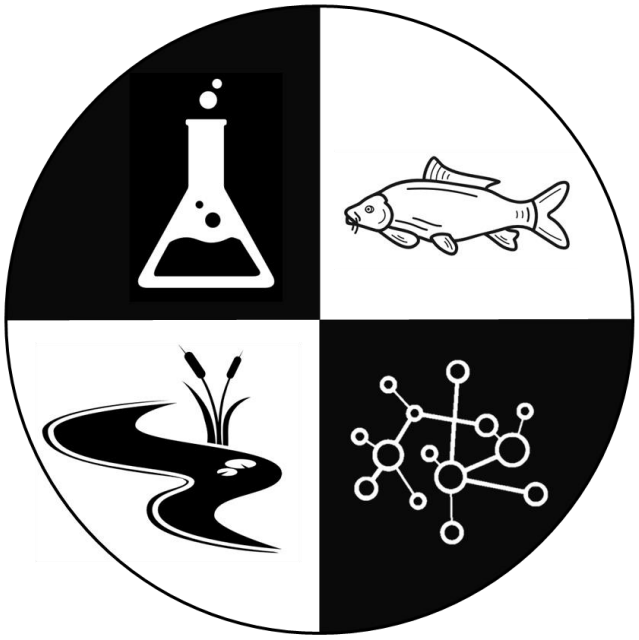
2019

GREAT PLAINS LIMNOLOGY CONFERENCE



18 – 19 OCTOBER

IOWA STATE UNIVERSITY
AMES, IOWA

Oral Session I: 11:00 – 12:00 PM

Room A – Communities and Stability
Room B – Aquatic Organisms
Room C – Monitoring Algal Blooms

Oral Session II: 1:15 – 2:15 PM

Room A – Food Webs & Connectivity
Room B – Biogeochemical Cycling
Room C – Understanding Algal Blooms

Oral Session III: 3:00 – 4:00 PM

Room A – Conservation & Management
Room B – Spatial & Temporal Scales

Poster Session II: 2:15 – 3:15 PM

Poster Session I: 12:30 – 1:15 PM

Oral Presentations
Session I: 11:00 – 12:00

Room A – Communities and Stability

Understanding intra-lake seasonal and spatial variability in shallow prairie lake diatom communities: implications for paleolimnological studies

Kui Hu, Jon N. Sweetman, David M. Mushet

In temperate lakes/wetlands, seasonality is a major characteristic of freshwater ecosystem dynamics. The seasonal occurrence of organisms is influenced by changing environmental conditions throughout the year. In this study, we assess the main environmental variables that affect diatom community seasonal change, and whether there is a high similarity for the distribution of biotic communities over spatial scales at both local (within pond) and regional scale (among ponds) at the Cottonwood Lake Study Area (CLSA), North Dakota.

Regional vs. local controls on community structure across a broad climate gradient

Daniel Nelson, Daniel C. Allen, Darin A. Kopp

Environmental factors at multiple scales contribute to the organization of local communities. However, the relative importance of local vs. regional scale factors influencing community structure remains largely unstudied. In this study, we used a multi-scale approach to examine the relative influences of spatial, local, and regional scale environmental factors in determining stream macroinvertebrate community structure. We sampled 16 streams across six ecoregions for macroinvertebrates and measured environmental variables from local and regional scales to determine the importance of these factors.

Seasonal turnover in small Oklahoma reservoirs

Rachel Hartnett

We are seeking to better characterize seasonal turnover in small Oklahoma reservoirs for algae and zooplankton, as well as determine drivers for the rate of turnover. Our study consisted of four old/young pairs of small OK reservoirs, which were sampled over the growing season to get a better understanding of the dynamics between diversity, turnover, and productivity. In addition, we will determine if the rates of turnover differ in old vs young reservoirs, and if this rate promote stability (synchrony between algae and zooplankton). Preliminary data on environmental parameters and water chemistry will be presented.

Does food web structure mediate ecosystem response to perturbations? A preliminary experiment

Tyler Butts, Elena Sandry, Michael Weber, Grace Wilkinson

Human activity has led to increased stress on ecosystems that often results in a regime shift to an undesirable state. The level of resilience between states can be influenced by food web structure. For example, bigmouth buffalo (BMB), a large planktivore, can reach high densities and negatively affect ecosystem function in shallow lakes making harvest of BMB a restoration strategy. We measured ecosystem response to a nutrient pulse in six experimental ponds that contained three treatments of BMB density: no fish, post-harvest, and ambient densities. We found that ecosystem resilience to a nutrient pulse was proportional to BMB density.

Oral Presentations
Session I: 11:00 – 12:00

Room B – Aquatic Organisms

Stomach content analysis of the Mudpuppy (Necturus maculosus) in Kansas

Jennifer Buchanan, Alexis Powell, Lynnette Sievert

The Mudpuppy (*Necturus maculosus*) is an elusive and poorly understood permanently aquatic salamander in the eastern United States. Little has been published on its natural history in Kansas and baseline data are needed to assess its status and to inform conservation efforts. Our goal is to examine the trophic role and community interactions of the Mudpuppy through examination of its diet. We obtained the stomach contents of 151 individuals with a non-lethal flushing protocol. We found dietary differences between lake and river populations but not between seasons. The data suggest that mudpuppies are more opportunistic than they are selective foragers.

