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Preview of Award 1440484 - Annual Project Report

[Cover](#) |
[Accomplishments](#) |
[Products](#) |
[Participants/Organizations](#) |
[Impacts](#) |
[Changes/Problems](#)

Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	1440484
Project Title:	LTET: Long-Term Research on Grassland Dynamics- Assessing Mechanisms of Sensitivity and Resilience to Global Change
PD/PI Name:	Jesse B Nippert, Principal Investigator Sara G Baer, Co-Principal Investigator John M Blair, Co-Principal Investigator Walter K Dodds, Co-Principal Investigator
Recipient Organization:	Kansas State University
Project/Grant Period:	11/01/2014 - 10/31/2020
Reporting Period:	11/01/2018 - 10/31/2019
Submitting Official (if other than PD/PI):	Jesse B Nippert Principal Investigator
Submission Date:	09/27/2019
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Jesse B Nippert

Accomplishments

* What are the major goals of the project?

The Konza Prairie LTER Program (KNZ) is a comprehensive, interdisciplinary research program with the overarching goal of understanding the interactive effects of natural and anthropogenically-altered drivers on grassland ecological dynamics, and to advance ecological theory through synthesis and integration of long-term datasets. In the most recent iteration of KNZ LTER funding (LTER VII), our focus is on assessing the mechanisms underlying sensitivity and resilience of this grassland ecosystem to a suite of critical forcing factors or 'drivers', by continuation of long-term manipulation of selected historically-important drivers, addition/alteration of novel drivers, and cessation of certain long-term experimental drivers to evaluate the strength of ecological legacies and feedbacks. KNZ will also continue to support numerous educational, training and outreach

activities, contribute knowledge to address land-use and management issues in grasslands, and provide infrastructure and data in support of scientific pursuits across a broad range of disciplines.

Our core research site is the Konza Prairie Biological Station (KPBS), a 3487-ha area of native tallgrass prairie in the Flint Hills of NE Kansas. KPBS was established in 1971 and joined the LTER network in 1980. LTER funding supports collection of long-term data on processes such as hydrology, nutrient cycling, plant productivity and community composition. These long-term records continue to provide unique insights into the dynamics of tallgrass prairie ecosystems, serve as a critical baseline for identifying and interpreting ecological responses to environmental changes, and are made available as a resource for the broader scientific community. The KNZ program encompasses studies at, and across, multiple ecological levels and a variety of spatial and temporal scales. Our unifying conceptual framework focuses on *fire, grazing and climatic variability* as essential and interactive factors determining the structure and function of mesic grasslands. The interplay of these natural disturbances leads to the complex, non-linear behavior characteristic of these grasslands. Because grazing and fire regimes are managed in grasslands worldwide, KNZ data are relevant for understanding and managing grasslands globally, and for addressing broader ecological issues including disturbance and ecosystem stability and resilience, top down vs. bottom up controls, and the interplay of mutualistic and antagonistic biotic interactions. In addition, because human activities alter key ecological drivers in these grasslands, we can use KNZ studies and data to address critical issues related to global change, including land-use and land-cover change, the ecology of invasions and restoration, and the direct and indirect alteration of nutrient and water availability. Thus, the KNZ program, while initiated nearly 40 years ago to understand the effects of natural disturbances in this grassland, has sustained and immediate relevance for understanding and predicting the consequences of global change for grasslands around the world.

A major goal of the KNZ LTER VII project is the continuation of core watershed-level fire and grazing studies and associated long-term data collection to document both short-term and long-term dynamics in response to these treatments and a variable climate. The KNZ program is built around a long-term database on ecological patterns and processes derived from a fully replicated watershed-level experimental design, in place since 1977 with some modifications to accommodate new long-term studies initiated in LTER V and VI (e.g., watershed-level Fire Reversal and Season of Fire experiments, Riparian Woody Vegetation Removal experiment, Patch-Burn Grazing experiment). This unique experimental design includes replicate watersheds subject to different fire and grazing treatments. In addition to fire and grazing, climatic variability, climate extremes and directional climate change are key drivers of grassland dynamics, and important focal areas for KNZ activities. The collection of diverse data from common sampling locations facilitates integration among our research groups. Within core LTER watersheds, permanent sampling transects are replicated at various topographic positions, where ANPP, plant species composition, plant and consumer populations, soil properties, and key above- and belowground processes are measured. In addition, a number of long-term plot-level experiments allow us to address the mechanisms underlying responses to various fire and grazing regimes, including manipulations of fire and N availability (e.g. Belowground Plots Experiment, Chronic N Deposition experiment) and of climatic variables in both terrestrial (e.g. Irrigation Transect Study, Rainfall Manipulation Plots (RaMPs) Experiment, Climate Extremes Experiment (CEE)) and aquatic (Experimental Stream Studies) habitats. In total, the Konza LTER Program is a rigorous ecological research program designed to elucidate patterns and processes important in grasslands, and address the potential impacts of global change in these ecosystems. Towards this end, we currently maintain 129 datasets (many with multiple subsets) associated with our long-term research and use these to support numerous shorter-term experiments focused on specific drivers and mechanisms.

In the fifth year (2018-2019) of our current funding cycle (LTER VII, 2014-2020) we continued to address fundamental ecological questions within the framework of assessing the mechanisms of sensitivity and resilience to global change, a theme relevant to understanding, managing and conserving grasslands worldwide. We focus on the global changes most relevant to grasslands and grassland streams – *changes in land-use* (altered fire and grazing regimes) and *land-cover* (particularly increases in woody plant cover); *climate change* (altered precipitation patterns including response to extreme events) and *altered nutrient cycles* (changes in nutrient availability) in both terrestrial and aquatic environments; and *restoration ecology* (active management of the ecosystem state) – and we couple long-term observations with manipulative studies to evaluate the strength of biological legacies and feedbacks in conferring sensitivity or resilience of the ecosystem state to these drivers.

Overarching goals for the KNZ LTER VII funding cycle are to:

1. Build upon our core LTER experiments and expand datasets on fire, grazing and climate variability to deepen and refine our understanding of the abiotic and biotic factors and feedbacks affecting grassland structure and function;
2. Develop a mechanistic and predictive understanding of grassland dynamics and trajectories of change in response to selected natural and anthropogenic drivers using long-term experiments and datasets, coupled with complementary shorter-

term studies;

3. Conduct new syntheses using KNZ data, alone and in combination with data from other sites, to advance ecological theory, and expand the inference of KNZ research to other grasslands and biomes;

4. Train the next generation of ecologists, educate the public, and provide outreach to increase the relevance of KNZ long-term research to society.

Consistent with our goals as a long-term ecological research program, many of the long-term experiments and datasets initiated in previous LTER grants are being continued throughout the current funding period, while several new experiments and datasets were, and are, being modified or initiated, as detailed in the KNZ LTER VII proposal. The value of these long-term experiments and datasets continues to increase with time. In addition, results from these long-term studies have new relevance as we move towards evaluating the ecological impacts of a suite of global change phenomena occurring at the Konza LTER site and in grasslands worldwide. Below we highlight a few selected activities and findings from our most recent funding period.

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities:

In the past year, we have continued core KNZ programs including watershed-level fire experiments, contrasts of grazed (bison and cattle) and ungrazed locations, and the associated data collection and synthesis that are central to our research program. This includes maintaining watershed-level manipulations of fire frequencies (1, 2, 4, 20-year fire return intervals), seasonal timing of fires (spring, summer, fall, winter), and the reversal of fire treatments over time to assess the potential for altered fire regimes to mitigate trajectories of land-cover change. Fire and grazing studies address multiple LTER core areas, including primary productivity, nutrient cycling, population and community dynamics (with core datasets on grasshoppers, small mammals, grassland birds, plant communities, and bison). These whole-watershed fire and grazing treatments are focal areas for a number of ongoing LTER data collection efforts, syntheses across networks (NutNet, Drought-net), groundwater and stream-water monitoring networks, flux-tower and micrometeorological (Ameriflux), as well as data validation and parameterization of GIS and remote-sensing analyses. This platform of research also provides unique research opportunities for graduate and undergraduate students at KSU, as well as visiting students from many other institutions. We have provided a detailed assessment of several new and ongoing research activities within 2018-2019 in the attached 'Activities' .pdf.

At this point in the 6-year funding cycle, we have initiated all research projects originally proposed in our LTER VII proposal and we have begun collecting preliminary data from several new projects that will be highlighted in our proposal renewal. While detailed project-specific accomplishments are described in the appended Activities and Findings documents, here we note several major activities and findings from our thematic areas of research. Within the Fire and Grazing Studies group, we have developed several new projects focused on the population ecology and demography of consumers and producers. This year we highlight the research activities of Ellen Welti (postdoc at OU) on the role of sodium as a driver of invertebrate communities in grasslands. Ellen's works shows promise for explaining changes in grasshopper abundance across fire/grazing treatments based on changes in sodium availability. 2019 marked the first year of treatment data for the Consumer Size Manipulation Experiment (ConSME). This large factorial experiment manipulates the abundance of multiple size classes of herbivores (invertebrates, small mammals, and bison) to identify consumer-identity effects on plant community composition and productivity. Given that the summer 2019 was an anomalously wet period (following the 2018 drought year) the Climate Change group initiated several studies to assess the impacts of stream flow recovery on fish communities within King's Creek. Many long-term nutrient addition/removal experiments were continued during the past year within the Biogeochemistry group. Within the long-term below-ground plots experiment, we have now had three years (2017-2019) without fertilizer additions to assess legacies of nutrient additions over the previous 30 years.

Work from the Zeglin lab in the past year shows interactions between fire and fertilization on nutrient dynamics, which have promoted changes in microbial communities through time. Woody Encroachment continues to be a primary focal topic of research on Konza Prairie. Research projects within the last year focused on changes in demography of *Cornus drummondii*, the impacts of simulated browsing on shrub physiology and growth, and the second year of data collection for the ShRaMPs shrub rainout experiment. Finally, many projects are underway on Konza that investigate community assembly, invasion ecology and grassland conservation. These projects are organized within the Restoration focal group. The sequential prairie restoration experiment began in 2010 to disentangle deterministic versus short-term stochastic drivers of grassland community assembly. The restoration projects continue to provide many opportunities for graduate and undergraduate projects in restoration ecology and provide an important avenue for Konza research to impact grassland conservation.

