Arkansas Water Resources Center
University of Arkansas

Annual Technical Report
2018

General Information

Products

2017AR400B Regionalizing agricultural field evapotranspiration observations Presentation Reavis CW, Suvo?arev K, Reva ML, Runkle BRK; Comparing eddy covariance and Penman-Monteith methods to estimate evapotranspiration from Mid-South rice production, presentation at American Geophysical Union Fall Meeting, Washington DC, Dec, 2018.
2017AR400B Regionalizing agricultural field evapotranspiration observations Presentation Runkle BRK, Reba M, Fong B, Teague T, Suvo?arev K, Dynamics of CO2 exchange in US Mid-South cotton production, oral presentation at the Beltwide Cotton Conference, New Orleans, LA, 1/9/19.
2018AR407B AWRC Information Transfer Publication Austin, B.J., S. Patterson, and B.E. Haggard. 2019 (accepted). Water Chemistry during base flow helps inform watershed management: A case study of the Lake Wister Watershed, Oklahoma, USA. Journal of Contemporary Water Research and Education.
2018AR407B AWRC Information Transfer Publication Austin, B.J. S. Entrekin, M.A. Evans-White, J. Kelso, and B.E. Haggard. 2018. Can high volume hydraulic fracturing effects be detected in large watersheds? A case study of the South Fork Little Red River. Current Opinion in Environmental Science and Health 3:40-46
2018AR407B AWRC Information Transfer Publication Entrekin, S., M.A. Evans-White, others, and B.E. Haggard. 2018. Ecological responses to surface water alterations from high-volume hydraulic fracturing: Fayetteville Shale as a case study. Current Opinion in Environmental Science and Health3:27-32
2018AR407B AWRC Information Transfer Publication Grantz, E., B.E. Haggard, and J.T. Scott. 2018. Censored data can inflate or obscure trends in analyses used for water quality target development. Environmental Monitoring and Assessment 190:394
2018AR407B AWRC Information Transfer Publication Harmel, R., K. King, D. Busch, D. Smith, F. Brigand, and B.E. Haggard. 2018. Measuring edge-of-field water quality: Where we have been and the path forward. Journal of Soil and Water Conservation 73:86-96
2018AR407B AWRC Information Transfer Publication McCarty, J.A., M.D. Matlock, J.T. Scott, and B.E. Haggard. 2018. Risk indicators for identifying critical source areas in five Arkansas watersheds. Transactions ASABE 61:1-8
2018AR407B AWRC Information Transfer Publication Reavis, M.A., and B.E. Haggard. 2018. Mitigating soil phosphorus release using liquid water treatment residuals. Journal American Water Works Association 110(12):E36-E43
2018AR407B AWRC Information Transfer Publication Scott, E., and B.E. Haggard. 2018 (submitted). Evaluating Water Quality and Standard Violations at the West Fork of the White River. Environmental Monitoring.
2018AR407B AWRC Information Transfer Publication Simpson, Z.P., and B.E. Haggard. 2018. Optimizing the flow-adjustment of constituent concentrations via LOESS for trend analysis. Environmental Monitoring and Assessment 190:103
2018AR407B AWRC Information Transfer Publication Austin, BJ, J.T. Scott, and B.E. Haggard. 2018. Managing Lake Fertility within the Guidelines of a Nutrient Management Plan and Based on Algal Nutrient Limitation. Final Report to the US Forest Service, AWRC Technical Report MSC 386, 14 pp.
2018AR407B AWRC Information Transfer Publication Austin, B.J., B. Smith, and B.E. Haggard. 2018. Stream water quality to support HUC 12 prioritization in the Lake Wister Watershed, Oklahoma. Final Report to the Poteau Valley Improvement Authority, AWRC Technical Report MSC 385, 35 pp.
2018AR407B AWRC Information Transfer Publication Reavis, M.A., and B.E. Haggard. 2018. Expanded Summary: Mitigating soil phosphorus release using liquid water treatment residuals. Journal American Water Works Association 110:12 (Page 34)
2018AR407B AWRC Information Transfer Publication Austin, B.J., B. Olsen, T. Wentz, and B.E. Haggard. 2018. Algal blooms in Arkansas streams, ponds and lakes. Arkansas Water Resources Center Fact Sheet FS-2018-02
2018AR407B AWRC Information Transfer Publication Burke, J., A. Sharpley, L. Berry, K. Brye, M. Daniels, E. Gbur, K. VanDevender, S. King, P. Hays, and B. Haggard. 2018. Nutrient concentrations in Big Creek correlate to regional watershed land use. UA Division of Agriculture Fact Sheet FSA9537
2018AR407B AWRC Information Transfer Publication Daniels, M., B.J. Austin, and B.E. Haggard. 2018. How to sample: collecting water samples is so easy anyone can do it! Arkansas Water Resources Center Fact Sheet FS-2018-01
2018AR407B AWRC Information Transfer Presentation Haggard, B.E. Illinois River: What, When and Where are we now? Oklahoma State Chapter of the Soil and Water Conservation Society, Grove, OK. June 2018.
2018AR407B AWRC Information Transfer Presentation Austin, B.J., B. Smith, and B.E. Haggard. Subwatershed

