Kansas Water Resources Institute
Kansas State University Research and Extension

Annual Technical Report
2018

General Information

Products

Moorberg, C., ed. 2019. Soil and Water Conservation: An Annotated Bibliography. Manhattan, KS: New Prairie Press. https://kstatelibraries.pressbooks.pub/soilandwater/.
Moorberg, C.J., A. Aubert, R. Burns, M. Brungardt, E. Carver, I. Euler, B. Hogan, M. Owens, A. Paddock, L. Starr, D. Stich, M. Tynon, C. Weber, and A. Williams. 2019. Chapter 4 - Soil Conservation Practices. In: Moorberg, C.J, ed. 2019. Soil and Water Conservation: An Annotated Bibliography. Manhattan, KS: New Prairie Press.
Benitez Nassar, D. and C.J. Barden. 2018. Monitoring the Effectiveness of Streambank Stabilization Projects in NE Kansas. In Proc. (abstract) Kansas Natural Resources Conference, Manhattan, KS. p. 13.
Karimov, V.R. (2017) Mathematical Modeling of Ephemeral Gully Erosion, PhD Dissertation. Kansas State University. Manhattan, KS. 193 p. http://hdl.handle.net/2097/38230

Information Transfer Program

The KWRI maintains a website that is used to transfer project results, inform the public on water issues and contact scientists with grant opportunities. An annual newsletter is prepared and posted on the website. News and updates are also sent to followers via a twitter account.

KWRI supported the Governor's Water Conference which is held each November. Approximately 700 people attend the conference including legislators, researchers, NGOs, small town representatives and farmers.

University Teaching Outreach and Classes:
BAE 869: Advanced Watershed Modeling. A presentation and a class project in Spring 2018.
NRES 582 Capstone Project: A field trip to Marion County Lake to evaluate lake algae condition.
AGRON 635: A field trip that was based off the research methods used for riparian buffer strip research project in the fall of 2018. Another is planned for the fall of 2019.
AGRON 405: Agronomy Internship, three internship posters were presented by students.

Conference Presentations:
Streambank Stabilization Effectiveness in the Cottonwood/Neosho River Basin. Governor's Water Conference, 2018.
Large-scale harmful algal bloom experiments at the University of Kansas Field Station. Governor's Water Conference, 2018.

Conference Posters:
Evaluation of the reach-scale effects of streambank stabilization structures on the Cottonwood River, Kansas. Governor's Water Conference, 2018.
Can glacial rock flour be used to reduce algal biomass in large-scale mesocosms? Great Plains Limnology Conference, 2018.
How do nitrogen form and ratio affect nitrogen fixation rates in experimental mesocosms? Great Plains Limnology Conference, 2018.

Student Support

8 Undergraduate
3 Graduate
1 Post Doc

Notable Achievements and Awards

Governor's Water Conference Poster Winners:

1st Place Undergraduate Student
Madison Foster
School: University of Kansas
Poster title: Potential for Subsurface Drip Irrigation to Influence Greenhouse Gas Emissions from Irrigated Systems

1st Place Graduate Student
Mohammadamin Ezazi
School: University of Kansas
Poster title: Polyacrylamide for water purification and separation of liquid mixtures

Runner ups (2)
Callie Dallimore
School: Emporia State University
Poster title: Metal concentrations in flood-prone sediments of Tar Creek near Miami, Oklahoma

Kelsey McDonough
School: Kansas State University
Poster title: Declining soil moisture threatens water availability in the U.S. Great Plains

Projects

2018 Governor's Water Conference

Project Type: Annual Base Grant **Project ID:** 2018KS193B

Project Impact: The sixth statewide Kansas "Governor's Conference on the Future of Water in Kansas Conference" was held on November 13-14, 2018 in Manhattan, Kansas. The conference was highly successful with nearly 700 people registered and attending. Attending the conference was the Lt. Governor of Kansas, Tracey Mann, and several state and national senators and representatives. The Governor fully supports this conference and has expressed her concern about the issue of preserving and protecting the future viability of water in Kansas. Fifty-four volunteer scientific, four panel discussions and six invited presentations were presented in plenary and concurrent sessions. Six Faculty/Staff/Professional scientific posters, twenty-one graduate student posters and eleven undergraduate posters were presented during the poster session. An undergraduate/graduate student poster award program was conducted to encourage student participation. The conference will be held again on November 7-8, 2019 in Wichita, Kansas. The conference website is located at: https://kwo.ks.gov/news-events/governor's-water-conference#39;s-water-conference

Assessing the effectiveness of streambank stabilization projects on the Cottonwood River using Unmanned Aircraft Systems (drones)

Project Type: Annual Base Grant **Project ID:** 2018KS198B

Project Impact: (1) Multiple UAS flight tests were performed at one stabilized streambank site to determine the appropriate number and location of ground control points (GCPs) needed to generate accurate 3D models of streambanks from UAS surveys. It was found that at least three GCPs installed at the top of each stabilized streambank would be sufficient for generating accurate 3D models. It was also found that vegetation provided a significant source of error in the 3D models and therefore flight surveys conducted in the fall/winter (i.e., leaf-off conditions) would provide the most accurate baseline datasets. (2) Multiple KHawk UAS flight tests were performed for aerial ortho-photo collection. (3) UAS generated orthorectified aerial maps were compared with satellite imagery. (4) ublox RTK GPS and RTK2 GPS ground tests and position error quantification were performed. (5) Multiple UAS flight surveys were conducted in the fall/winter on the Cottonwood River. Eleven reaches were surveyed and included (1) proposed construction sites C102 and C112, (2) 17 constructed sites (C2, C3, C4, C5, C7, C9, C10, C11, C12, C13, C14, C15, C18, C62, N28, N30, and N34) and (3) four KBS/KU-CE natural survey sites (C Nat 6, C Nat 1, C Nat 25, N Nat 27). These datasets provide the baseline data needed to assess the effectiveness of stabilization projects on the Cottonwood River.