Nippert is completing his second year as the PI of the KNZ program. In 2019 we added a new staff position to the KNZ LTER -- GIS Analyst. We hired Pam Blackmore to revive and update our spatial datasets, assist PIs and students with spatial data analysis, collect new GPS data from the site, and to work with our IM Yang Xia on a new spatial data portal for our website (under development). Several of our 'long-term postdocs' were hired into permanent academic jobs in the past year. These include Zak Ratajczak (hired at KSU), Nate Lemoine (hired at Marquette) and Allison Veach (hired at UT-San Antonio). With Zak's return to KSU, he will undoubtedly have a large impact on our grassland ecology program, the scope and direction of future Konza research, and bring much needed theoretical ecology insight to Konza science. KSU was also fortunate to hire a new grassland population ecologist -- Dr. Allison Louthan. Allison is new to the LTER network (having previously worked in the Serengeti, and alpine environments in Colorado and Alaska). Allison brings fresh perspectives to our research group, a very strong quantitative background, and new analytical techniques. KNZ was sad to say goodbye to Dr. David Hartnett, who retired in July 2019. Dave's work on grassland population ecology over the past 30+ years provided a foundation for which most of our current research is based.

The infrastructure of KPBS and long-term data associated with KNZ were integral to the success of several new extramural awards funded during 2018-2019. KNZ PIs Nippert and Pam Sullivan received a ~\$500,000 award by NSF - Hydrological Sciences to investigate the consequences of woody plants replacing grasses in tallgrass prairie. Deeper roots associated with woody-encroachment are likely to enhance transport of water and carbon to greater depths and increase potential subsurface weathering. This research incorporates hydrologic sciences, ecology and geochemistry to better understand how water moves within the landscape, how roots modify subsurface flow paths, and how the replacement of grasses with woody plants may accelerate weathering in the karst landscapes of the Flint Hills. Nippert also was awarded a three-year \$299,000 grant funded by the NSF-Macrosystems Biology and NEON-Enabled Science program to work with a team of researchers to add new knowledge on anatomical and physiological grass species traits to enhance fundamental understanding of grass-dominated ecosystems. The research team will develop an integrative framework that organizes grass vegetation types around phylogeny-driven functional diversity. Data will come from environmental gradients in North America at select NEON and LTER sites. KNZ PI's Blair and Baer received \$392,655 from the NSF-DEB Population and Community Ecology cluster for an LTREB renewal for the Konza Heterogeneity Plots Restoration project. This research will extend a record of reconstructed prairie plant diversity and productivity in response to soil nutrients and depth that were altered to create variable conditions for more species to coexist, compared to soil conditions left unchanged and homogenized, following long-term tillage. The 25-year field experiment will test whether variation in the soil environment affects plant diversity and resilience of reconstructed ecosystems to climate variability and drought. These data will be used to test whether spatial heterogeneity in soil

resources sustains more diverse and variable plant communities over the long term and whether this ecological heterogeneity makes grassland resilience to drought less predictable.

Specific Objectives: These specific objectives are derived from goals and activities included in our original KNZ LTER VII proposal.

1. Maintain and expand core long-term experiments and data sets to better understand how natural and anthropogenic drivers (fire, grazing, climatic variability, nutrient availability and grassland restoration) affect grassland states and dynamics at multiple levels of ecological organization.
2. Evaluate the long-term rates, trajectories and underlying mechanisms/constraints of grassland response to altered drivers; with focus on drivers that past research has identified as most influential on ecological states.
3. Test complementary conceptual and theoretical models of ecosystem change over time, and identify mechanisms and feedback that support or differentiate directional, non-linear and threshold trajectories of change.
4. Measure grassland resilience to and recovery from altered drivers, identify feedbacks that support or constrain resilience and recovery, and understand whether recovery can be facilitated based on ecological principles.
5. Determine which abiotic and biotic factors regulate community assembly and ecosystem state changes in restored prairie.
6. Lead and participate in synthesis and cross-site research activities, to evaluate the fundamental controls on ecosystem resistance and resilience to changes in key drivers, both within and among different grasslands and biomes.
7. Continue to update KNZ LTER database to meet requirements for the LTER Network Information System. Provide up-to-date, accurate LTER data to KNZ investigators and to the broader scientific community as quickly and efficiently as possible.
8. Continue KNZ education and outreach activities to achieve our broader impact goals. Continue and expand on-site science activities and enlist new classes and students. Provide opportunities for undergraduate research experiences and continue to support graduate student research and training. Contribute LTER data to address relevant environmental issues (e.g., prescribed fires and air quality, land-use and water quality). Expand science and art interactions as a novel way of increasing awareness of and interest in grassland ecology and grassland conservation.

Significant Results: Please see the supporting .pdf files, which provide detailed information on the activities and findings of individual research projects which have contributed to the overall progress of LTER VII in 2018-2019.

Key outcomes or Other achievements: Please see the supporting .pdf files, which provide detailed information on the activities and findings of individual research projects which have contributed to the overall progress of LTER VII in 2018-2019.

*** What opportunities for training and professional development has the project provided?**

The Konza LTER program provides training and professional development opportunities at many levels, including K-12 teachers, undergraduate and graduate students, post-doctoral scientists from a number of different institutions, junior tenure-earning faculty members, and professional research staff. Below we summarize some of the recent and continuing opportunities provided by the KNZ program.

The Konza Prairie Schoolyard LTER (SLTER) program is in its 21st year as a science education program for K-12 teachers and their students, built around the successful Konza Prairie LTER program. The Konza Prairie SLTER program aims to educate students about ecology and global change, with emphasis on regional grasslands, by engaging students and teachers in realistic and relevant science-based activities focused on long-term data collection at our LTER site. These activities were designed to give students an understanding of ecology, provide them the opportunity to collect and interpret their own data. K-12 teachers who wish to bring their classes to Konza Prairie and to experience the Schoolyard LTER activities must first participate in a Summer Teachers' Workshop. This week-long program introduces the teachers to each of the activities offered by the Konza Environmental Education Program (KEEP) and, at the completion of the workshop, allows them to tailor an educational experience specific to the needs of their students. The teachers who complete the program qualify to bring their classes to Konza for no charge and have their bus transportation costs paid. This agreement stands for the rest of the teachers' professional career. These educators have become important partners in KEEP and many return annually. We have trained 109 area teachers since our program began in 1998. The number of SLTER student participants in 2018 (most recent year with complete data) was 850.

KEEP has partnered with the Manhattan/Ogden KS School District 383 to be a ready source of informal science education – specifically addressing core science concepts that are easily experienced during a Konza visit. To meet this need we train volunteer docents that assist in public education and outreach activities. New docents are added to the program annually and receive 40 hours of training on the history and ecology of the tallgrass prairie as well as an overview of research being conducted at Konza. Experienced docents regularly are apprised of new research programs and the progress of existing research and become ambassadors of science to the community. The KEEP program has trained over 300 docents (over 60 who are currently active). Additionally, we partner with the Flint Hills Discovery Center (Manhattan, KS) to co-host visiting school groups. Last year we hosted nearly 3,000 area students who participated in either a SLTER activity or a natural history activity.

The Konza LTER program continues to emphasize quality graduate student training. During the 2018-2019 funding period, we provided stipends and other forms of non-financial support (vehicle use, site use, analytical laboratory use, attendance at regional/national meetings) for 15 students, including both KSU and non-KSU graduate students. We continue to foster graduate research involving students attending Colorado State University, University of Kansas, Southern Illinois University, Oklahoma State University, and others. In 2018-2019, 13 thesis/dissertations were completed that included research conducted and data acquired from the Konza Prairie.

KNZ also offers research experiences for a large number of undergraduate students. In the summer of 2019, we supported four LTER REU students. A detailed account from each student is provided in the supplementary 'Findings' document included with this annual report. In addition to the REU students, the Konza LTER program provides hands-on research opportunities for ~45-50 undergraduate research assistants each year. These undergraduates are employed by KNZ LTER directly (as part of field crews collecting core LTER datasets) or indirectly in the labs of Konza faculty researchers. KNZ also supports and provides professional development opportunities for our professional research staff members, including training in the use of field and laboratory equipment, training in health and safety protocols, training in prescribed fire practices, and other relevant professional development.

KNZ has a strong history of providing mentoring and research training for recent PhD's and junior faculty members. Several former PhD students that completed dissertation projects on Konza are now post-docs or junior faculty at other institutions but continue to participate in, and in many cases, lead KNZ research projects. Within the past year, three of our postdocs have accepted academic faculty positions – Zak Ratajczak at Kansas State University, Allison Veach at University of Texas at San Antonio, and Nate Lemoine at Marquette. Former Konza LTER graduate students that continue to work at Konza as postdocs include Bram Verheijen (KSU), Ellen Welti (Oklahoma), Gabriel de Oliveira (KU), Robert Griffin-Nolan (Syracuse), Rory O'Connor (USGS) and Kim O'Keefe (Wisconsin-Madison). The KNZ program also provides resources and mentoring to new tenure-earning faculty members. In our current funding cycle, this includes assistant professors in Biology at KSU (Lydia Zeglin, Michi Tobler, Andrew Hope) and Agronomy at KSU (Eduardo Santos), as well as support for Pam Sullivan (Geography at KU), Sally Koerner (UNC-Greensboro), Meghan Avolio (John Hopkins), Kevin Wilcox (University of Wyoming), and Kim Komatsu (Smithsonian Environmental Research Center).

*** How have the results been disseminated to communities of interest?**

Konza LTER results are disseminated to the scientific community via publications in peer-reviewed literature, through presentations at professional meetings and workshops, through seminars by KNZ scientists and students, through social media (Twitter, Facebook, Researchgate), and via the KNZ and KPBS websites. In addition, KNZ scientists have participated in a broad range of activities that go beyond the scientific community. For example, KNZ data and findings are used in a

number of undergraduate and graduate courses at Kansas State University, the University of Kansas, University of Arizona, Colorado State University, University of Oklahoma, among others. In addition, KNZ findings are increasingly utilized in undergraduate ecology texts and supplementary teaching material. For example, KNZ long-term studies were used to demonstrate the role of fire and grazing in grasslands in 'General Ecology, 2nd edition' by D.T. Krohne, and as an example of the importance of long-term research in the 'Ecology' text by Cain et al. ('Life. The Science of Biology. 7th edition' by Purves, Sadva, Orians and Heller) and KNZ data and findings are highlighted in several upper-level and graduate texts including 'Freshwater Ecology' (W.K. Dodds), 'The Ecology of Plants' (Gurevitch, Scheiner and Fox), and 'Biogeochemistry. An Analysis of Global Change' (W.H. Schlesinger).

Data and insight from the Konza LTER program is being used by resource managers for effective land stewardship. Currently, our research concerning the role of seasonal burning and fire intensity on woody encroachment is being used to inform the Great Plains Fire Science Exchange (www.gpfirescience.org) and the Tallgrass Prairie and Oak Savanna Fire Science Consortium (www.tposfirescience.org). Both of these non-profit groups focus on conservation issues and land management of Midwestern grasslands. In addition, many of the Konza investigators serve as scientific consultants for a regional cultural and natural history center, the 'Flint Hills Discovery Center' in Manhattan, KS.