Prioritization of Lake Wister Watershed Using Baseflow Water Quality Monitoring Data. Oklahoma Clean Lakes and Watersheds Conference, Stillwater, Oklahoma. April 2018.
2018AR407B AWRC Information Transfer Presentation Lasater, A.L., B.J. Austin, E.E. Scott, and B.E. Haggard. Stream Discharge Monitoring and Load Estimation for Small Scale Watersheds. University Council on Water Resources (UCOWR) 2018 Annual Conference. Pittsburgh, PA. June 2018.
2018AR407B AWRC Information Transfer Presentation Haggard, B.E., and B.J. Austin. Sediment phosphorus release sustains nuisance algal growth in a small impoundment. University Council on Water Resources (UCOWR) 2018 Annual Conference. Pittsburgh, PA. June 2018.
2018AR407B AWRC Information Transfer Presentation Henson, E., A.L. Lasater, and B.E. Haggard. Reducing Dissolved Phosphorus in Stream Water May Not Influence Estimation of Sediment Equilibrium Phosphorus Concentrations. Arkansas Water Resources Center Annual Water Research Conference, Fayetteville, AR. July 2018.
2018AR407B AWRC Information Transfer Presentation Henson, E., A.L. Lasater, and B.E. Haggard. Reducing Dissolved Phosphorus in Stream Water May Not Influence Estimation of Sediment Equilibrium Phosphorus Concentrations. University of Arkansas Honors College Research Conference, Fayetteville, AR. October 2018.
2018AR407B AWRC Information Transfer Presentation Lee, D., B.J. Austin, and B.E. Haggard. Microcystin and Algal Biomass in Streams Across a Land-Use Gradient in Northwest Arkansas. Arkansas Water Resources Center Annual Water Research Conference, Fayetteville, AR. July 2018.
2018AR407B AWRC Information Transfer Presentation Ledezma, H.E.O., B. Smith, B.J. Austin, and B.E. Haggard. Comparison of Three Methods for Measuring Chlorophyll in Water Samples. Arkansas Water Resources Center Annual Water Research Conference, Fayetteville, AR. July 2018.
2018AR407B AWRC Information Transfer Presentation Scott, E.E., B.A. Smith, and B.E. Haggard. Water-Quality Changes in the West Fork of the White River, Upstream to Downstream. Beaver Watershed Alliance Annual Symposium, Fayetteville, AR, September 2018.
2017AR398B Combined application of nutrient manipulation and hydrogen peroxide exposure to selectively control cyanobacteria growth and promote eukaryote phytoplankton production in aquaculture ponds Publication (non-peer review) Sinha, A.K., N. Romano, M. Eggleton, J.H. Howe, and R. Lochmann. 2018. Removing cyanobacteria and associated toxins in aquaculture ponds. Global Aquaculture Alliance, Environmental and Social Resonsibility, https://www.aquaculturealliance.org/advocate/removing-cyanobacteria-toxins-aquaculture-ponds/.
2017AR398B Combined application of nutrient manipulation and hydrogen peroxide exposure to selectively control cyanobacteria growth and promote eukaryote phytoplankton production in aquaculture ponds Presentation Sinha, A.K., W.R. Green, L. Howe, A. Surratt, and J. Howe. 2019. Combined application of nutrient manipulation (by phoslock) and hydrogen peroxide based algaecide to control cyanobacterial growth in hypereutrophic ponds, in Aquaculture America 2019, New Orleans, Louisiana.
2017AR398B Combined application of nutrient manipulation and hydrogen peroxide exposure to selectively control cyanobacteria growth and promote eukaryote phytoplankton production in aquaculture ponds Presentation Sinha, A.K., W.R. Green, and J. Howe. 2019. Combined Application of Hydrogen Peroxide Based Algaecide and Phosphorus Binding Compound - A Potential Strategy to Efficiently Control Cyanobacterial bloom for a Prolonged Duration, in Associate of the Research Directors, Jacksonville, Florida.
2017AR400B Regionalizing agricultural field evapotranspiration observations Publication Lu Liang, B.R.K. Runkle, B.B. Sapkota, and M.L. Reba, 2019, Automated mapping of rice fields using multi-year training sample normalization, International Journal of Remote Sensing, DOI: 10.1080/01431161.2019.1601286
2018AR402B Overcoming adoption barriers to promote surface water irrigation in the Arkansas Delta Region Presentation G.H. West, 2018, The Influence of Resource Attributes and Climate Change Narratives on Preferences for Groundwater Management Policies: Exploring Coalitions of Belief Using Latent Class Models. Invited presentation from Research and Professional Development Series in the Public Policy PhD Program, Graduate School and International Education, University of Arkansas, Fayetteville, AR.
2018AR402B Overcoming adoption barriers to promote surface water irrigation in the Arkansas Delta Region Publication West, G.H., K. Kovacs, H. Snell, and R. Nayga, 2019 (in preparation), Groundwater and Time Preference Elicitation: Estimating the Value of Market and Non-Market Groundwater Services over Time, Water Resources Research.
2018AR402B Overcoming adoption barriers to promote surface water irrigation in the Arkansas Delta Region Publication West, G.H., K. Kovacs, and R. Nayga, 2019, (in preparation), How Narrative Framing About Climate Change Impacts Preferences for Long-term Groundwater Management, Climate Policy.
2018AR403B An In Situ Approach to Harmful Algal Blooms: Simultaneous Treatment of Cyanobacteria and Cyanotoxins in Natural Water Sources Using Catalytic Nanoparticle-Fiber Nets Publication Ivandic, S., W. Zhang, and L.F. Greenlee. 2019. Degradation of MC-LR Cyanotoxin with Fiber-Immobilized TiO2 Nanoparticles. In preparation.