Determining if Riparian Buffer Strip Age Impacts Phosphorus Retention Potential

Project Type: Annual Base Grant **Project ID:** 2018KS196B

Project Impact: The field work and sample collection of this project is complete. In total, 24 riparian buffer strips were surveyed and sampled along the Little Blue, Big Blue, and Republican Rivers in the summers of 2018 and 2019. At each site, three transects were set up extending across the buffer strip from the streambank towards the crop field. A streambank stability assessment was performed at each transect, along with a plant survey. Five sampling points for soil samples were established for each buffer strip, including one at the slope break, one at the field edge, one in the field, and two in the buffer strip between the slope break and field edge. Each sampling point was sampled for soil phosphorus samples at 0-15 cm, and 15-60 cm depths, and sampled for bulk density at the surface. Samples are currently being submitted to the K-State Soil Testing Lab for analysis. Other data from the field work will be analyzed in conjunction with the soil sample data once that analysis is complete. No preliminary data analysis is available at this time.

Does nutrient form control harmful algal bloom (HAB) toxin release?

Project Type: Annual Base Grant **Project ID:** 2018KS197B

Project Impact: Cyanobacterial blooms are capable of producing harmful toxic metabolites; however, the causes of cyanobacterial blooms and cyanotoxin production are yet to be fully elucidated. We experimentally tested the affects of different nutrient limitation regimes (nitrogen-N and phosphorus-P) and nutrient forms (nitrate -NO3 and ammonia-NH3) on phytoplankton community composition and cyanotoxin concentrations in 18 large-scale (11m3) mesocosms inoculated with Milford reservoir water at the University of Kansas Field Station for 21 days in 2018. Mesocosms were fertilized with one of six nutrient treatments: (1) ambient conditions (control), (2) nitrate, (3) nitrate and phosphorus, (4) ammonium, (5) ammonium and phosphorus, and (6) phosphorus, to simulate N- and P- limited nutrient loading using chemically oxidized (nitrate) and reduced (ammonia) nitrogen forms. Mesocosms where only N was added were P-limited; mesocosms were P was added (or N and P) were N-limited. Preliminary results indicate that nutrient loading amendments were successful at creating substantially different nutrient regimes in the large-scale mesocosms. After initial amendments, P-limited and control mesocosms had an average TN:TP ratio >30 whereas N-limited mesocosms averaged

Evaluation of the geomorphological adjustment of a meandering, alluvial river

Project Type: Annual Base Grant **Project ID:** 2018KS195B

Project Impact: The primary objective of this study is to measure the short-term, reach-scale impacts of streambank stabilization projects on a meandering, alluvial river of Kansas that outlets into a federally owned reservoir. More specifically, the research team aims to test the following hypotheses through data collected for this project: Streambank stabilization projects utilizing rock (1) decrease sediment input from streambank erosion at the stabilized site but (2) increase sediment transport capacity along the site, resulting in localized bed scour, upstream channel degradation, and accelerated streambank erosion upstream of the project, and (3) induce aggradation and accelerated streambank erosion downstream of the stabilized streambank. In the first year of this project, the team has completed the following tasks and activities needed to address these hypotheses. • Study reach selection: Two study reaches were selected on the Cottonwood River near Plymouth (C102 and C112), upstream of John Redmond Reservoir. • Preconstruction surveys were completed: Stream surveys were completed using a total station to characterize study reaches prior to SBS installation. • Soil borings were completed to characterize geotechnical properties of streambank materials. Three electrical conductivity (EC) profiles were obtained at site C102 using a GeoProbe direct push machine. • Preliminary hydraulic models have been developed. Preliminary HEC-RAS modelling has been performed to estimate boundary shear stress exerted by the flow at site C112. • Knowledge dissemination. A poster providing an overview of this research and its aims was presented at the Kansas Water Conference in Fall 2018.

Stochastic Forecasting of Harmful Algae Blooms in Cheney Reservoir

Project Type: Annual Base Grant **Project ID:** 2018KS194B

Project Impact: Cyanobacterial Harmful Algal Blooms (CyanoHAB) are considered one of the threatening issues for fresh water ecology across the world. Periodic blooms in larger reservoirs such as Cheney Lake have potential to produce toxins and taste-and-odor compounds that may cause substantial economic, public health, and environmental concerns in the United States. Predictive tools are needed to better manage CyanoHAB outbreaks; this includes predictive simulation models, fine-scale remote sensing data, and bacteria detection floating devices. During the reporting period, two tasks were completed. First, a comprehensive watershed model for Cheney lake watershed was developed and calibrated. The model was able to predict inflows and influent nutrient concentrations in the lake with good statistical certainty. Second, we conducted correlation analysis of cyanobacteria concentration against environmental parameters (e.g. temperature, nutrients, turbidity, DO, irradiation, discharge) based on multiyear sub-daily USGS dataset from Cheney Reservoir, Kansas. As planned, we began developing a mechanistic modeling framework considering watershed modeling of contributing catchment, process-based modeling of cyanobacteria growth in a lake, and rapid lake assessment. A non-linear dynamic cyanobacteria growth model included physical factors of phosphorus and nitrogen concentrations, temperature, and irradiation as well as biological interactions of bacteria growth and decay rate. A watershed model was used to generate influent discharge, TSS, and nutrient concentrations to the lake. When developed in the next reporting period, this forecasting tool linking with climate and reservoir watershed model would help to conceptualize future CyanoHAB prevention strategies, and its relation with climatic change, watershed condition, and nutrient abundance in the lake.