Odonate communities in Ozark springs respond strongly across a steep riparian gradient

Cameron Cheri, Deb Finn

Odonata are often characterized as tolerant to poor instream water quality but have been shown to respond to structural and compositional characteristics of aquatic and riparian flora. Our objective was to evaluate whether odonate communities respond more strongly to riparian conditions than general benthic communities examined from standard sampling methods. We addressed our objective with community data collected from 12 Ozark springs along a steep gradient of riparian conditions. Results support that odonate communities better characterize the state of Ozark spring riparian zones than general benthic communities. We subsequently propose a new odonate-specific biomonitoring metric for assessing stream riparian zones.

Testing Janzen's mountain passes theory through analyses of thermal breadth in livebearing fishes of the genus Limia (Teleostei, Poeciliidae) in the Antille

Rodet Rodriguez Silva, Ingo Schlupp

Janzen's (1976) mountain passes hypothesis states that due the low overlap in temperature regimes between low and high elevations in the tropics, organisms living in high-altitude evolve narrow tolerance for colder temperatures while low-altitude species develop narrow tolerance for warmer temperatures. We assessed variation in tolerance to extreme temperatures (measured as critical thermal minimum (CT_{min}) and maximum (CT_{max})) and also compared thermal breadth for eight species of livebearing fishes of the genus *Limia* occurring in three Caribbean islands and that occupy different altitudinal distribution. This study did not provide evidence supporting Janzen's theory since thermal tolerance and altitudinal distribution of *Limia* species in the Caribbean were not related to temperature gradients expected in nature.

Oral Presentations

Session I: 11:00 – 12:00

Room C – Monitoring Algal Blooms

The Swan Lake story: regime shift prediction and detection in both space and time

David Ortiz, Jason Palmer, Grace Wilkinson

Regime shifts, such as dominance of algal blooms, exhibit statistical early warning indicators (EWIs), but this predictive method has only been evaluated in oligotrophic lakes under experimental conditions. While important, this body of literature is not applicable to the common lake classification found in the great plains; shallow and hypereutrophic. Using high frequency data, we have demonstrated that temporal EWIs can be detected in a shallow hypereutrophic lake up to two weeks in advance. In addition to detecting EWIs temporally, we also provide evidence of detecting regime shifts and EWIs using a weekly sampling scheme across a 65 meter grid.

Implementing an intensive monitoring program to better understand the causes and impacts of HABs in a large, subtropical reservoir

Bill Mausbach, Matthew Conrad, Dustin Browning, and Stephen Nikolai

HABs can be challenging to predict and monitor in large reservoirs due to their abrupt occurrences and sometimes rapid dissipation. Grand Lake, Oklahoma has episodic HABs that are often isolated to certain areas of the lake; however, the factors causing these blooms are unclear. We have developed an intensive monitoring program to capture pre-bloom, during-bloom, and post-bloom environmental conditions in this cove to better predict when and where HABs will form and their severity.

Harmful algal bloom monitoring using multispectral imagery in tandem with chlorophyll-a/microcystin regression to map microcystin variability in Iowa

Sarah Douglas, Gregory LeFevre, Corey Markfort

Harmful algal blooms contain cyanobacteria that release cyanotoxins into the water, which negatively impact human and ecosystem health. Weekly microcystin screenings occur at 36 of Iowa's state beaches, but the current method is ineffective for mapping the spatial distribution of toxins. To overcome this challenge, we captured multispectral imagery at low altitudes with a drone, in tandem with improving pigment/toxin correlations. Chlorophyll-a and microcystin concentrations were recorded throughout the summer to develop pigment/toxin correlations, including 19 of Iowa lakes. We conducted a case study at Green Valley Lake coupling the derived correlations with multispectral imagery to map microcystin concentrations.

Lake monitoring with multi-wavelength fluorescence: insight into phytoplankton community and their health

Tania Leung, Elizabeth Swanner

Cyanobacteria harmful algal blooms can produce microcystin, a toxin that harms human health. In this study, we adapted a multi-wavelength fluoremeter as a scalable tool to quickly monitor HABs and assess their photosynthetic yield (Fo/ Fv). We will discuss limitations including intra-taxa variations and high uncertainty associated with low chlorophyll a readings, and how to obtain reproducible estimates of phytoplankton measurements and identify those that are suspicious. Results provide insight on how overall health of HABs community relates to nutrients, such as iron.

Oral Presentations
Session II: 1:15 – 2:15

Room A – Food Webs & Connectivity

What can we learn from vegetation in a mining-contaminated river?
La Toya Kissoon-Charles, Jordan Heiman, Trang Tran, Madalyn Behlke-Entwisle, Robert Pavlowsky

Big River located in the Old Lead Belt mining district of southeast Missouri experienced large-scale contamination of channel sediment and floodplain soils. Sand and gravel bars in Big River are contaminated with lead and zinc. Many of these bars have vegetation which could play a role in the cycling of metals and provide a pathway from sediments to other levels of the food chain. We sampled vegetation on contaminated and non-contaminated gravel bars and analyzed the samples for lead and other metals. Vegetation on contaminated gravel bars had about 10-100 times higher metal concentrations compared to vegetation on non-contaminated bars.

Tracking changes in water quality following large scale biomanipulation of two fish species
Martin Simonson, Michael Weber

Fishes can impact the stable state of shallow lake ecosystems. Common carp have been described as ecosystem engineers that are associated with large-scale disturbances in physical, chemical, and biological properties in shallow aquatic systems. In contrast, bigmouth buffalo impacts on ecosystems are not well quantified but in high densities bigmouth buffalo may induce a trophic cascade by consuming zooplankton and releasing phytoplankton from grazing pressure. Changes in water quality and freshwater community assembly are examined relative to harvest in order to determine if biomanipulation of these two species induces a shift in alternative stable states.