2018AR403B An In Situ Approach to Harmful Algal Blooms: Simultaneous Treatment of Cyanobacteria and Cyanotoxins in Natural Water Sources Using Catalytic Nanoparticle-Fiber Nets Presentation Ivandic, S., W. Zhang, and L.F. Greenlee. 2019. In Situ Treatment of Cyanotoxins in Water Sources Using Fiber-Immobilized TiO2/Fe Nanoparticle Catalysts, in American Institute of Chemical Engineers national conference, Orlando, FL.
2018AR403B An In Situ Approach to Harmful Algal Blooms: Simultaneous Treatment of Cyanobacteria and Cyanotoxins in Natural Water Sources Using Catalytic Nanoparticle-Fiber Nets Patent Invention disclosure anticipated along with publication submission based on the work of S. Ivandic and the manuscript in preparation (listed in #2).
2018AR404B Quantifying flow sources and their impacts on water quality in forested Ozark streams Presentation Dodd, A., E. Pollock, S. Dias, B. Hillebrand, and M. Evans-White. 2019. Relative Rain and Groundwater Contributions to Streamflow Across Two Flow Regimes in Northern Arkansas, in Society for Freshwater Science Annual Meeting, Salt Lake City, Utah.
2018AR404B Quantifying flow sources and their impacts on water quality in forested Ozark streams Dissertation Dodd, Allyn, M. Evans-White, 2019, Flow Regime Influences on Stream and Riparian Soil Carbon Dynamics in the Ozark Highlands and Boston Mountains of Arkansas, PhD Dissertation, Department of Biological Sciences, University of Arkansas, Fayetteville, AR, pp. 141.
Admin Presentation Haggard, B.E., B.J. Austin, and M. Shults. 2019. Variability in microcystin concentrations in a recreatioal lake during sampling and analysis. In Arkansas Water Resources Center annual conference, Fayetteville, AR.
Admin Presentation Haggard, B.E. 2019. Microcystin is highly variable in Lake Fayetteville. In Lake Fayetteville Watershed Partnership public speaker series, Fayetteville, AR.
2018AR402B Overcoming adoption barriers to promote surface water irrigation in the Arkansas Delta Region Dissertation West, G.H. 2019 (expected). Interpreting potential groundwater policies through modelling of market and non-market benefits and costs. University of Arkansas, Fayetteville, AR.
Admin Presentation Austin, B.J., D.R. Lee, B.E. Haggard. 2019. Occurrence of Microcystin in Ozark Streams across a Nutrient Gradient in Northwest Arkansas. In National Water Quality Monitoring Conference. Denver, CO
Admin Presentation Austin, B.J., D.R. Lee, B.E. Haggard. 2019. Occurrence of Microcystin in Ozark Streams across a Nutrient Gradient in Northwest Arkansas. In HABs working group for South Carolina.
2017AR400B Regionalizing agricultural field evapotranspiration observations Publication Runkle BRK, Suvo?arev K, Reba ML, Reavis CW, Smith SF, Chiu Y-L, Fong B, (2019), Methane emissions reductions from alternate wetting and drying of rice fields detected using the eddy covariance method, Environmental Science & Technology, 53(2), 671-681, DOI: 10.1021/acs.est.8b05535.
2017AR400B Regionalizing agricultural field evapotranspiration observations Presentation Reavis CW, Suvo?arev K, Runkle BRK, Reba ML, Utilizing eddy covariance and Penman-Monteith methods to estimate evapotranspiration from Mid-South rice production, poster presentation at the Ameriflux PI meeting, Bloomington IN, October 2018
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, March Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, April Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, May Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, June Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, July Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, August Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, September Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, October Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, November Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News, January Newsletter, Arkansas Water Resources Center.
2018AR407B AWRC Information Transfer Publication, Newsletter Scott, E.E. and B.E. Haggard, 2018, Water News,

