that students get to participate in a project that has such real impact."

Nelson and Datta said they received positive reviews about the project from students.

"Students found the project difficult and complex because they had to work within real-world constraints," Nelson said, "but they enjoyed the challenge and they're often highlighting this experience on their resumes. They had an opportunity to show leadership, work together and get results."

The Kansas Department of Health and Environment and the Wichita-based law firm of Depew Gillen Rathbun & McInteer provided project and student support.