The geography of traits that influence the duration and extent of aquatic insect subsidies in terrestrial ecosystems of the United States
Darin Kopp, Tom Neeson, Daniel Allen

When materials are transported across ecosystem boundaries by living animals, traits related to their movement and development could determine the magnitude and duration of allochothony. Using a national survey of benthic macroinvertebrate communities (n ~ 1,886), we ask how climate factors influence the composition of traits that couple aquatic and terrestrial ecosystems and whether these traits respond similarly to the same environmental gradient (i.e. watershed size) in different regions. Our results demonstrate that environmental factors drive differences in certain traits which could have consequences for aquatic-terrestrial linkages both among and within drainage basins.

What lurks beneath: illuminating biological pattern and process in the hyporheic underworld
Deb Finn, Nathan Dorff, David Fleshman

Out-of-sight and out-of-mind, the hyporheic zone (HZ) of streams is often neglected in research and management despite its strong potential to influence processes in greater stream/riparian ecosystems. We are assessing HZ invertebrate diversity, secondary production, and response to flow events in contrasting stream types. HZ diversity and production are substantial in Ozark streams with deep alluvial gravels but minimal in streams on Mount St. Helens that are still in early stages of channel evolution following the 1980 eruption. Ongoing work includes modeling both geomorphic controls on HZ development and contribution of HZ biomass to stream/riparian food webs.

Oral Presentations
Session II: 1:15 – 2:15

Room B – Biogeochemical Cycling

Physico-chemical characterization of an urban stream impacted by mine drainage
Jessican Wilson, Alba Argerich

The Tri-State Mining District encompassing portions of Missouri, Oklahoma, and Kansas, was the world's leading producer of lead and zinc for over 100 years. Legacy mining effects such as mine adits containing heavy metals are common throughout this region. This study explores the influence of alkaline mine drainage on basic water quality parameters and nutrient concentrations of phosphorus, nitrogen and carbon in a small headwater stream in the City of Joplin, Missouri. Preliminary findings indicate decreased oxygen and pH levels, low availability of phosphorus, elevated ammonium concentrations, and decreased dissolved organic carbon concentrations in the downstream reach receiving mine adit discharge.

Ecosystem metabolism and carbon fluxes from a restored tallgrass prairie stream
David Manning, Ashlee Dere, Andrew Miller, and Tracy Coleman

Glacier Creek Preserve (Omaha, NE, USA), encompasses a watershed with no-till agriculture and a 57-ha restored tallgrass prairie and that is drained by a perennial headwater stream. We monitored streamwater dissolved oxygen, turbidity, pH, and fluorescent dissolved organic matter (DOM) continuously for 2 years and estimated whole-stream metabolism and carbon (C) fluxes. Preliminary data suggest hydrologic pulses of DOM fuel respiration within the stream, but highest metabolic activity occurs seasonally. Average C fluxes were dominated by inorganic (69.7 kg C/d), vs. organic C (2.69 kg C/d). Future efforts will quantify watershed C pools and fluxes from soils to the stream.

Evaluating links between algal blooms and CO_2 and CH_4 fluxes in a eutrophic lake
Adam Rexroade, Emily Stanley

Due to its high radiative potential, methane production in relation to cyanobacteria blooms in lakes is of increasing concern. We measured methane and carbon dioxide fluxes in eutrophic Lake Mendota in Dane Country throughout summer 2019 to examine the relationship between cyanobacterial abundance and carbon dioxide and methane fluxes. Initial data suggests that on days with high cyanobacterial abundance, carbon dioxide emissions become very negative while methane emissions become very positive. This increase in methane emissions associated with cyanobacteria blooms, which are occurring more intensely and more regularly, poses new risks and challenges regarding climate change when managing watersheds.

Nitrogen cycling and ecosystem metabolism in Kansas streams draining cropland vs. grassland watersheds
Kynser Wahwahsuck, Norma Snelding, Amy Burgin

Nitrogen cycling is well known in streams; however, we want to better understand how metabolism and nitrogen cycling are connected in streams affected by land use. In this study, we sampled two watersheds in eastern Kansas, grassland and cropland. To understand in-stream nitrogen processes and metabolism, we measured diel patterns of nitrate concentrations, dissolved oxygen, and nitrous oxide (N_2O) to estimate assimilation and denitrification. We asked: how does land use affect stream metabolism, nitrate and N_2O concentrations? We predict the grassland stream will have smaller changes in nitrate and N_2O concentrations due to overall lower N supplies to the stream.

Oral Presentations

Session II: 1:15 – 2:15

Room C – Understanding Algal Blooms

Effect of nutrient form and concentration on phytoplankton sedimentation

Abagael Pruitt, Janaye Hanschu, Amy Burgin

Midwestern lakes obtain high levels of nitrogen from agricultural runoff, often leading to toxin-producing harmful algal blooms. The phytoplankton in these blooms fall to the lake bottom in a process called sedimentation. This led us to the question: how do nutrient form and concentration affect phytoplankton sedimentation? To answer, we placed sediment traps in tanks filled with water from a eutrophic and a mesotrophic lake. We treated the mesocosms with differing forms and concentrations of nitrogen. The sediment traps were analyzed for total suspended solids, chlorophyll-a, and microcystin to understand phytoplankton and toxin sedimentation rates.