In the interest of increasing the reach of our environmental education program to classrooms around the world, KEEP is working to develop online curriculum utilizing LTER data. We currently have two separate activities that ask students to look at bison weight data and answer specific questions about what the data are telling them. The activities ask students to graph the data and make predictions about future bison weights indicating how environmental conditions might affect the data. Additional online curriculum is in development and will reflect the story arc of The Autumn Calf children's book from the SLTER book series.

In 2019, KNZ scientists and graduate students participated in numerous public outreach events designed to enhance the understanding of LTER science and dissemination of important findings. KNZ investigators presented research findings at local Science Café meetings, as well as 'Science on Tap' at Tallgrass Taphouse. KNZ investigators, Nippert and Hope delivered research talks to other KSU departments. Several KNZ investigators participate in the Kansas Science Communications Initiative, which is teaching scientists how to better communicate their findings to the public. KNZ graduate students at KSU are instrumental in maintaining a blog entitled Science Snapshots (<https://sciencesnapshots.com>), where students post entries covering other student's research. KNZ lead investigator, Nippert, spoke about climate change in the tallgrass prairie on NPR station affiliate KCUR in Kansas City. Our local art museum (Beach Museum of Art) has a Prairie Studies Initiative (<http://beach.k-state.edu/prairiestudies>). KNZ scientist, Blair, has acted as consultant, participant, and speaker at many Prairie Studies outreach events. Several other broader impacts and scientific extensions from Konza LTER program are discussed in further detail in the 'Broader Impacts' section of this annual report.

*** What do you plan to do during the next reporting period to accomplish the goals?**

During the last year of this funding cycle (Year 6 of LTER VII: 2019-2020), we will: 1) complete the collection, processing, and online data integration of the current year sample collection; 2) continue to update and error-check the online data associated with KNZ LTER database and LTER network information management system; 3) continue to improve our data accessibility and search options within our online database; 4) continue to support the development of new research projects initiated by KNZ junior faculty including Pam Sullivan (KU), Meghan Avolio (Johns Hopkins), Sally Koerner (UNC-Greensboro), Kim Komatsu (Smithsonian), Andrew Hope (KSU), Kevin Wilcox (Wyoming), Abby Langston (KSU), Zak Ratajczak (KSU) and Allison Louthan (KSU); 5) promote educational training and inclusion of undergraduate researchers within site science; 6) invest in the training and development of our graduate student researchers at KNZ, contribute towards their career advancement, and engage them in synthesis activities available within the broader LTER network; 7) continue to provide leadership and participation in LTER network level activities including the 2020 spring Science Council, and the LTER Executive Board, Education and Information Management working groups; 8) plan, prepare, and submit the best possible LTER VIII proposal that our research group can produce.

Supporting Files

Filename	Description	Uploaded By	Uploaded On

Filename	Description	Uploaded By	Uploaded On
2018-2019_activities_final.pdf	Please see the supporting .pdf files, which provide detailed information on the activities and findings of individual research projects which have contributed to the overall progress of LTER VII in 2018-2019.	Jesse Nippert	09/26/2019
2018-2019 KNZ LTER Findings.pdf	Please see the supporting .pdf files, which provide detailed information on the activities and findings of individual research projects which have contributed to the overall progress of LTER VII in 2018-2019.	Jesse Nippert	09/26/2019

Products

Books

Hooten, M.B. and T.J. Hefley (2019). *Bringing Bayesian Models to Life* Chapman and Hall/CRC Press. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; ISBN: 9780429243653

W. K. Dodds (2019). *Concepts and Environmental Applications of Limnology 3*. Whiles, Matt. Elsevier. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; ISBN: 9780128132562

Book Chapters

Baer, SG, Birge, H (2018). Soil ecosystem services: an overview. *Managing Soil Health for Sustainable Agriculture* 1. Reicosky, D.. Burleigh Dodds Science Publishing Limited. Cambridge. 17. Status = PUBLISHED; Acknowledgement of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.19103/AS.2017.0033.02.

Ratajczak, Z. and L. Ladwig (2019). Will climate change push grasslands past critical thresholds?. *Grasslands and Climate Change* Gibson, D. and Newman, J.. British Ecological Society and Cambridge Universit. Cambridge, UK.. 98 - 114. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Inventions

Journals or Juried Conference Papers

Avolio, ML, Carrol, I, Collins, SL, Houseman, G, Hallett, LM, Isbell, F, La Pierre, KJ, Koerner, SE, Smith, MD, Wilcox KR (). Metrics for analyzing community changes based on changes in rank abundance curves. *Ecosphere*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Avolio, ML, Forrestel, EJ, Chang, CC, La Pierre, KJ, Burghardt, KT, Smith, MD (2019). Demystifying dominant species. *New Phytologist*. 223 (3), 1106. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/nph.15789

Bachle, S, Griffith, DM, Nippert, JB (). Intraspecific trait variability in *Andropogon gerardii*, a dominant grass species in the US Great Plains. *Frontiers in Ecology and Evolution*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes ; DOI: <https://doi.org/10.3389/fevo.2018.00217>

Bachle, Seton. and Jesse B. Nippert (2018). Physiological and anatomical trait variability of dominant C4 grasses. *Acta Oecologica*. 93 14 - 20. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1016/j.actao.2018.10.007

Baer, S.G., T. Adams, D.A. Scott, J.M. Blair and S.L. Collins (). Soil heterogeneity increases plant diversity after twenty years of manipulation during grassland restoration.. *Ecological Applications*. . Status = ACCEPTED; Acknowledgment of Federal Support = Yes

Baer, SG, Gibson, DJ, Johnson, LC (2019). Restoring grassland in the context of climate change. *Grasslands and Climate Change*. . Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Baker, K.R. and Koplitz, S.N. and Foley, K.M. and Avey, L. and Hawkins, A. (2019). Characterizing grassland fire activity in the Flint Hills region and air quality using satellite and routine surface monitor data. *Science of The Total Environment*. 659 1555 - 1566. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.scitotenv.2018.12.427

Borer, E. T. and Lind, E. M. and Firn, J. and Seabloom, E. W. and Anderson, T. M. and Bakker, E. S. and Biederman, L. and Kimberly J. La Pierre and MacDougall, A. S. and Moore, J. L. and Risch, A. C. and Schimel, D. T. and Uhlir, M. and Stevens, C. J. (2019). More salt, please: global patterns, responses and impacts of foliar sodium in grasslands. *Ecology Letters*. 22 1136 - 1144. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1111/ele.13270

C. M. Carson, A. Jumpponen, J. M. Blair and L. H. Zeglin (2019). Soil fungal community changes in response to long-term fire cessation and N fertilization in tallgrass prairie. *Fungal Ecology*. 41 45. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1016/j.funeco.2019.03.002

Caplan, JS, Gimenez, D, Hirmas, DR, Brunzell, NA, Blair, JM, Knapp, AK (2019). Decadal-scale shifts in soil hydraulic properties induced by altered precipitation. *Science Advances*. 5 (9), eaau6635. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; DOI: 10.1126/sciadv.aau6635

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Shaffer, Monica. *The ecology of grazing lawns on the tallgrass prairie.* (2019). Kansas State University. Acknowledgement of Federal Support = Yes

Adams, T.J.. *The role of soil heterogeneity in the recruitment of new species and interactions with grasshoppers (Acrididae) and Katydid (Tettigoniidae) in restored prairie.* (2017). Southern Illinois University, Carbondale. Acknowledgement of Federal Support = Yes

Frenette, Bryan. *The thermal ecology of prairie stream fishes.* (2019). Kansas State University. Acknowledgement of Federal Support = Yes

Websites

Konza LTER project website

<http://lter.konza.ksu.edu/>

This is the main website for the KNZ LTER project, and includes links to KNZ documents, databases, and publications.

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Nippert, Jesse	PD/PI	4
Baer, Sara	Co PD/PI	4
Blair, John	Co PD/PI	2
Dodds, Walter	Co PD/PI	2
Avolio, Meghan	Co-Investigator	1
Boyle, Alice	Co-Investigator	1
Briggs, John	Co-Investigator	1
Brunsell, Nathaniel	Co-Investigator	1

Name	Most Senior Project Role	Nearest Person Month Worked
Collins, Scott	Co-Investigator	1
Gido, Keith	Co-Investigator	1
Hartnett, David	Co-Investigator	2
Hope, Andrew	Co-Investigator	1
Horne, Eva	Co-Investigator	1
Jensen, William	Co-Investigator	1
Jumponnen, Ari	Co-Investigator	1
Knapp, Alan	Co-Investigator	2
Koerner, Sally	Co-Investigator	1
Komatsu, Kimberly	Co-Investigator	1
Lee, Sonny	Co-Investigator	1
Louthan, Allison	Co-Investigator	1
Macpherson, Gwendolyn	Co-Investigator	2
Olson, KC	Co-Investigator	1
Ratajczak, Zak	Co-Investigator	1
Rice, Charles	Co-Investigator	1
Santos, Eduardo	Co-Investigator	1
Smith, Melinda	Co-Investigator	2
Sullivan, Pam	Co-Investigator	1
Whiles, Matt	Co-Investigator	1
Wilcox, Kevin	Co-Investigator	1
Wilson, Gail	Co-Investigator	1
Zeglin, Lydia	Co-Investigator	1
Zolnerowich, Gregory	Co-Investigator	1

Name	Most Senior Project Role	Nearest Person Month Worked
Carter, Tiffany	Faculty	1
Ferguson, Carolyn	Faculty	1
Goodin, Douglas	Faculty	1
Greer, Mitch	Faculty	1
Hutchinson, Stacy	Faculty	1
Johnson, Loretta	Faculty	1
Kaufman, Donald	Faculty	1
Langston, Abigail	Faculty	1
Mather, Martha	Faculty	1
Mayfield, Mark	Faculty	1
Moore, Trisha	Faculty	1
Ocheltree, Troy	Faculty	1
Ransom, Michel	Faculty	1
Ricketts, Drew	Faculty	1
Sandercock, Brett	Faculty	1
Tobler, Michi	Faculty	1
Todd, Timothy	Faculty	1
Veach, Allison	Faculty	1
Frennette, Bryan	K-12 Teacher	1
de Oliveria, Gabriel	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Griffin-Nolan, Robert	Postdoctoral (scholar, fellow or other postdoctoral position)	1
O'Conner, Rory	Postdoctoral (scholar, fellow or other postdoctoral position)	1

