Kansas Water Research Institute

December 2018 Newsletter

Your water...

...our focus

The Kansas Water Resources Institute (KWRI) develops and supports research on high-priority water resource problems as defined by the Kansas state water plan. KWRI is designed to facilitate effective communication between water resources professionals and to foster the dissemination and application of research results.

The projects we fund represent key issues affecting Kansas water quality and water resources. These projects have diverse and wide-ranging subjects, including studies on the efficacy of new irrigation technologies, studies on river morphology, drought assessment tools, or water quality assessments. Current KWRI projects, which will wrap up in 2021, include a study on stochastic forecasting of harmful algae blooms in Cheney Reservoir; the evaluation of geomorphological adjustment of a meandering, alluvial river subject to streambank stabilization structures; a determination if riparian buffer strip age impacts phosphorus retention potential; an investigation about nutrient forms and if they control harmful algal bloom toxin release; and an Unmanned Aircraft Systems (UAS) assessment of the effectiveness of streambank stabilization projects on the Cottonwood River.

Although research on these projects is still ongoing, this newsletter includes summaries of KWRI projects that have just come to an end. Take a moment to read about this important research that answers key questions about water issues for our state. If you would like additional information about any project, please contact us at KWRI for more information or email the project leader directly.

Want more information? Visit the online version of this newsletter at the KCARE website for publication links, project websites and more!

Team members from the K-State Climatic and Hydrologic Extremes Lab measure the sediment layer thickness using a penetrometer rod.

Examining sedimentation and water quality of small impoundments: Sediment capturing opportunity upstream of federal reservoirs

The objectives of this project were to study the quantity and quality of sediment as well as the infill and water quality properties of farm ponds in the Delaware River Basin in eastern Kansas. In the selected ponds, the team analyzed the impacts of various watershed and pond characteristics and climate conditions on sediment quantity and sediment and water quality. This led to the identification of a list of 25 potential contributing factors on sediment accumulation rate in the ponds including catchment shape, slope, soil properties, and extreme precipitation events. It was determined that slope, catchment shape, and soil texture contributed the most to sediment accumulation in the farm ponds.

These small impoundments, by capturing and releasing sediment and water during drought and flooding events, impact the availability and accessibility of water downstream of the watersheds – particularly in much larger reservoirs. Results of this study will help water managers understand the opportunity provided by small impoundments for long-term management of watersheds and improve water sustainability. The goal of the study is to improve the state's understanding of watershed-wide sedimentation processes in order to facilitate the development and optimization of sediment control strategies that will help prolong the life and services of our small impoundments and large reservoirs.

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Monitoring the Effectiveness of Streambank Stabilization Projects in Northeast Kansas

Streambank stabilization projects represent a key element in the plan to reduce sediment in Kansas waterways and reservoirs. In this project, investigators worked to quantify the environmental benefits of government-sponsored streambank stabilization and restoration projects in northeastern Kansas, with a special focus on sites within the Kickapoo Tribe in Kansas and Prairie Band Potawatomi Nation Indian Reservations.

For this project, researchers inserted a set of bank pins above stabilized and unstabilized reaches at both sites and monitored those sites for erosion in order to document erosion and deposition rates. In addition to the monitoring, they partnered with Haskell Indian National University students to conduct macroinvertebrate sampling on the Kickapoo sites to conduct bio-assessment surveys documenting aquatic organism presence at stabilized sites, as compared to nearby unstabilized reaches. This project also compared the performance of cedar revetments to rock vein and weir stabilization projects.

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Quantifying Ephemeral Gully Erosion and Evaluating Mitigation Strategies with Field Monitoring and Computer Modeling

Soil erosion causes severe soil degradation and significantly contributes to soil loss in agricultural fields, with some producers losing substantial amounts of arable land each season.

To combat this soil loss, it is important to understand the mechanisms related to ephemeral gully formation and location, as well as the geomorphological properties related to storm characteristics. This three-year project focused on these goals, as well the quantification of soil loss in Kansas resulting from ephemeral gully erosion.