February Newsletter, Arkansas Water Resources Center.

Information Transfer Program

We run a robust information transfer program at the Arkansas Water Resources Center that includes an annual water conference, website updates, monthly electronic newsletters and archiving these stories on our “blog”.

We drew in about 160 people for this year’s conference, with a theme of “The Value of Water”, where we facilitated conversations about how valuable water is to the economy of communities, states, and regions, and the need to be more proactive in management decisions to sustain our water supplies.

We continue to maintain and improve our main Center website, Arkansas-Water-Center.uark.edu, where users navigate an easy to use, aesthetically pleasing site to find current research information, technical reports, raw data reports, conference information, lab information, grant and job opportunities, and more.

We publish monthly electronic newsletters to a listerv of 465 interested stakeholders from students to professionals. Articles cover a range of topics and these articles are archived on our blog website, WaterCurrents.uark.edu. We also share these articles and other posts on Facebook, where we have almost 700 followers, as well as on Twitter and Instagram.

We also develop an annual ‘Arkansas Water Research Bulletin’ to share research activities, especially 104B sponsored research and fact sheets geared toward the general public.

All of our IT activities emphasize the USGS 104B program. We encourage 104B research presentations at our conference, we share research results on our website and through our monthly newsletters, we highlight student and faculty work through social media, and we include report articles in the Bulletin.

Student Support

Total = 21; Undergraduate = 11 (includes 1 USGS intern); Masters = 5; PhD = 4; Post-doc = 1

Notable Achievements and Awards

Through this program we funded a research project for Gina Riggio, a graduate student working with Dr. Kristen Gibson. Gina received first place in the poster competition at the annual conference of the Universities Council on Water Resources/ National Institutes of Water Resources in June 2019.