Name	Most Senior Project Role	Nearest Person Month Worked
Verheijen, Bram	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Welti, Ellen	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Blackmore, Pam	Other Professional	5
Haukos, Jill	Other Professional	12
Rhodes, Jennifer	Other Professional	12
Xia, Yang	Other Professional	12
Allenbrand, Jaide	Graduate Student (research assistant)	1
Bachle, Seton	Graduate Student (research assistant)	1
Bartmess, Michael	Graduate Student (research assistant)	1
Black, Sarah	Graduate Student (research assistant)	1
Bloodworth, Kathryn	Graduate Student (research assistant)	1
Broderick, Caitlin	Graduate Student (research assistant)	1
Chaves Rodriguez, Francis	Graduate Student (research assistant)	1
Connell, Kent	Graduate Student (research assistant)	1
Duell, Eric	Graduate Student (research assistant)	1
Eckhoff, Kathryn	Graduate Student (research assistant)	1
Felton, Andrew	Graduate Student (research assistant)	1
Fralick, Kasey	Graduate Student (research assistant)	1
Fulgoni, Jessica	Graduate Student (research assistant)	1
Gray, Jesse	Graduate Student (research assistant)	1
Gunnip, James	Graduate Student (research assistant)	1
Higgs, Sophie	Graduate Student (research assistant)	1
Hoffman, Ava	Graduate Student (research assistant)	1

Name	Most Senior Project Role	Nearest Person Month Worked
Nieland, Matthew	Graduate Student (research assistant)	1
Norwood, Brock	Graduate Student (research assistant)	1
Rivera-Zayas, Johanie	Graduate Student (research assistant)	1
Santos, Marshall	Graduate Student (research assistant)	1
Scott, Drew	Graduate Student (research assistant)	1
Shaffer, Monica	Graduate Student (research assistant)	3
Siders, Adam	Graduate Student (research assistant)	1
Slette, Ingrid	Graduate Student (research assistant)	1
Smith, Dylan	Graduate Student (research assistant)	1
Vilonen, Leena	Graduate Student (research assistant)	1
Wedel, Emily	Graduate Student (research assistant)	1
Wiggam-Ricketts, Shelly	Graduate Student (research assistant)	1
Wilson, Luci	Graduate Student (research assistant)	1
Winnicki, Sarah	Graduate Student (research assistant)	1
Zaricor, Marissa	Graduate Student (research assistant)	1
Kuhl, Amanda	Non-Student Research Assistant	12
Sandwick, Mark	Non-Student Research Assistant	9
Taylor, Jeff	Non-Student Research Assistant	12
Tobler, Courtney	Non-Student Research Assistant	12
Arun, Aditi	Research Experience for Undergraduates (REU) Participant	1
Duarte, Miguel	Research Experience for Undergraduates (REU) Participant	1
Turnley, Matt	Research Experience for Undergraduates (REU) Participant	1

Name	Most Senior Project Role	Nearest Person Month Worked
Vega Anguiano, Nicholas	Research Experience for Undergraduates (REU) Participant	1

Full details of individuals who have worked on the project:

Jesse B Nippert

Email: nippert@ksu.edu

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 4

Contribution to the Project: Dr. Nippert is the Konza Prairie LTER lead PI and project director. Provides overall LTER project leadership and coordination. He contributes expertise in plant ecology and ecophysiology, and plant responses to environmental variability and change. Dr. Nippert oversees the application of environmental sensor networks to assess spatial variability in microclimate, and plant responses on core LTER watersheds at the Konza Prairie LTER site. He is responsible for wood plant encroachment studies, and also directs the KSU Stable Isotope Mass Spectroscopy Laboratory, and provides expertise on the application of stable isotopes to ecological studies.

Funding Support: DOE: Using root and soil traits to forecast woody encroachment dynamics in mesic grasslands

International Collaboration: Yes, South Africa

International Travel: No

Sara G Baer

Email: sgbaer@ku.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 4

Contribution to the Project: Dr. Baer is a project co-PI and provides expertise on grassland restoration, particularly with respect to plant community dynamics and long-term changes in ecosystem properties and processes. She is responsible for directing research on grassland restoration ecology at the Konza site, including recovery of ecosystem properties in restored grasslands, and the influence of genotypic differences in cultivars and native vegetation on ecological processes in restored grasslands. Dr. Baer oversees the new Restoration Chronosequence study as part of the LTER VII project. Supported with a subcontract to Southern Illinois University.

Funding Support: NSF LTREB: The role of ecological heterogeneity in a long-term grassland restoration experiment. Provides partial support for a related restoration experiment initiated with non-LTER funds.

International Collaboration: No

International Travel: No

John M Blair

Email: jblair@ksu.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Konza LTER investigator and Director of the Konza Biological Station (the primary research site for the Konza LTER program) (became director in July 2018). Research expertise in ecosystem ecology and terrestrial biogeochemistry; soil ecology, including decomposition, soil nutrient cycling, litter/soil/plant nutrient dynamics; effects of climate change and other disturbances on ecosystem processes; ecology of soil invertebrates; and restoration ecology.

Funding Support: LTREB: The Role of Ecological Heterogeneity in a Long-Term Grassland Restoration Experiment

International Collaboration: No

International Travel: No

Walter K Dodds

Email: wkdodds@ksu.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Konza LTER Co-PI. Dr. Dodds provides leadership for the Konza LTER aquatic research group. Research expertise in aquatic ecology; phycology; nutrient cycling and retention in streams; groundwater chemistry; watershed-level hydrologic export; water quality. Dr. Dodds is also leading the riparian vegetation removal study as part of the LTER VII funding cycle. This study assess the impacts of riparian land-cover change on grassland streams.

Funding Support: NSF EPSCoR MAPS

International Collaboration: Yes, Brazil

International Travel: No

Meghan Avolio

Email: megan.avolio@gmail.com

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Former Ph.D. student at Yale University (Advisor: Melinda Smith). Research on grassland plant communities, mycorrhizae, climate change, nitrogen deposition, and genetic structure of plant communities. Currently an assistant professor at John Hopkins University

Funding Support: None.

International Collaboration: No

International Travel: No

Alice Boyle

Email: aboyle@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in bird ecology and physiology; particular interest in reproduction, dispersal and energetics.

Funding Support: NSF: What are the environmental causes of population variability of highly mobile animals.

International Collaboration: No

International Travel: No

John M Briggs

Email: jbriggs1@k-state.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Former Konza LTER investigator and Director of the Konza Prairie Biological Station (the primary research site for the Konza LTER program). Dr. Briggs oversaw studies of grass-shrub interactions and the causes and consequences of woody plant encroachment into grasslands. Directed research into patterns and controls of

ANPP in grasslands, as well as studies of the relationship between ANPP and species richness. Also provided expertise in database management, GIS and remote sensing studies. Dr. Briggs retired from KSU in July 2018.

Funding Support: None

International Collaboration: No

International Travel: No

Nathaniel Brunsell

Email: brunsell@ku.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in ecosystem and global C and water flux measurement and modeling; coordinates collection and analysis of data from the Ameriflux towers located on Konza Prairie.

Funding Support: None.

International Collaboration: No

International Travel: No

Scott Collins

Email: scollins@sevilleta.unm.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in grassland ecology and plant community ecology; ecological analyses of spatial and temporal dynamics; ecological responses to disturbance; analysis of species distribution and abundance; local-regional interactions; productivity-diversity relationships.

Funding Support: NSF Savannah Convergence Project LTREB: The Role of Ecological Heterogeneity in a Long-Term Grassland Restoration Experiment

International Collaboration: Yes, South Africa

International Travel: No

Keith Gido

Email: kgido@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Provides expertise in aquatic ecology; stream communities and ecosystems; the effects of fish on stream ecosystem properties such as primary productivity, nutrient cycling, community structure (species richness and diversity), decomposition and transport of particulate organic matter (POM); impacts of altered hydrologic regimes on stream ecosystems. Oversees the LTER experimental stream facility. Coordinates regional assessments of stream fish communities.

Funding Support: NSF Macrosystem Project: Scale, Consumers, and Lotic Ecosystem Rates (SCALER): from decimeters to continents NSF Dissertation Research: Forecasting Global Warming Effects on Developmental Performance of Prairie Stream Fishes along the River Continuum.

International Collaboration: Yes, Australia

International Travel: No

David C Hartnett

Email: dchart@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Expertise in grassland plant population ecology; the role of belowground bud banks in grassland communities; plant mycorrhizal interactions in grasslands; plant-herbivore interactions; fire ecology. Also involved in ILTER activities, and Co-Director of the Institute for Grassland Studies.

Funding Support: None.

International Collaboration: Yes, Botswana

International Travel: No

Andrew Hope

Email: ahope@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in mammalogy; particularly phylogeography, speciation and climate impacts on evolutionary mechanisms of community assembly.

Funding Support: None.

International Collaboration: No

International Travel: No

Eva Horne

Email: ehorne@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Research in behavioral ecology of grassland reptiles; responses of reptile and amphibian populations to fire and grazing. Dr. Horne also assists with administration of the Konza Prairie Biological Station, and coordination of research permits and projects at the site.

Funding Support: None.

International Collaboration: No

International Travel: No

William Jensen

Email: wjensen1@emporia.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Jensen is an Associate Professor at Emporia State University. He is studying the effects of patch-burn grazing on brood parasitism of Dickcissel nests in the Flint Hills tallgrass prairie, and is responsible for collecting data on avian consumer responses to the patch-burn grazing experiment..

Funding Support: None.

International Collaboration: No

International Travel: No

Ari Jumponen

Email: ari@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise on fungal ecology, particularly mycorrhizae and other endophytic fungi; diversity of soil microbial communities; application of molecular methods to characterize soil microbial communities.

Funding Support: None.

International Collaboration: No

International Travel: No

Alan Knapp

Email: alan.knapp@colostate.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Provides research expertise in grassland ecology, plant ecology, physiological ecology, global change studies, plants-herbivore interactions, invasive species ecology. Dr. Knapp also provides leadership for LTER studies of plant productivity and responses to climatic variability and climate change, and conducts multi-site research involving SGS and KNZ LTER sites. Supported by a subcontract to Colorado State University.

Funding Support: NSF Savannah Convergence Project USDA Foundational research for managing forage production in semi-arid grasslands: preparing for a future with increased climate variability

International Collaboration: Yes, South Africa

International Travel: No

Sally Koerner

Email: sally.koerner@uncg.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Koerner is an assistant professor at the University of North Carolina Greenboro. Her research interests include ecology (community, ecosystem and plant ecology); drivers of biodiversity across spatial scales and through time.

Funding Support: None.

International Collaboration: No

International Travel: No

Kimberly Komatsu

Email: lapierrek@si.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Former PhD student from Yale University. Dr. La Pierre is currently a principal investigator, senior scientist at the Smithsonian Environmental Research Center. Her research areas consists of animal plant interactions, biodiversity, climate change, ecology, ecosystem function, ecosystem services, global change, herbivores, insects, invasive species, nutrient pollution, plant ecology, and terrestrial ecology.