Iron demand in a diazotrophic cyanobacteria as a function of supply (N:P) stoichiometry

Yetkin Ipek, Punidan Jeyasingh

Nitrogen: Phosphorus supply alone does not adequately predict cyanobacterial Harmful Algal Blooms (cHABs). Iron (Fe) is used in N-fixation; and varies greatly among freshwater lakes. However, we know little about the role of Fe in affecting N-fixers. We grew *Anabaena* cylindrical in chemostats with different N:P and bioavailable Fe; and analyzed growth and elemental contents. We found that N limitation decreased growth rate. Importantly, changes in Fe availability impacted growth more in N limited, compared to balanced conditions (N:P= 16). These results indicate that attention to key trace metals such as Fe may be useful in honing predictions of cHABs.

Bizarro cyanotoxins: green reservoirs are not toxic

Rebecca North, D.V. Obrecht, A.P. Thorpe, K. Florea, R. Bhattacharya, E. Kinzinger, J. Gaskill, A. Argerich

Globally, lakes and reservoirs are getting greener and are predicted to become more toxic. We know that blooms like it hot- with a side of light and nutrients, therefore, we anticipate cyanotoxins in the summer in eutrophic reservoirs. Here, we challenge this assumption and ask- are hot spots and hot moments in cyanotoxin production happening in the cold? Cyanotoxins were measured on temporal gradients from biweekly during the summer to year-round, and on a diversity of reservoirs across the trophic range. We found no relationship between cyanotoxins and chlorophyll a. Implying, that our indicators of toxic reservoirs are failing us.

All Hands on Deck to #RehabHABs: A Place-Based, Project-Based (PBL^2) Learning Project

Cora Bartlett, Ryan Fullerton, Jacob Hanna, Aidan Leon, and Isaac Stanton

In an attempt to predict the occurrence of harmful algal blooms (HABs) in Cheney Reservoir, students of Maize High School conduct primary water quality sampling in partnership with the United States Geological Survey (USGS) and the University of Missouri's Reservoir Observer Student Scientists (ROSS) Project. USGS and primary-collected data is analyzed using the Concord Consortium's Common Online Data Analysis Platform (CODAP) and the EDDIE Project's R modules. Students will demonstrate their water sampling techniques, their primary and USGS data analyses, and the monetary and healthcare value of no-till and crop barrier agricultural practices to all stakeholders.

Oral Presentations
Session III: 3:00 – 4:00

Room A – Conservation & Management

Understanding how upgrading the Tomahawk Wastewater Treatment Facility affects Indian Creek sources of impairment, Indian Creek, KS
Jessica Wilhelm, Amy Burgin

Wastewater treatment facilities (WWTF) serve as a major point source of nutrients to streams and rivers, causing potential impairments to water quality. Indian Creek is one of the most urban drainage basins in Johnson County, Kansas, with both the Johnson County Douglas L. Smith Middle basin (MB) and Tomahawk Creek (TC) Wastewater Treatment Facilities discharging in to Indian Creek. In early Spring of 2019, the TC-WWTF went offline as construction began for a dual removal system. Our objective is to understand how cessation of WWTF inputs and upgrade of the new TC-WWTF affects the causes of impairment to Indian Creek.

Ex situ measurements of gross internal phosphorus loading for shallow lakes and reservoirs
Ellen Albright, Rachel Fleck, Grace Wilkinson

Internal phosphorus (P) loading varies across waterbodies; however, the underlying mechanisms are poorly-understood in shallow systems. Using ex situ sediment core incubations, we measured gross internal P loading rates for Iowa lakes. Profundal sediments incubated under anaerobic conditions produced the highest P release rates. Although sediments in the oxic treatment generally exhibited sediment P retention, several littoral cores released P. Both anaerobic and aerobic internal loading pathways are influential in shallow lakes. We observed considerable variability in sediment P release rates and treatment response within individual systems. Spatiotemporal variability must be considered in core incubation measurements and internal loading estimates.

How fluvial hydro-morphological manipulations in a eutrophicated stream improve self-purification capacity
Marta Tobella Sanmarti, Alba Argerich, Eugènia Martí, Francesc Sabater

Rivers have a natural capacity to transform and retain nutrient loads coming from their catchments. This capacity is the product of the interaction between chemical reactions, biological uptake, and hydraulic retention. This study focuses on identifying channel hydro-morphological manipulations that best improve fluvial nutrient retention. We selected three reaches of Cànoves stream (NE Spain) and we modified its channel morphology to alter hydraulic parameters. Our findings demonstrate that high hydraulic retention enhance phosphorous uptake, whereas ammonium uptake is enhanced by high velocity. These results can be useful for fluvial managers in charge of restoring eutrophic streams.

Planning for freshwater conservation in an uncertain climate: identifying projects that remain valuable and feasible across future climate scenarios
Sean Wineland, Rachel Fobargue, Thomas Neeson

Conservation actors make large investments to protect ecosystems from climate impacts, but, the ecological value and socio-political feasibility of proposed projects vary independently across climate scenarios. This makes identifying projects resilient to climate change difficult. We develop a conservation planning framework that jointly considers the ecological value and socio-political feasibility of candidate projects across climate scenarios and apply this framework to meeting instream flow targets across the Red River of the south-central USA. We find a subset of river reaches that are good candidates for conservation investments. Our framework could have broad applicability to other river basins and ecosystems worldwide.

Oral Presentations
Session III: 3:00 – 4:00

Room B – Spatial & Temporal Scales

Changes in stream water quality across an agriculture-urban gradient
Alba Argerich

Despite constituting a small fraction of the land use, urban areas have a disproportionate impact on water chemistry, hydrology, and stream habitat. However, because of the variety of stressors, these impacts are not always predictable. Here we examine how water chemistry changes across a stream network draining a mixed-use watershed across a range of streamflow conditions. Our results show that agriculture pollution signals show a strong seasonality, whereas urban pollution signals persevere across streamflow conditions and seasons.