Projects

An In Situ Approach to Harmful Algal Blooms: Simultaneous Treatment of Cyanobacteria and Cyanotoxins in Natural Water Sources Using Catalytic Nanoparticle-Fiber Nets

Project Type: Annual Base Grant **Project ID:** 2018AR403B

Project Impact: Concern about harmful algal blooms is increasing throughout the country as more states are seeing more blooms that could affect drinking water supplies, recreational waters, and even private ponds. Indeed, the Arkansas Water Resources Center has worked with many pond owners this summer who have lost livestock and pets potentially due to cyanobacteria and cyanotoxin contamination of waters. Methods of analysis are generally well-defined, but there is a gap in knowledge about how to best address or remediate waters with blooms and toxins. This research introduced a novel approach to simultaneously treat cyanobacterial blooms and degrade cyanotoxins using nanoparticle technology. They found that titanium dioxide and iron oxide nanoparticles removed cyanobacterial cells from the water column by flocculation, binding them up and deactivating them. They also found that titanium dioxide nanoparticles degraded the common cyanotoxin microcystin-LR through a UV-light-initiated catalyst. This research is highly valuable because it elucidated mechanisms and limitations of the methods used in the study. The results have already informed method adjustments to try to more effectively treat blooms and toxins using nanoparticle technologies, with minimal to no negative environmental impact. Not only does Arkansas directly benefit from this research, but development of the technology introduced here has the potential to help water resource managers throughout the country to protect water supplies and public health.

Combined application of nutrient manipulation and hydrogen peroxide exposure to selectively control cyanobacteria growth and promote eukaryote phytoplankton production in aquaculture ponds

Project Type: Annual Base Grant **Project ID:** 2017AR398B

Project Impact: Algal blooms, and of particular interest, toxin-producing harmful algal blooms (HABs), are increasing in frequency and magnitude in Arkansas and throughout the United States. HABs can be detrimental to many water resource uses such as drinking water supplies, recreation, and aquaculture. This study looked at the efficacy of a novel approach to managing HABs and toxins in experimental aquaculture ponds, which can be tricky because producers need to selectively control and degrade HABs and toxins, while preserving other algae and aquatic organisms that are food sources for fish. The researchers found that using a granular H2O2 sodium bicarbonate peroxyhydrate (SCP) compound can be effective in targeted degradation of cyanobacteria and their toxins, while avoiding negatively impacting other beneficial algal species and zooplankton. In less than a week, dosing experimental ponds with 2.5 mg/L of the granular H2O2 led to significant reductions (by approximately 80%) of cyanobacterial abundance and significantly reduced total microcystins (which was maintained throughout the 6 week experiment). Further, H2O2 concentration degraded rapidly and was not detectable 3 days after application. This research may lead to a highly effective approach to mitigate HABs and toxins without negatively impacting other organisms and fisheries production. This would be extremely valuable to Arkansas, which ranks second among aquaculture producing states in the nation.

Do stream phosphorus dynamics correspond with biological condition in the Lake Conway Point Remove Watershed, Arkansas?

Project Type: Annual Base Grant **Project ID:** 2018AR405B

Project Impact: There is a pressing need for water resource stakeholders in the United States to identify subwatersheds that transport a disproportionately greater amount of nutrients and prioritize these subwatersheds for management activities to reduce downstream eutrophication. This study looked at many levels of nutrient dynamics in streams (concentrations in waters, sediment phosphorus release potentials, and macroinvertebrate communities) across agricultural streams in Arkansas and Michigan. Results from this study support the notion that streams draining agricultural lands have higher nitrogen and phosphorus (P) concentrations compared to streams draining less agricultural land. This study also showed that macroinvertebrate density generally increased with greater

agricultural land use in the watershed, but diversity and richness generally decreased. An interesting result demonstrated in this study is that P sorption and desorption to streambed sediments can be an important influence on stream nutrient concentrations and transport. For example, when watershed management activities are implemented to reduce nutrient transport to waterways, nutrient concentrations in those waterways might not actually see a reduction, at least not right away. This is a similar but separate issue to legacy P in soils on land. Arkansas streams in this study showed lower P sorption rates and the authors suggest this means that these streams may have greater potential to recovery after management efforts compared to streams with higher sorption (and higher potential desorption) rates. Water resource managers can use results from this study to better understand how streams might respond to landuse management activities. This can help them decide where management activities might have the most beneficial effect to reduce nutrient transport and downstream eutrophication.