Funding Support: None

International Collaboration: No

International Travel: No

Sonny Lee**Email:** leet1@ksu.edu**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 1**Contribution to the Project:** New Professor in the KSU Division of Biology. Interest include: metagenomics, bioinformatics, microbial ecology, microbial diversity and cultivation.**Funding Support:** None**International Collaboration:** No**International Travel:** No**Allison Louthan****Email:** allisonmlouthan@gmail.com**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 1**Contribution to the Project:** New professor in the KSU Division of Biology.**Funding Support:** None**International Collaboration:** No**International Travel:** No**Gwendolyn Macpherson****Email:** glmac@ku.edu**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 2**Contribution to the Project:** Expertise in hydrogeology; subsurface hydrology; long-term studies of groundwater flux and biogeochemistry at Konza LTER site. Supported by a subcontract to the University of Kansas.**Funding Support:** None.**International Collaboration:** No**International Travel:** No**KC Olson****Email:** kcolson@ksu.edu**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 1**Contribution to the Project:** KC Olson is a professor of animal science, who brings expertise on the physiology and management of cattle in mesic grasslands. Dr. Olson is an active participant in the new patch-burn grazing study, and will oversee assessment of animal performance as a management-related aspect of this LTER study.**Funding Support:** None.**International Collaboration:** No**International Travel:** No**Zak Ratajczak****Email:** zaratajczak@gmail.com**Most Senior Project Role:** Co-Investigator**Nearest Person Month Worked:** 1

Contribution to the Project: Former PhD student working with Jesse Nippert. Research area involves woody encroachment. Will be new professor in Division of Biology at Kansas State University.

Funding Support: NSF Postdoctoral Fellowship - Tipping points and ecosystem resilience

International Collaboration: No

International Travel: No

Charles Rice

Email: cwrice@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in soil microbial ecology; responses of grassland microbial communities to fire, grazing climatic variability; soil C and N dynamics; denitrification in grasslands; effects of management on soil C sequestration. Contributor and author for IPCC AR4.

Funding Support: NSF EPSCoR MAPS

International Collaboration: No

International Travel: No

Eduardo Santos

Email: esantos@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Micro-meteorology and measurements of carbon and water fluxes from grassland. Expertise in eddy flux techniques and stable isotope analyses.

Funding Support: None

International Collaboration: No

International Travel: No

Melinda Smith

Email: melinda.smith@colostate.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 2

Contribution to the Project: Associate Professor at Colorado State University conducting research on plant population and community dynamics at Konza Prairie, and the impacts of climate change. Directs site-based activities related to the multi-site Nutrient Network (NutNet) project.

Funding Support: NSF Savannah Convergence Project USDA Foundational research for managing forage production in semi-arid grasslands: preparing for a future with increased climate variability

International Collaboration: No

International Travel: No

Pam Sullivan

Email: pamela.sullivan@oregonstate.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: As an ecohydrologist, Dr. Sullivan is interested in investigating the interactions between climate, vegetation and geology on freshwater resources over different temporal and spatial scales.

Funding Support: None

International Collaboration: No

International Travel: No

Matt Whiles

Email: mwhiles@ufl.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in invertebrate ecology; research focused on assessment of patterns and controls of secondary productivity in grassland streams; ecology of soil invertebrates in grasslands. Participant in new riparian vegetation removal experiment.

Funding Support: NSF Macrosystem Project: Scale, consumers, and Lotic Ecosystem Rates (SCALER): from decimeters to continents Missouri Department of Conservation Grant: Biotic integrity of prairie streams as influenced by patch burn grazing and riparian protection

International Collaboration: No

International Travel: No

Kevin Wilcox

Email: wilcoxkr@gmail.com

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Professor at University of Wyoming. Research focuses on global change and land use impacts on plant community dynamics, primary productivity, and biogeochemical cycles.

Funding Support: DOE: Using root and soil traits to forecast woody encroachment dynamics in mesic grasslands

International Collaboration: No

International Travel: No

Gail Wilson

Email: gail.wilson@okstate.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Gail Wilson provides expertise on the role of mycorrhizal fungi in grasslands, and is responsible for long-term studies of the impacts of of mycorrhizal fungi on plant community dynamics and on soil structure and C storage in grasslands. She is supported with subcontract to Oklahoma State University.

Funding Support: None.

International Collaboration: No

International Travel: No

Lydia Zeglin

Email: lzeglin@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Provides expertise in molecular microbial ecology; taxonomic and functional diversity of soil and stream microbiota in the context of ecosystem N and C cycles.

Funding Support: Kansas NSF EPSCoR First Award: Microbial mechanisms of drought tolerance and the implications for grassland soil carbon storage DOE: Using root and soil traits to forecast woody encroachment dynamics in mesic grassland

International Collaboration: No

International Travel: No

Gregory Zolnerowich

Email: gregz@ksu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in grassland insect biodiversity and insect systematics, particularly of parasitic wasps. Dr. Zolnerowich oversees the KSU Museum of Entomological and Prairie Arthropod Research, and provides expertise on electronic databasing of biological collections.

Funding Support: None.

International Collaboration: No

International Travel: No

Tiffany Carter

Email: cartert@apsu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Former PhD student of Dr. Charles Rice. New professor at Austin Peay State University.

Funding Support: None

International Collaboration: No

International Travel: No

Carolyn Ferguson

Email: ferg@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in plant systematics, plant population biology, and plant-pollinator interactions. Dr. Ferguson oversees the KSU Herbarium, and also provides expertise on electronic databasing of biological collections. Dr. Ferguson is also PI of GK-12 grant, which includes students and faculty scientists from the Konza LTER program.

Funding Support: None.

International Collaboration: No

International Travel: No

Douglas Goodin

Email: dgoodin@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Provides expertise on remote sensing of ecological data, including patterns of plant productivity and spatial distributions of grazing and fire effects; research on climatology in the Central Plains (Dr. Goodin serves on the LTER Climate Committee); research on the impacts of burning on air quality.

Funding Support: NSF: Impacts of Spatially Heterogeneous Nitrogen to Grazer Distribution and Activity: Effects on Ecosystem Function in Tallgrass Prairie

International Collaboration: No

International Travel: No

Mitch Greer

Email: mjgreer@fhsu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in grassland ecology and range management.

Funding Support: None.

International Collaboration: No

International Travel: No

Stacy Hutchinson

Email: sllhutch@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Hutchinson is a Professor of Biological and Agricultural Engineering, and has assumed responsibility for overseeing the water addition treatments and soil moisture monitoring in the long-term Irrigation Transect Experiment at the Konza site. This was previously the responsibility of Dr. Jim Koelliker until his retirement in 2010

Funding Support: None.

International Collaboration: No

International Travel: No

Loretta Johnson

Email: johnson@k-state.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Provides research expertise in plant ecology, plant-soil interactions, and ecological genomics. Oversees a long-term water x N amendment experiment at Konza Prairie, and a cross-site study of the impacts of climate on success of local vs. non-local ecotypes of dominant grasses.

Funding Support: None.

International Collaboration: No

International Travel: No

Donald Kaufman

Email: dwkaufman@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Research focus is on the ecology of small mammals, and temporal and spatial dynamics of consumer populations in grasslands.

Funding Support: None.

International Collaboration: No

International Travel: No

Abigail Langston

Email: alangston@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Professor in the KSU Department of Geology. Dr. Langston's core areas of geographic research are in quantitative geomorphology and landscape evolution modeling.

Funding Support: None

International Collaboration: No

International Travel: No

Martha Mather

Email: mmather@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in fish ecology and management with focus on Great Plains taxa.

Funding Support: None.

International Collaboration: No

International Travel: No

Mark Mayfield

Email: markherb@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in plant systematics.

Funding Support: None.

International Collaboration: No

International Travel: No

Trisha Moore

Email: tlcmoore@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in environmental engineering with a focus on ecohydrology and water and carbon cycling.

Funding Support: None

International Collaboration: No
International Travel: No

Troy Ocheltree

Email: Troy.Ocheltree@colostate.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in range ecology; particularly plant-water relations.

Funding Support: None

International Collaboration: No

International Travel: No

Michel Ransom

Email: mdransom@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in pedogenesis and soil mineralogy.

Funding Support: None.

International Collaboration: No

International Travel: No

Drew Ricketts

Email: arickett@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Former PhD student (advisor, Brett Sandercock) working with small mammal responses to patch burn grazing. Currently, assistant professor of Wildlife and Outdoor Management at Kansas State University.

Funding Support: None.

International Collaboration: No

International Travel: No

Brett Sandercock

Email: brett.sandercock@nina.no

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in bird ecology and conservation; particular interest in prairie chickens, shorebirds and grassland management impacts

Funding Support: None.

International Collaboration: No

International Travel: No

Michi Tobler

Email: tobler@ksu.edu

Most Senior Project Role: Faculty
Nearest Person Month Worked: 1

Contribution to the Project: Dr. Tobler studies the adaptation and speciation, fish biology, and extreme environments.

Funding Support: None

International Collaboration: No

International Travel: No

Timothy Todd

Email: nema@ksu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Expertise in nematode ecology; particularly plant-nematode interactions and soil food web dynamics.

Funding Support: None.

International Collaboration: No

International Travel: No

Allison Veach

Email: allison.veach@utsa.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: New professor at University of Texas at San Antonio. Research focuses on quantifying the variation in microbial community structure and its significance to ecosystem health.

Funding Support: Kansas NSF EPSCoR First Award: Microbial mechanisms of drought tolerance and the implications for grassland soil carbon storage

International Collaboration: No

International Travel: No

Bryan Frenette

Email: frenette@k-state.edu

Most Senior Project Role: K-12 Teacher

Nearest Person Month Worked: 1

Contribution to the Project: Advised by Keith Gido. Studies trophic dynamics in grassland streams. Received PhD in Spring 2019. Now a science teacher.

Funding Support: None.

International Collaboration: No

International Travel: No

Gabriel de Oliveria

Email: gabrieloliveira@ku.edug

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Postdoc of Nate Brunsell

Funding Support: None

International Collaboration: No

International Travel: No

Robert Griffin-Nolan

Email: robertgn13@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Former PhD student (Advisor, Alan Knapp) working on plant physiological responses to drought and ecosystem drought sensitivity. Received PhD in 2019. Now postdoc at Syracuse University.

Funding Support: None.

International Collaboration: No

International Travel: No

Rory O'Conner

Email: ro.c.oconnor@gmail.com

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Former PhD student (Advisor, Jesse Nippert) working on the mechanisms of woody plant establishment in grasslands. Received PhD in 2019. Now post doc with the U.S. Geological Survey, Idaho.