Mesocosms, macrocosms, and whole ponds, oh my! The importance of scale in aquatic experiments - Ted Harris

Does experimental scale matter in aquatic experiments? Here, a brief review of temporal and spatial scales used in aquatic experiments – and the pros and cons of each - will be presented.
Additionally, prelim results from recent mesocosm and macrocosm experiments will be presented.

Beyond the trends: The need to incorporate multi-annual dynamics in a wavy world
Grace Wilkinson, Jonathan Walter, Rachel Fleck, Michael Pace

Inter-annual variability is a pervasive feature of aquatic ecosystems. This variability results from short-term and long-term dynamics of biotic and abiotic origin, overlaying multi-annual trends and oscillations. While understanding short-term variability and forecasting directional change are important research issues, far less attention has been paid to oscillatory, or wave-like dynamics, in aquatic ecosystems. We argue that understanding these modes of variability and their underlying causes are imperative for predicting future ecosystem trajectories. Fortunately, given the growing availability of multi-decadal data, development of statistical tools, and the urgent need to forecast change, we can readily adopt multi-annual dynamics into our understanding of aquatic ecosystems.

Existing river conceptual models are less relevant in the Anthropocene: towards a new ecohydrologic perspective that includes non-perennial river
Daniel Allen, T Datry, K Boersma, M Bogan, D Bruno, M Busch, K Costigan, W Dodds, K Fritz, S Godsey, J Jones, T Kaletova, S Kampf, M Mims, T M. Neeson, J Olden, A Pastor, NL Poff, B Ruddell, A Ruhi, G Singer, P Vezza, A Ward, M Zimmer

Conceptual frameworks comprise the foundation of river ecology, but have historically focused on perennial rivers (those that always flow). However, rivers that dry or cease to flow (intermittent rivers and ephemeral streams, IRES) occur worldwide and are becoming more prevalent due to climate change and human water abstractions. We review and synthesize 18 river conceptual frameworks to determine how well they describe IRES. We found these frameworks center on (1) 4-dimensionality at the local scale: longitudinal (upstream-downstream), lateral (channel-riparian-floodplain), vertical (surface water-groundwater), and temporal (variation in hydrologic flow over time); or (2) ecological processes and patterns at network and larger scales. We review how drying controls the biological organization of streams across these 4-dimensions at the local scale and across larger spatial scales. We call for a new perspective that focuses on drying as an important hydrologic process, particularly in our current era of rapid global change.

Poster Presentations

Session I: 12:30 – 1:15

1. ***Examining nutrient fluxes after a historic flood in Nebraska***

Alexa Davis, Jessica Corman

The historic March 2018 flooding in Nebraska presents an optimal opportunity to investigate how stream ecosystem resilience to extreme disturbances various by land use. The objective of this study is to assess stream ecosystem impacts, focusing on nutrient cycling changes from this major flood. The year prior to the flood we assessed nutrient cycling in 10 streams across Nebraska. Specifically looking at nutrients, this data is a proxy for pre flooding. The year following the flood we returned to the same sites implementing, the same protocol. Differentiating pre and post flood data will aid in determining which land use type is more adaptable to flooding.

3. ***Toxicity thresholds of tropical stream heterotrophs exposed to an organophosphate pesticide***

Caleb Klingseis, Christine Tominiko, and Carissa Ganong

Pesticides applied to banana and pineapple plantations are likely sources of pollution to nearby biological reserves, and macroinvertebrates and fish are potential bioindicators of agrochemical pollution. We quantified the threshold concentrations at which ethoprophos, a common organophosphate pesticide, impacts the behavior and survival of three common stream species (guppy *Priapichthys annectens*, mayfly *Traverella holzenthali*, and caddisfly *Leptonema sp.*) at La Selva Biological Station, Costa Rica. Survivorship decreased significantly with increasing pesticide concentration, with LC50 values of 15-30ug/L (macroinvertebrates) and 1530ug/L (*P. annectens*). These concentrations exceed ambient concentrations recorded in Costa Rican streams, but possible synergistic effects remain to be explored.

5. ***Intestinal morphology of Wabash River carp***

Emily Arsenault, Mark Pyron, Paul Derolf, Will Kesterson, James Thorp

Nonnative carps threaten freshwater food webs by altering habitat and outcompeting native species. To conduct a larger study on the intestinal microbiome of nonnative carps, we collected a total of 53 common carp, silver carp, and grass carp from 8 sites in the Wabash River main stem, tributaries, and floodplain lakes (Indiana and Illinois, USA). Here, I examine the intestinal morphology of these three carp species to determine how intestine length varies with body length, sex, and age, and to identify segments of the mid- and lower intestine appropriate for fecal microbiome sampling.

7. ***Less is more: primary production in Missouri reservoirs increases as phosphorus concentrations decrease***

Erin Petty, Daniel Obrecht, Rebecca North

Lakes and reservoirs play an important role in global carbon dynamics. With high primary productivity expected in small reservoirs, we explore gross primary production (GPP) in 27 Missouri reservoirs. The reservoirs, which span the trophic gradient, were sampled during summer stratification in 2018. We hypothesized GPP would vary across the trophic gradient, with hypereutrophic reservoirs being the most productive. Results showed that, regardless of trophic status, GPP ranged from 4.60–1,971.59 mol O2 (mg chla-1) m-1 day-1. Mean GPP, however, was 55 times higher in oligotrophic reservoirs than hypereutrophic reservoirs.