Groundwater and Time Preference Elicitation: Estimating the Value of Market and Non-Market Groundwater Services Over Time

Project Type: Annual Base Grant **Project ID:** 2018AR402B

Project Impact: It is unavoidable to hear about agricultural irrigation without also hearing about the dwindling supplies of water to support it. Even in Arkansas, considered to be relatively “water rich”, there are serious concerns over the sustainability of groundwater supplies that support the majority of crop production in the state. This study evaluated groundwater depletion from a socio-economic perspective. The researchers surveyed producers in the Mississippi River Valley Alluvial (MRVA) aquifer to understand people’s willingness to pay for different services that groundwater provides, with some services lacking market prices. Valuating non-market ecosystem services can be extremely difficult, but is paramount to understanding the entire economic picture and deciding on policy actions. Results show that survey respondents value the provision of water-quality service the most, followed by certainty of supply and agricultural jobs. They were not concerned with wildlife habitat and avoiding subsistence. Respondents also were not interested in the policy alternatives of cap-and-trade or increased investment in surface water infrastructure over the status quo of subsidies for best management practices. It is interesting to note that the current policies to protect the sustainability of groundwater supplies are not enough, as there continues to be groundwater depletion in the MRVA. Despite this fact, respondents are satisfied with current policies. This research can help water resource managers understand the basis of public opinion and willingness to pay for various services, which will help them figure out effective strategies to communicate with the public and develop new policies to sustain this economically invaluable water resource.

Herbicide Mitigation Potential of Tailwater Recovery Systems in the Cache River Critical Groundwater Area

Project Type: Annual Base Grant **Project ID:** 2017AR399B

Project Impact: Due to groundwater depletion in intensive agricultural regions, surface water impoundments can help producers bridge their needs with multiple water supplies. But, it is important to understand the quality of water in farm reservoirs, as it may contain herbicides that were agriculturally applied to crops, before that water is reapplied to the landscape. This study initiated an herbicide monitoring record for seven Arkansas tailwater recovery systems. Four herbicides (clomazone, glyphosate, metolachlor, and quinclorac) were readily detectable and peaked seasonally, reflecting interplay of application timing and precipitation. Clomazone and quinclorac, common spring-applied rice herbicides, were elevated in spring and summer. Metolachlor was elevated in summer only, reflecting mid-season applications to soybean acres. Glyphosate concentrations peaked in summer, but were also elevated in spring and fall, reflecting frequent, broad spectrum glyphosate use. Herbicide concentrations were otherwise low in off-season months and mostly below detection. During the growing season, clomazone, glyphosate, and quinclorac concentrations were higher in ditches than in the linked reservoir. Metolachlor concentrations were similar in magnitude between linked ditches and reservoirs. The observed spatial and temporal patterns in residual herbicide concentrations will inform best management practices for tailwater recovery systems in Arkansas and the region. For example, recovered tailwater should be cycled through and sourced from the reservoir before reapplication to minimize the risk of sensitive crop exposure to residual herbicides. Also, artificial groundwater recharge strategies should source water from reservoirs and only during winter months to minimize the risk to groundwater supplies.

Quantifying flow sources and their impacts on water quality in forested Ozark streams

Project Type: Annual Base Grant **Project ID:** 2018AR404B

Project Impact: Precipitation and groundwater are two dominant flow source inputs to minimally-impacted headwater streams in Arkansas. These sources are termed Runoff flashy and Groundwater flashy, respectively, based on previous modeling work. Identification of flow sources is important for water managers since the source of water can dictate water and nutrient budgets in streams, with potential impacts on stream ecosystems. In this study, researchers used water chemistry and hydrologic data to evaluate six minimally-impacted forested streams in the Boston Mountains and Ozark Highlands regions of Arkansas. They measured nutrient and mineral concentrations in the water column and in groundwater and precipitation sources. They used end-member mixing analysis to evaluate relative proportions of each water source (groundwater or precipitation). This study provided empirical measurements that support previous modeling research. As expected, Groundwater flashy streams were driven primarily by groundwater inputs, except during storm events when precipitation dominated. Runoff flashy streams were driven by precipitation inputs during base and stormflow conditions. Interestingly, Groundwater streams had higher nitrogen and phosphorus concentrations compared to Runoff streams. Also, groundwater inputs actually drove nitrogen concentrations in Runoff streams. These data support previous classifications based on modeling work, but also show that previously held assumptions might need some refinement. An important take-away from this research is that groundwater nitrogen can influence streams that are classified as Runoff streams. This can have important implications for water managers, as potential landscape changes towards agricultural land use might indirectly increase stream nutrient concentrations via infiltration and groundwater transportation to streams.