Funding Support: None

International Collaboration: No

International Travel: No

Bram Verheijen

Email: bramverheijen@ksu.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Postdoc research associate with Dr. Dave Haukos at KSU.

Funding Support: None.

International Collaboration: No

International Travel: No

Ellen Welti

Email: welti@ou.edu

Most Senior Project Role: Postdoctoral (scholar, fellow or other postdoctoral position)

Nearest Person Month Worked: 1

Contribution to the Project: Former PhD student (Advisor, Tony Joern) working on mechanisms of food web stability. Currently is a postdoc at University of Oklahoma.

Funding Support: None

International Collaboration: No

International Travel: No

Pam Blackmore**Email:** pblackmore@ksu.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 5**Contribution to the Project:** GIS Specialist. Interests include: spatial analysis, global positioning system, geographic information system, graphic design, and cartography.**Funding Support:** None**International Collaboration:** No**International Travel:** No**Jill Haukos****Email:** jhaukos@ksu.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 12**Contribution to the Project:** Director of the Konza Education Program (KEEP). Jill directs the K-12 education program, including the Konza Prairie SLTER program and serves as the KNZ LTER education representative for LNO activities. Jill also oversees the Konza docent program and some of the public outreach activities.**Funding Support:** Konza Prairie Biological Station**International Collaboration:** No**International Travel:** No**Jennifer Rhodes****Email:** jenniferrhodes@ksu.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 12**Contribution to the Project:** Program coordinator and event planner.**Funding Support:** None**International Collaboration:** No**International Travel:** No**Yang Xia****Email:** yangx@ksu.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 12**Contribution to the Project:** LTER Information Manager. Responsibilities include data management, database design and implementation, and overseeing KNZ LTER computer network activities.**Funding Support:** None.**International Collaboration:** No**International Travel:** No**Jaide Allenbrand****Email:** jallenbrand@ksu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Dr. Lydia Zeglin

Funding Support: None

International Collaboration: No

International Travel: No

Seton Bachle

Email: sbachle@ksu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD Student with Jesse Nippert. Studies drought tolerance of grasses.

Funding Support: None

International Collaboration: No

International Travel: No

Michael Bartmess

Email: mbartmes@k-state.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: John Blair

Funding Support: None

International Collaboration: No

International Travel: No

Sarah Black

Email: sarah.black@siu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Graduate student of Dr. Sara Baer. Studies insect communities in restored tallgrass prairie and if/how herbivory shapes plant community.

Funding Support: None

International Collaboration: No

International Travel: No

Kathryn Bloodworth

Email: bloodworthk@si.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Meghan Avolio

Funding Support: None

International Collaboration: No

International Travel: No

Caitlin Broderick

Email: cbrods21@ksu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: John Blair

Funding Support: None

International Collaboration: No

International Travel: No

Francis Chaves Rodriguez

Email: fachaves@rams.colostate.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student (Advisor, Melinda Smith) studying the influence of species diversity and dominance on community structure and ecosystem function.

Funding Support: None.

International Collaboration: No

International Travel: No

Kent Connell

Email: rkconnell@k-state.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student. Works with John Blair. Kent studies microbial dynamics and regulation of biogeochemical cycling.

Funding Support: None

International Collaboration: No

International Travel: No

Eric Duell

Email: eric.duell@okstate.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Dr. Gail Wilson. Research focus: plant ecology, grassland ecology, global change ecology

Funding Support: None

International Collaboration: No

International Travel: No

Kathryn Eckhoff

Email: kathryn.d.eckhoff@siu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Sara Baer

Funding Support: None

International Collaboration: No

International Travel: No

Andrew Felton

Email: felton12392@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student (Advisor, Melinda Smith) studying climate effects on plant community structure and function. Received his PhD within the last year.

Funding Support: None

International Collaboration: No

International Travel: No

Kasey Fralick

Email: fralickk@siu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Matt Whiles

Funding Support: None

International Collaboration: No

International Travel: No

Jessica Fulgoni

Email: jfulgoni@siu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student at SIU. She is examining the effects of patch-burn grazing on macroinvertebrate assemblages.

Funding Support: None

International Collaboration: No

International Travel: No

Jesse Gray

Email: Jesse.Gray@colostate.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student (Advisor, Melinda Smith) studying trait-mediated effects of diversity at different scales and consequences for ecosystem function.

Funding Support: None.

International Collaboration: No

International Travel: No

James Gunnip

Email: jguinnip@k-state.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Ph.D. student that works with Dr. Walter Dodds. James studies stream biogeochemistry.

Funding Support: None

International Collaboration: No

International Travel: No

Sophie Higgs

Email: sahiggs@k-state.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: MS Student that works with Dr. Walter Dodds. Sophie studies stream biogeochemistry.

Funding Support: None.

International Collaboration: No

International Travel: No

Ava Hoffman

Email: avamariehoffman@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student (Advisor, Melinda Smith) working on how the ecology and genetics of dominant species influence ecosystem function.

Funding Support: None.

International Collaboration: No

International Travel: No

Matthew Nieland

Email: nielandm@ksu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Lydia Zeglin

Funding Support: None

International Collaboration: No

International Travel: No

Brock Norwood

Email: bnorwood027@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Dr. Gwen Macpherson

Funding Support: None

International Collaboration: No

International Travel: No

Johanie Rivera-Zayas

Email: johanie@ksu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student. Advisor: Dr. Charles Rice

Funding Support: None

International Collaboration: No

International Travel: No

Marshall Santos

Email: marshallvictor@hotmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Adviser: Dr. Eduardo Santos

Funding Support: None

International Collaboration: No

International Travel: No

Drew Scott

Email: dascott@siu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Former MS student (Advisor, Sara Baer) working on development of soil aggregate structure and consequence for seed germination and biomass of plant functional groups during prairie restoration. Received master's degree in 2019.

Funding Support: None

International Collaboration: No

International Travel: No

Monica Shaffer

Email: mshaffer@ksu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 3

Contribution to the Project: Advisor: David Hartnett Defended master in Spring 2019.

Funding Support: None

International Collaboration: No

International Travel: No

Adam Siders

Email: adam.siders@siu.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Adam is a PhD student in the lab of Matt Whiles. He is studying the effects of extreme drought on aquatic invertebrate communities living in isolated pools in a perennial prairie stream.

Funding Support: None

International Collaboration: No

International Travel: No

Ingrid Slette

Email: ingrid.slette@gmail.com

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: PhD student (Advisor, Alan Knapp) working on historical effects of climate change on grassland carbon cycling.

Funding Support: None.

International Collaboration: No

International Travel: No

Dylan Smith

Email: xenocide@k-state.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Alice Boyle Research focus on brown-headed Cowbirds

Funding Support: None

International Collaboration: No

International Travel: No

Leena Vilonen

Email: lvilonen@colostate.edu

Most Senior Project Role: Graduate Student (research assistant)

Nearest Person Month Worked: 1

Contribution to the Project: Advisor: Dr. Melinda Smith

Funding Support: None

International Collaboration: No

International Travel: No

Emily Wedel**Email:** erwedel@k-state.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Advisor: David Hartnett/Jesse Nippert**Funding Support:** None**International Collaboration:** No**International Travel:** No**Shelly Wiggam-Ricketts****Email:** wiggie@ksu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** PhD student (Advisor, Greg Zolnerowich) working on effects of fire regime on grassland pollination dynamics.**Funding Support:** None.**International Collaboration:** No**International Travel:** No**Luci Wilson****Email:** lucir@okstate.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Graduate student of Dr. Gail Wilson, studying natural resources ecology and management**Funding Support:** None**International Collaboration:** No**International Travel:** No**Sarah Winnicki****Email:** skwinnicki@ksu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Former REU student, former MS Student (mentored by Alice Boyle). Studied Grasshoper Sparrow mating and cooperative care influence on aggregation. Successfully defended masters summer 2019.**Funding Support:** None**International Collaboration:** No**International Travel:** No**Marissa Zaricor****Email:** mzaricor@ksu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Advisor: Jesse Nippert

Funding Support: None

International Collaboration: No

International Travel: No

Amanda Kuhl

Email: akuhl@ksu.edu

Most Senior Project Role: Non-Student Research Assistant

Nearest Person Month Worked: 12

Contribution to the Project: Research assistant and field crew leader.

Funding Support: None.

International Collaboration: No

International Travel: No

Mark Sandwick

Email: sandwick@ksu.edu

Most Senior Project Role: Non-Student Research Assistant

Nearest Person Month Worked: 9

Contribution to the Project: Field Technician.

Funding Support: None

International Collaboration: No

International Travel: No

Jeff Taylor

Email: jht@ksu.edu

Most Senior Project Role: Non-Student Research Assistant

Nearest Person Month Worked: 12

Contribution to the Project: Field technician.

Funding Support: None.

International Collaboration: No

International Travel: No

Courtney Tobler

Email: ctobler@ksu.edu

Most Senior Project Role: Non-Student Research Assistant

Nearest Person Month Worked: 12

Contribution to the Project: LTER analytical lab supervisor, research coordinator.

Funding Support: None

International Collaboration: No

International Travel: No

Aditi Arun

Email: aditi12@k-state.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant
Nearest Person Month Worked: 1

Contribution to the Project: REU Student of Kent Connell

Funding Support: None.

International Collaboration: No

International Travel: No

Year of schooling completed: Junior

Home Institution: Kansas State University

Government fiscal year(s) was this REU participant supported: 2018

Miguel Duarte

Email: maduarte@asu.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 1

Contribution to the Project: REU student of Meghan Avolio

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Other

Home Institution: ASU

Government fiscal year(s) was this REU participant supported: 2018

Matt Turnley

Email: matt.turnley@my.simpson.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 1

Contribution to the Project: REU student of Melinda Smith (CSU).

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Other

Home Institution: Simpson College

Government fiscal year(s) was this REU participant supported: 2018

Nicholas Vega Anguiano

Email: na743@humbolt.edu

Most Senior Project Role: Research Experience for Undergraduates (REU) Participant

Nearest Person Month Worked: 1

Contribution to the Project: REU student of Lydia Zeglin

Funding Support: None

International Collaboration: No

International Travel: No

Year of schooling completed: Other

Home Institution: Humbolt

Government fiscal year(s) was this REU participant supported: 2018

What other organizations have been involved as partners?