9. ***Native and invasive macrophyte degradation rates and implications for nutrient availability***
Halle Rosenboom, Quin Shingai, Grace Wilkinson

Macrophytes remove nutrients from the sediment and water and store them in tissues. Native species in the Midwest begin growing later in the spring, senescing in the fall. However, the invasive *Potamogeton crispus* grows early in the spring and senesces in July. We hypothesized that the invasive decomposes rapidly, releasing nutrients, potentially fueling algal blooms. We tested this hypothesis with decomposition experiments and found that the decomposition rate of *P. crispus* was 10x faster than the native species and that the macrophyte disappeared in <2 weeks. Given the large *P. crispus* beds in shallow lakes, their mid-summer senescence may supply nutrients that help fuel blooms.

11. ***Phytoplankton Response to Changes in Light: Can Glacial Rock Flour be used to Control Cyanobacterial Blooms?***
Jacob Gaskill, Ted Harris, Rebecca North

Light manipulation is an understudied strategy for managing cyanobacterial harmful algal blooms. Here, we added glacial rock flour (GRF), a fine particulate that remains suspended and floats on the water's surface, to 12,000L mesocosms. Our objective was to reduce cyanobacteria biomass through light reduction. After GRF addition, we observed a decline in cyanobacterial biovolume and a shift from communities where the greatest biovolume was cyanobacteria or chlorophyta, to communities where cryptophyta had the highest biovolume. Further experimentation should explore whether this community shift persists as this suggests that reducing light may control cyanobacterial blooms.

13. ***Spatial variability in equilibrium P release from sediments in a hypereutrophic reservoir***
Jenna Rasmusson, Ellen Albright, Rachel Fleck, Grace Wilkinson

The sediment equilibrium phosphorus concentration (EPC) is the point at which the phosphorus concentrations in the overly water column is balanced with the dissolution or sorption of loosely-bound phosphorus in the sediment. When phosphorus in the water column is lower than the EPC, the gradient drives loosely-bound phosphorus release from sediments. We performed an EPC assay of the sediments in Green Valley Lake, Iowa to determine if the sediments were a source or sink of loosely-bound phosphorus. The EPC in the lake was 83 µg/L, which was lower than water concentrations most of the summer indicating that the sediment was a sink for loosely-bound phosphorus.

15. ***Daphnia adaptation to changing phosphorus conditions***
Kayla Wernsing, Eric Moody, Cal Buelo, David Ortiz, Grace Wilkinson

Models have predicted that *Daphnia* should not exist in phosphorus-rich environments, but recent evidence has found they rapidly adapt to thrive. The question we attempted to answer was can a *Daphnia* population adapt to phosphorus-rich environments over a single summer? We tested this using *Daphnia* populations from a phosphorus fertilized and reference lake. We ran common garden experiments in differing phosphorus concentrations and compared the results from the two lakes. After a summer, *Daphnia* from the fertilized lake showed slight adaptation to high phosphorus concentrations in their mass specific growth rates (MSGR) but not fecundity.

17. ***How human recreation impacts nutrient chemistry and periphyton abundance in the Niobrara River***
Matthew Chen, Sydney Kimnach, Kayla Vondracek, Jessica Corman

The intent of this study was to determine the impact of human activity on the Niobrara river. We examined three representative reaches: areas surrounded by wildlife refuge ("no" impact), wildlife refuge with public access but alcohol restrictions ("low" impact), and private/public lands with no public use restrictions ("high" impact). Three methods were used to compare the three reaches: river chemistry, benthic periphyton biomass analysis, and nutrient diffusing substrata. Our results suggest no

strong relationship between human activity and ecosystem health. This indicates that the Niobrara is likely being managed well.

19. ***Effect of a multi-month volcanic eruption on macroinvertebrate communities and populations in high-elevation Ecuadorian streams***
Nicholas Coppock, Patricia Blankenship, Andrea Encalada, Henni Hampel, Deb Finn

It is a rare opportunity to study the ecological effects of a volcanic eruption with a BACI design. We collected macroinvertebrates quantitatively from nine streams (4,000m asl) across one active and one dormant glaciated Ecuadorian volcano both before and after the 2015 multi-month eruption of the active volcano, Cotopaxi. Just one of the nine streams showed substantial before/after differences, including effects at both community and population levels. The affected stream is glacier-fed with a large watershed size and was downwind of the eruption, suggesting that physical or chemical changes associated with ash deposition drove these impacts.

21. ***Reframing the microcystin problem: A biogeochemical cycling approach***
Quin Shingai, Adrianna Le Compte, Grace Wilkinson

Harmful algal blooms pose a serious threat to freshwater ecosystems and public health. As such, there is a strong interest in understanding when and where microcystin is present in the environment, including a focus on microcystin production, degradation, and pathways of human exposure. Despite the ubiquity of microcystin in the environment, the study of these dynamics has largely remained isolated to various disciplines. Here we propose a biogeochemical cycle of microcystin as a new framework for understanding the sources, sinks, and cycling of this toxin in the aquatic environment.

23. ***Top-down grazing control of phytoplankton in a hypereutrophic lake***
Riley Barbour, Tyler Butts, Grace Wilkinson

Harmful algal blooms (HABs) are increasingly becoming a threat to public health as lake eutrophication becomes more common. HABs, however, are poor quality food for zooplankton grazers, which reduces zooplankton ability to control large cyanobacteria blooms. Nonetheless, grazing and trophic interactions within zooplankton are still influential factors in eutrophic lakes, but less is known about hypereutrophic lakes. We performed weekly 24hr incubation experiments using natural phytoplankton and zooplankton assemblages to answer the question, does zooplankton grazing control phytoplankton growth in a hypereutrophic lake? We find that zooplankton grazing generally does not control phytoplankton growth in a hypereutrophic lake.