In the first and second years of the project, investigators established field measurements and collected continuous and survey data for three gullies. In the project's second year, they also developed a framework for an integrated channel erosion model and tested it on a collection of rainfall events applied to the studied gullies. In the project's final year, the computer model was applied to more rainfall and runoff events specific to gully developments between selected consecutive surveys.

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Assessing the impact of constructed wetlands on nitrogen transformation and release from tile outlet terraces in Kansas

This project focused on the influence of tile outlet terrace (TOT) croplands on nitrogen and sediment fluxes. Specifically, researchers concentrated on three TOT fields, where the tiles drained to constructed wetlands.

In this course of the research, investigators measured water fluxes and water chemistry into and out of the wetlands during wet weather periods. Rainfall, water velocity and water levels were measured continuously. Automated samplers assessed water chemistry during storm events, and grab samples were collected weekly/biweekly from within the wetlands in order to understand wetland water chemistry variability. During the final year of the project, researchers continued collecting water samples and soil water in fields using lysimeters. They also completed a bulk chemical analysis of soil. These data were used together to separate storm hydrographs to event and pre-event water, to determine the sources and interactions of pre-event water and to develop a conceptual model of nitrogen transformation and flux for TOT systems.

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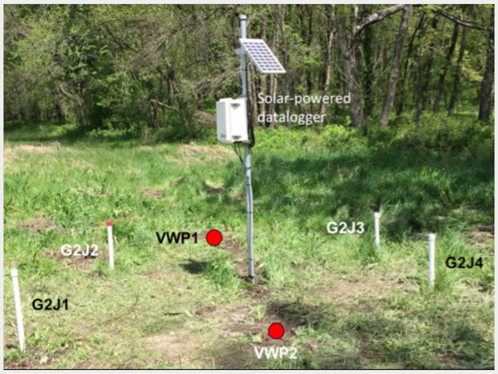
Governor's water conference

The fifth statewide "Governor's Conference on the Future of Water in Kansas" was held on November 8-9, 2017 in Manhattan, Kansas. The conference was highly successful with 691 people registered and attending. Attending the conference was the Governor of Kansas, Sam Brownback, and several state and national senators and representatives. The conference also included 35 volunteer scientific and four invited presentations, presented in plenary and concurrent sessions. Participants had opportunities to attend four panel discussions. In the scientific poster session, there were eight faculty/staff/professional scientific posters and 33 student posters presented. A student poster award program was conducted to encourage student participation.

Contaminant barriers or pathways? Hydraulic and chemical methods to improve characterization of shallow aquitards



The field instrumentation of aquitard characterization at a Kansas Geological Survey field site in the Kansas River valley.

Shallow aquifers are heavily used for drinking water and irrigation. These aquifers are often part of multi-layered systems where confining layers, also known as aquitards, can "isolate" an aquifer from poorer quality waters that can lie either above or below them. The aquitard's capability to isolate is estimated using the vertical component of hydraulic conductivity (K). Accurate estimates of vertical K are needed when it comes to protecting groundwater used for human supply.

This project investigated different methods, both hydraulic and chemical, to estimate the vertical K of an aquitard in the field. The key questions commonly faced by practicing hydrogeologists are what method is the most appropriate for a particular application, and how much uncertainty is associated with the method selected. To answer these questions, the research team tested two common approaches for aquitard K characterization at a Kansas Geological Survey field site. The first was a chemical method based on porewater concentrations at different depth intervals; the second was a hydraulic method based on the monitored pressure at different depth intervals in response to well constructions and water level fluctuations in the underlying aquifers.

Preliminary results indicated that as aquitard K distribution is heterogeneous, the chemical method provides a vertical K estimate that is only representative of the conditions in the immediate vicinity of sampling location, while the hydraulic method provides a larger spatial average of K that may include higher-permeability pathways at some distances.

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