Name	Type of Partner Organization	Location
Colorado State University	Academic Institution	Fort Collins, CO
Department of Energy	Other Organizations (foreign or domestic)	USA
University of Kansas	Academic Institution	Lawrence, KS
Kansas State University	Academic Institution	Manhattan, KS
NOAA	Other Organizations (foreign or domestic)	USA
Oklahoma State University	Academic Institution	Stillwater, OK
Southern Illinois University at Carbondale	Academic Institution	Carbondale, IL
State of Kansas	State or Local Government	Kansas
The Nature Conservancy	Other Nonprofits	Kansas
US EPA	Other Organizations (foreign or domestic)	USA
USGS	Other Organizations (foreign or domestic)	USA

Full details of organizations that have been involved as partners:**Colorado State University****Organization Type:** Academic Institution**Organization Location:** Fort Collins, CO**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution: Dr. Alan Knapp (Biology Department, Colorado State University) collaborates on many aspects of the Konza LTER program. His research includes studies of grassland ecology, responses to climatic variability and climate change, and the ecology of plant invasions. Knapp's LTER research is supported by a subcontract to Colorado State University, which also provides support for students participating in cross-site research that utilizes the Konza Prairie LTER site and database. Dr. Melinda Smith is an LTER collaborator and participates in several aspects of Konza LTER research, including studies of plant community dynamics, the ecology of plant invasions, genomic responses of plants to climate change, and comparisons of the ecology of North American and South African grasslands. Dr. Smith and her students also oversee the NutNet project at Konza as part of a multi-site study of the effects of nutrient amendments and herbivory on herbaceous community and ecosystem dynamics. The Konza LTER program provides a subcontract to CSU and logistical support for these studies.

Department of Energy**Organization Type:** Other Organizations (foreign or domestic)**Organization Location:** USA

Partner's Contribution to the Project:

Financial support
In-Kind Support
Collaborative Research

More Detail on Partner and Contribution: The Konza LTER program provides partial support for two CO2 flux towers, which are part of the Ameriflux network of net C exchange measurement sites. DOE provides some financial and logistical support for tower operations and data processing.

Kansas State University

Organization Type: Academic Institution
Organization Location: Manhattan, KS

Partner's Contribution to the Project:

In-Kind Support
Facilities

More Detail on Partner and Contribution: KSU owns a portion of the Konza Prairie Biological Station, and provides access and use of the field site and associated on-site facilities. KSU also provides campus lab facilities, and computer server and network support through a partnership between the KNZ LTER program and the KSU Physics Computer Support Center, where KNZ network servers are housed. KSU provides support for operation of the Environmental Chemistry Laboratory in Bushnell Hall, which is used for LTER water sample analyses. KSU also provides support in the form of available assistantships for graduate students conducting KNZ research.

NOAA

Organization Type: Other Organizations (foreign or domestic)
Organization Location: USA

Partner's Contribution to the Project:

Facilities
Collaborative Research

More Detail on Partner and Contribution: Konza Prairie is part of the U.S. Climate Reference Network (USCRN). USCRN is a network of climate stations developed as part of a National Oceanic and Atmospheric Administration (NOAA) initiative. Its primary goal is to provide future long-term homogeneous observations of temperature and precipitation that can be coupled to long-term historical observations for the detection and attribution of present and future climate change.

Oklahoma State University

Organization Type: Academic Institution
Organization Location: Stillwater, OK

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: The Konza LTER program provides a subcontract to Oklahoma State University to support collaborative research with Dr. Gail Wilson. Dr. Wilson's research focuses primarily on the role of mycorrhizae in grasslands, and the ecology of *Bothriochloa bladhii* (Caucasian bluestem), an important invasive grass species.

Southern Illinois University at Carbondale

Organization Type: Academic Institution
Organization Location: Carbondale, IL

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Collaborative Konza LTER research is supported by subcontracts to SIU collaborators: (1) Dr. Matt Whiles and students to support research on stream invertebrate ecology and soil macroinvertebrate ecology; (2) Dr. Sara Baer and students to support research on grassland restoration ecology.

State of Kansas

Organization Type: State or Local Government

Organization Location: Kansas

Partner's Contribution to the Project:

Financial support

Facilities

More Detail on Partner and Contribution: The state of Kansas provides an operating budget for Konza Prairie Biological Station personnel and general site maintenance.

The Nature Conservancy

Organization Type: Other Nonprofits

Organization Location: Kansas

Partner's Contribution to the Project:

Facilities

Collaborative Research

More Detail on Partner and Contribution: Konza Prairie Biological Station is a Nature Conservancy site, established on land purchased by The Nature Conservancy and managed by the Division of Biology at KSU. Konza LTER scientists interact with TNC scientists and officers on a broad range of management-related issues, including grassland conservation, restoration ecology, and grazing management.

US EPA

Organization Type: Other Organizations (foreign or domestic)

Organization Location: USA

Partner's Contribution to the Project:

Facilities

Collaborative Research

More Detail on Partner and Contribution: The US EPA jointly operates a CASTNet (Clean Air Standards and Trends Network) and AMoN (ammonia monitoring) site located at the Konza Prairie LTER site. The Konza Prairie LTER program provides site support and the EPA provides analytical services and compiles data on atmospheric nutrient concentrations and dry deposition rates, and tropospheric ozone concentrations. The EPA Region 7 office also supports a collaborative modeling project, which is using Konza LTER data to build linked models of hydrology and biogeochemistry that can be used to assess the effects of alternate land-use scenarios in the Flint Hills region. This project is led by Dr. Bob McKane (EPA) in collaboration with KNZ scientists.

USGS

Organization Type: Other Organizations (foreign or domestic)

Organization Location: USA

Partner's Contribution to the Project:

Facilities
Collaborative Research

More Detail on Partner and Contribution: The USGS collects and provides data on the hydrology and chemistry of Kings Creek, a USGS benchmark stream located on the Konza Prairie LTER site, and the Konza LTER program facilitates the transfer of these data to the Hydro-DB database. The Konza LTER site is also a part of the USArray component of the USGS EarthScope project- a continental-scale seismic observatory.

University of Kansas

Organization Type: Academic Institution
Organization Location: Lawrence, KS

Partner's Contribution to the Project:

Collaborative Research

More Detail on Partner and Contribution: Dr. Gwen Macpherson (Dept of Geology) and her students conduct collaborative research on groundwater hydrology and chemistry as part of the Konza Prairie LTER program. We also provide a subcontract and logistical/technical support to Dr. Nathaniel Brunsell (Dept of Geography), who oversees flux tower operations at the Konza site. Dr. Brunsell's research addresses the role of land-use/land-cover change land surface heterogeneity in vegetation, moisture, soil type, topography on water and energy fluxes from local to regional scales. This research uses a combination of field measurements, remote sensing and numerical modeling, and is integrated with flux tower studies at the Konza LTER site.

What other collaborators or contacts have been involved?

Nothing to report

Impacts

What is the impact on the development of the principal discipline(s) of the project?

The Konza Prairie LTER Program is a comprehensive, interdisciplinary research program designed to contribute to synthetic activities and conceptual and theoretical advances in ecology, and to further an understanding of ecological processes in grasslands. Examples of specific recent contributions to the discipline of ecology are provided in the attached 'Konza LTER Findings' file. Here we summarize in more general terms the contributions of the Konza LTER program to the advancement of ecology. Konza LTER scientific findings continue to be published in a broad range of high-quality journals.

In the 2018-2019 funding period, the KNZ program produced or contributed to 87 publications: 70 refereed journal articles (including 19 currently in press) and 13 dissertations and theses. These publications cover topics ranging from riparian tree removal altering streams to consequences of global change in grasslands to effects from regional droughts. Within the past year, Konza LTER scientists have continued to publish high-quality articles in disciplinary focused areas (e.g. *Chemical Geology, Journal of Mammalogy, and Avian Conservation and Ecology*), general ecology (e.g. *Ecology, Journal of Ecology, and Functional Ecology*), and high-impact general science journals (e.g. *Global Change Biology, Science Advances, and BioScience*). Several syntheses of long-term KNZ research were published in 2018, including a *Science Advances* article based on a 25-year precipitation manipulation experiment.

In addition to site-based science, KNZ scientists made substantial contributions to multi-site, collaborative ecological research, and the widespread use of KNZ LTER data and resources by the broader ecology community. For example, KNZ LTER data were used in several recent multi-site or synthetic efforts, including a *PNAS* article based on a global synthesis of 105 experiments showing grassland community responses to global change will increase over time. Konza Prairie is also an active node in the Nutrient Network (NutNet) and KNZ scientists continue to lead and contribute to NutNet publications.

What is the impact on other disciplines?

The Konza Prairie LTER program and our core research experiments attract numerous scientists from a broad spectrum of scientific disciplines beyond ecology. For example, KNZ supports long-term collaborations with several physical scientists from the University of Kansas: Gwen Macpherson (Geology, KU) is a hydrogeochemist whose research includes long-term studies of groundwater chemistry sampled via permanent wells located on Konza Prairie. Dr. Pamela Sullivan (Geography, KU) began additional subsurface geochemistry research at Konza in 2016 and is continuing to develop a site-based program on Konza. Sullivan's work focuses on the interface of freshwater resources – changing climate – vegetation dynamics, and she is collaborating with Macpherson, Blair, and Nippert. Dr. Andrea Brookfield (Geography, KU) is a geohydrologist with an emphasis on groundwater modeling. Brookfield is collecting data on Konza, attending annual meetings, and making regular contributions. An atmospheric scientist from the University of Kansas (Nate Brunsell, Geography) oversees KNZ flux tower research, uses Konza sites to study the effects of surface heterogeneity on land atmosphere interactions, and is employing a Large Aperture Scintillometer (LAS) to measure sensible heat fluxes over longer path lengths that span Konza watersheds with ongoing C flux measurements. Dr. Eduardo Santos (Agronomy, KSU) also focuses on land-atmosphere interactions. KNZ is supporting Santos's use of stable isotopes to partition C fluxes on grazed and ungrazed watershed. The work by Brunsell and Santos compares plot-based vegetation measurements with data from eddy covariance stations and satellite-derived estimates of surface energy fluxes. Two hydrologists from Biological and Agricultural Engineering (Dr. Stacy Hutchinson and Dr. Tricia Moore) maintain and contribute to the 'Irrigation Transect Experiment'. Contributions by Hutchinson and Moore have provided numerous training opportunities for Biological and Agricultural Engineering and Hydrology students. In 2019, we welcomed Dr. Abby Langston (KSU Geography). Langston is a geomorphologist with research interests on landscape evolution and modeling and she is collaborating with Dr. Walter Dodds on projects related to stream flow and stream corridor change.