25. ***The abundance of macroinvertebrates as influenced by heavy metals and variations in stream flow***
Tabitha Gatts, Alba Argerich, Jessica Wilson

Lone Elm is a heavy metal contaminated urban stream located in Joplin, MO, within the Tri-State mining district. The objective of this study is to assess the impact of stream flow, and mine adit discharge with elevated levels of lead, zinc, cadmium, and iron, on the macroinvertebrate community. To this end, we have examined macroinvertebrate abundance and stream flow upstream and downstream of the mine adit from samples taken biweekly during the summer of 2019. Our results show that there is significantly lower macroinvertebrate abundance in the downstream reach.

27. ***Stabilizing silver nanoparticles for toxicity tests***
Tory Lydy, La Toya Kissoon-Charles

Silver nanoparticles (AgNPs) released in aquatic systems have negative effects on the growth of organisms. The growth media currently used for toxicity tests have high concentrations of salts which

cause the AgNPs to become unstable and aggregate. We are currently testing the growth of Lemna minor in a commonly used growth media of different concentrations with 2 mM citrate buffer. This buffer was added to increase stability of AgNPs in the growth media. We predict that AgNPs will have greater toxicity effect when stable in the growth media.

27. ***Design and development of an open-sourced, cost effective water temperature sensor string***
Kevin Gauthier*, Paul Schramm*

[Abstract forthcoming]

Poster Presentations

Session II: 2:15 – 3:00

2. ***Making it rain: using rainfall simulators to investigate land use effect on runoff composition***
Brittany Kirsch, Jessica Corman, Andrea Basche

Land use can impact the chemical composition of runoff but this is often studied by observational measurements after rainstorms. We conducted a pilot study using rainfall simulators to examine how runoff impacts stream chemistry composition and how that impact changes across agriculture- and prairie-dominated land use. Runoff was produced using two rainfall simulators placed on either side of the bank to mimic a two inch in thirty-five minute rainfall event. Stream nutrient concentrations increased during the rainfall simulation periods with concentrations being generally higher in the agricultural stream.

4. ***Commercial harvest of bigmouth buffalo as a biomanipulation strategy***
Elena Sandry, Tyler Butts, Martin Simonson, Michael Weber, Grace Wilkinson

Bigmouth Buffalo (BMB) are an endemic planktivore that thrive in shallow lakes. They are commercially harvested for human consumption, which substantially changes their densities. While the addition or removal of BMBs is likely to cause a trophic cascade, it is unclear what effects decreasing BMB density will have on water quality in shallow lakes. We added BMBs to experimental ponds at ambient, harvested, and no-fish densities to investigate if harvesting induces a trophic cascade. We found that the no-fish and harvested density treatments had similar, low concentrations of algae, indicating that commercial harvest may be a viable biomanipulation strategy in shallow lakes.

6. ***What's happening in Missouri reservoirs when no one is looking?***
Emily Kinzinger, Rebecca L. North

Most cyanotoxin research is conducted during the summer months because blooms like it hot. As winters get shorter and water temperatures increase, however, we need to know what is happening year-round. We expect that toxic cyanobacterial blooms occur in the summer, but is that always the case? Year-round water quality samples from multiple Missouri reservoirs were analyzed to understand seasonal patterns in cyanotoxin occurrence. Peaks in cyanotoxin concentrations were not associated with peaks in chlorophyll a, indicating that staying out of green reservoirs in the summer may not be enough to keep the public safe.

8. ***Macroinvertebrate Metrics along a Gradient of Substrate Size***
Garrett Frandson, Alba Argerich, Brett Landwer

Aquatic macroinvertebrates are commonly used as indicators of environmental conditions. In stream ecosystems, macroinvertebrate communities are shaped by key physical conditions including discharge, temperature, and substrate. At the Lower Taum Sauk Reservoir on Missouri's East Fork Black River, downstream discharge patterns and water temperature closely follow those upstream and only substrate conditions dramatically differ. The three parameters, affected by most dams, are usually difficult to separate. Here we examine macroinvertebrate community structure along a stretch of river from armored to reference conditions. A linkage between community structure and substrate will aid in informing future stream substrate restoration projects.

10. ***Does aquatic vegetation abundance in a spring-fed pond follow a seasonal pattern?***
Hannah Whaley, La Toya Kissoon-Charles

Spring-fed ponds in the Ozarks have cooler waters, which influences their inhabitants. Many of these ponds are shallow and small, which can contribute to their high productivity and eutrophic conditions. We conducted quarterly vegetation surveys in a spring-fed pond to determine changes in abundance throughout the year. We predicted that plants tolerant of eutrophic conditions would dominate all year while others would follow specific seasonal patterns. Preliminary data indicated that plants found followed seasonal patterns of abundance, and certain species peaked at specific times of the year.

12. ***Spatial variation in benthic respiration rates in a restored tallgrass prairie stream***
Jessica Rodino, David Manning

Prairie restoration is common in the Great Plains, but the effects of watershed-scale restoration on stream functions remain unclear. Glacier Creek is a headwater stream with two segments influenced by agriculture and restored prairie, respectively. We measured benthic respiration rates using laboratory incubations performed in low light in May and June 2019 in agricultural and restored reaches of Glacier Creek. We found respiration rates were higher in the restored reach, whereas respiration was undetectable in the agricultural reach, with consistent oxygen production in low light. We expect our results will inform seasonal and spatial ecosystem metabolism estimates for this stream.

14. ***The Role of Nutrient Form and Ratio in Cyanobacterial Nitrogen Fixation***
Madison Foster, Janaye Hanschu, Abagael Pruitt, Amy Burgin

Nitrogen (N) fixation in cyanobacteria increases N availability when N concentrations are low, however, data from a previous mesocosm experiment indicated that N additions may also facilitate N-fixation. To better understand the nutrient conditions that promote N-fixation, we asked: How does N form, concentration, and microbiome source affect N-fixation in cyanobacteria? We measured N-fixation in aquatic mesocosm tanks filled with water from a mesotrophic and hypereutrophic lake; both lake microbiomes received two different N forms (NO_3 and NH_4) at high and low levels. Our experiment will help us understand how N form, concentration and microbiome affect N-fixation.

16. ***Evaluating ecosystem services of restored prairie pothole wetlands***
Morgan Ransiear, Jon Sweetman, Marinus Otte

[Abstract forthcoming]

18. ***Rising Algae and sinking phosphorus: Spatial variability of sediment phosphorus***
Psalm Amos, Ellen Albright, Rachel Fleck, Grace Wilkinson

Green Valley Lake is facing a water quality crisis, with high levels of internal P loading leading to cyanobacteria blooms. However, little is known about the variability in sediment P speciation across the lake and how it compares to other lakes in Iowa. We used sequential P extractions to explore sediment characteristics at 6 sites across the lakebed. Sediments P concentrations around Green Valley Lake

were highly variable. We observed that the stratified areas of the lake generally contained higher concentrations of P than the mixed layers. This variability should be considered with future measurements and maintenance of the site.

20. ***Microscale resolution on how sedimentary pyrite forms***
Raisa Islam, Elizabeth Swanner

Sedimentary pyrite is one of the most abundant minerals on the earth's surface. Chemical mechanisms involved in its creation at low temperatures during sedimentary diagenesis are understood primarily from lab-based experiments, rather than natural systems. The change in oxidation state of sulfur from S2- to S- to form pyrite during sedimentary diagenesis is enigmatic. We studied sediments and water-column particulates in Brownie Lake, a meromictic, ferruginous lake in Minneapolis, MN. Results from analyses of embedded particulates and sediments show co-localization of Fe and S, consistent with FeS formation, and reduced S in particulates, with more oxidized sulfur in sediments.

22. ***Variability of algal biomass and chlorophyll a in an urban stream affected by heavy metal contamination***
Sabine Miller, Alba Argerich, Jessica Wilson

Abandoned mine shafts (adits) pose a threat to surface water quality as ground water draining from these adits contains dissolved heavy metals and other pollutants. Benthic algae can be used as a bioindicator to assess stream health of these systems because of its short lifespan and sensitivity. This study aims to determine the influence of mine drainage on the algal community by analyzing algal samples for chlorophyll a and biomass at sites upstream and downstream of an adit. Our preliminary research shows that the algal community downstream of the mine adit exhibits higher levels of Chl a and biomass than upstream.

24. ***Does age play a part in rain garden infiltration rates?***
Teresa Aguayo, La Toya Kissoon-Charles

Urban runoff contains pollutants such as fertilizers, pesticides, and oils which have negative effects on downstream habitats. Rain gardens are constructed in urban areas to filter runoff and can vary in size, design, vegetation, and substrate. Little is known about the differences in vegetation composition, age, and soil infiltration rates in rain gardens five years post construction. Preliminary results indicated that soil infiltration rates did not differ between young (<7 years old) and old rain gardens (>7 years old).

26. ***Changes in microcystin-degrading potentials within natural lake samples throughout the harmful cyanobacterial bloom season***
Xuewei Liang, Kaoru Ikuma

Biodegradation is the most effective and reliable method of removing microcystins, one of the most prevalent groups of cyanotoxins commonly produced during harmful cyanobacterial blooms (HCBs). The bacterial communities of water and sediment samples from Green Valley Lake in Iowa appeared to have different microcystin-biodegrading potential across six sampling sites as well as over the course of the HCB season. The effective degrading gene, mlrA, will be quantified using quantitative PCR and used to normalize the microcystin-biodegradation rates. Metabolomics, water quality data, and other parameters will be used to analyze the triggers of the different biodegradation potentials in the samples.

28. ***Establishment of a water quality dataset for MWSU campus pond: baseline aquatic macroinvertebrates and physiocochemical data***
Zachary Schank, Carissa Ganong

We compared physicochemical and biotic data from nine campus ponds to test the prediction that urban ponds (in open areas near parking lots) would exhibit different physicochemical and biotic characteristics than wooded ponds. In May 2019 we measured nitrate concentration, pH, and

conductivity at each pond; we also conducted plankton tows and sampled benthic macroinvertebrates and determined richness and Shannon's diversity. Contrary to our prediction, none of the response variables differed consistently between urban and wooded ponds, although one urban pond showed significantly increased conductivity and nitrate levels. We plan to continue annual sampling to create a long-term dataset.

30. ***Methane contributions to stream food webs***

Caleb J. Robbins, Jake A. Lutchen, James H. Thorp

Methane is frequently supersaturated in flowing waters. Methane-oxidizing bacteria convert this methane into consumable biomass for higher trophic levels, such as invertebrates. How much of the stream trophic base is fueled by methane, and what factors might determine contributions of methane to the food web? We are currently collecting data to address these questions across Great Plains rivers from Texas to North Dakota. We will use stable isotope signatures and fatty acid biomarkers of basal resources and invertebrate consumers to understand the prevalence of methane and its potential drivers (e.g., geomorphology, nutrient and organic matter quantity) in lotic food webs.