Konza Prairie is also a research platform for several collaborative teams of ecologists and molecular biologists that are part of the KSU Ecological Genomics Institute. Many of these interdisciplinary teams are using the Konza LTER site and associated long-term experiments to address questions related to the genetic mechanisms underlying plant and animal responses to environmental constraints. The KNZ LTER patch-burn grazing experiment is being done in collaboration with Dr. KC Olson, a grazing animal nutritionist (Animal Science and Industry - KSU) that is using the experiment to assess the impacts of alternative grassland management practices on animal nutrition and animal health. We also collaborate with atmospheric chemists and modelers with the EPA CASTNet program in sampling concentrations of selected airborne particles and use these to model dry deposition rates.

What is the impact on the development of human resources?

The Konza Prairie LTER VII program makes significant contributions to human resource development in science, engineering and technology. Our program has a long history of undergraduate training and exposure to scientific research for local KSU students. Amanda Kuhl (KNZ Staff) mentors 15-25 students year-round that assist in collection and measurement of long-term productivity plots, as well as grass and grasshopper population data in the core KNZ datasets. In addition, training of undergraduates includes REU students supported each summer (typically 2/summer). Indirectly, we support the development of undergraduates via the use of the Konza LTER data in ecology classes and text books. As documented elsewhere in this report, we also train numerous graduate students and provide valuable experience in interdisciplinary research and the synthetic use of long-term datasets. In addition to supporting KSU graduate students, the Konza Prairie LTER site is widely utilized by graduate students from other institutions. During the 2018-2019 funding period, the site was used by graduate students from the University of Kansas, Southern Illinois University, Colorado State University, Oklahoma State University, Johns Hopkins, UNC-Greensboro, University of Wyoming, and the University of Nebraska. We also hosted field trips for students from many regional colleges and universities, and in the last year hosted a summer student training field trip organized by the Haskell Indian Nations University. The Konza Environmental Education Program and the Konza Prairie Schoolyard LTER Program, provide formal and informal research experiences and science education to public groups, children and K-12 teachers. Finally, the Konza LTER site continues to be used in conjunction with the NSF-funded Girls Researching Our World (GROW) program (www.ksu.edu/grow), with several KSU scientists and students leading educational activities for 6th-12th grade girls.

What is the impact on physical resources that form infrastructure?

The Konza LTER program provides a research platform for scientists and students from around the world. The 3,487-ha Konza Prairie Biological Station (KPBS), located in the Flint Hills of NE Kansas, is the core research site for the KNZ program. In addition to providing the watershed-level fire and grazing treatments, agricultural fields, restored prairie, stream networks and weirs, KPBS includes several buildings in the headquarters area that support LTER research. The on-site Ecology Laboratory (2,400 ft²) includes (1) a wet/dry lab with sinks, fume hood, refrigerators, balances, etc., (2) two large multi-purpose work rooms with bench space and sinks for processing samples, drying ovens, refrigerators and freezers, and

equipment storage, and (3) a large researchers' shop equipped with a variety of tools and field supplies. Other station buildings include a fire station and maintenance building, a large storage building for equipment, and a residence occupied by the site foreman year around. The 4,650-ft² Hulbert Center houses a library/conference room, administrative office, classroom and teaching laboratory (used primarily for K-12 activities), reference herbarium and animal collections, and a kitchen and dormitory-style housing for 15 visitors. Two small guest cottages (each with 2-bedrooms, living room, bath, kitchen, and laundry facilities), can accommodate up to 5 persons/cottage. A larger cottage, built in 2012, can accommodate up to 12 guests, expanding the capacity of on-site accommodations to 37 visiting researchers.

With funding from an NSF-FSML grant and additional support from KSU and a private donor, an historic limestone barn at the KPBS headquarters was transformed into a multipurpose meeting facility for on-site conferences, workshops, and educational programs. The historic stone barn was renovated in 2008 and has the Cortelyou Lecture Hall (1,750 ft²) with a seating capacity of ~100 persons fully equipped with A/V equipment and wireless internet. Additional large multi-purpose room (1,850 ft²) is designed as flexible space for varied uses including additional meeting space, workshops, scientific posters and other research displays, social gatherings, and education programs for large groups. All lab and office buildings have internet connectivity to the KSU campus. In addition, there is a wireless link to KPBS from campus with multiple wireless access points that provides coverage to >60% of the 3,487-ha site.

Other LTER infrastructure, maintained by KPBS, includes the outside perimeter fence (29.8 km), the interior bison management area closed by 16.4 km of "New Zealand" fence, 98 small (25 m²) grazing enclosures, 11.7 km of fence for cattle research, 26.4 km of access roads and 61 km of fireguards separating the experimental watershed units. KPBS maintains several general-purpose vehicles on-site, as well as specialized equipment (tractors, fire trucks, mowers, soil augers, etc.). KPBS makes staff and equipment available to assist with KNZ research activities, including mowing fireguards, installing equipment, soil coring, etc. KPBS staff also coordinates the fire management of bison and cattle herds for KNZ grazing treatments. The headquarters area includes a corral and handling facilities for managing the bison herd (hydraulic chute, electronic scales, etc.), which is essential for LTER grazing studies. In late 2017, then KPBS director, Briggs received an NSF award to upgrade the corral area. In 2018, KPBS and KNZ staff redesigned and improved the bison handling facility. The changes provide a safer working environment for staff, reduce stress on bison, and allow greater ease and flexibility in conducting bison-related research. In 2018, we constructed a 900 ft² walk-in drying oven using a modified shipping container. Temperatures within the large drying oven are regulated by a small home furnace powered using propane. Other field equipment and instrumentation on-site includes the main KNZ weather station, a network of 11 rain gauges, two eddy flux towers for quantifying ecosystem-level C and water vapor flux, four weirs and associated stream gauging equipment, 46 wells for measuring groundwater levels and chemistry, numerous TDR probes, neutron access tubes and tension lysimeters for soil water measurements. Related equipment co-supported by other programs includes USGS stream monitoring station, 2 seismometers (USGS), an aerosol and ozone monitoring facility (CASTNet), and a NOAA Climate Reference Network (CRN) weather station. These facilities add significantly to data for LTER research and education programs, and for regional cross-site studies. KPBS is also a core site for National Ecological Observatory Network (NEON), which is fully-built-out and operational. NEON provides additional unique measurement capabilities and data at KPBS, which will complement many KNZ LTER studies.

In addition to facilities at KPBS, a wide-range of modern laboratory facilities are available on the nearby KSU campus, approximately 15 km from KPBS (e.g., Analytical Chemistry Labs, Stable Isotope Lab, Ecological Genomics Institute, Core Sequencing and Genotyping Facility). The majority of core LTER laboratory space and analytical equipment are located in Bushnell Hall (Biology), including space and equipment for preparing plant, soil and water samples for analysis (drying ovens, grinders, shaker tables, block digesters, vacuum filtration systems). Bushnell Hall also houses an extensive collection of prairie plant specimens in the KSU Herbarium, and these specimens are electronically databased and georeferenced. Some specific equipment and facilities available for LTER research are located within other Departments (Agronomy, Biological and Agricultural Engineering, Plant Pathology, Geography), reflecting the interdisciplinary nature of our research. Some major analytical instruments available for KNZ investigators include: 2 Alpkem autoanalyzers (FlowSolution IV) for liquid samples, Carlo-Erba 1500 automated C/N analyzer for solid samples, Shimadzu TOC 500 analyzer for dissolved C, a Hitachi U2900 automated dual-beam spectrophotometer, 4 LiCor 6400 Portable Photosynthetic Systems, 2 LiCor 8100 systems dedicated for soil CO₂ flux measurements, a LiCor 1600 null-balance porometer for stomatal conductance, and 3 pressure chambers (PMS model 1000) for measuring plant water potential, 4 Tektronix cable testers (model 1502B) coupled to Campbell CR10 data loggers for TDR soil moisture measurements, 2 Troxler (model 3221) neutron probe gauges for soil moisture determinations, and several Trimble GPS units. Eight multi-parameter sondes (YSI 6000) are used for monitoring oxygen and temperature for 3 watersheds.

What is the impact on institutional resources that form infrastructure?

Nothing to report.

What is the impact on information resources that form infrastructure?

KNZ resources are used to support the hardware and software associated with the KNZ website and data portal. In the 2018-2019 funding cycle, we continued to add all KNZ LTER-supported/related publications, thesis and dissertations (total of 1851 publications are online), searchable by key word, author, year, and publication type. We continue to provide up-to-date, accurate LTER data to KNZ investigators and to the broad scientific community as quickly and efficiently as possible.

Datasets of KNZ projects are available from the KNZ website (total of 129 projects), and also from the Environmental Data Initiative (EDI) data portal (total of 129 projects). We continue to make improvements to our stream data workflow infrastructure. We edited and updated our metadata and procedural protocols to ensure any changes in technique or structure of our datasets are accurately reported.

We have redesigned our outreach webpages to increase the visibility of KNZ impacts on the education, outreach, and training activities, increasing the relevance of our long-term research to the broader society (<http://lter.konza.ksu.edu/konza-lter-outreach>). In addition, our website now includes our diversity, inclusivity, and non-harassment statements.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

The KNZ LTER program contributes to increased public awareness of ecological and environmental issues (e.g., biodiversity conservation, habitat loss, ecosystem services, restoration ecology, etc.) through outreach and public education activities. Our research concerning the role of seasonal burning and fire intensity on woody encroachment is being used to inform the Great Plains Fire Science Exchange (www.gpfirescience.org) and the Tallgrass Prairie and Oak Savanna Fire Science Consortium (www.tposfirescience.org). Both of these are non-profit groups focusing on conservation issues and land management of Midwestern grasslands. Konza investigators have a strong working and advisory relationship with the Kansas chapter of the The Nature Conservancy. We work closely with Brian Obermeyer, the Director of Protection and Stewardship for KS TNC. As an example, KNZ and TNC routinely collaborate on research tours of the site, give joint talks (Brian and Jesse Nippert had paired talks in at the Missouri Department of Conservation in June, 2019) and disseminate conservation management practices to local land owners. A recent example of collaborative extension sharing long-term KNZ research with private landowners includes KNZ and TNC participation in the Tallgrass Summer Management Workshop and Tour in the southern Flint Hills (Sept. 2019).

In addition, the Konza Prairie LTER Program is increasingly called upon to provide data relevant to resource management and regulatory policy. Dr. John Blair (KPBS director) and Dr. Jesse Nippert (KNZ LTER lead-PI) regularly provide outreach and tours to state and national policy-makers and law-makers. Because of the widespread use of prescribed fire for both grassland conservation and agricultural tours, KNZ research on ecological responses to contrasting long-term fire regimes and different seasons of fire has taken on new importance. At the regional level, KNZ scientists advise EPA Region 7 staff and scientists on the ecological benefits of fire in maintaining native tallgrass prairie habitat and diversity and contribute long-term data to guide the development of the Flint Hills regional smoke and management plan. The issue of smoke management coupled with concerns about woody plant expansion have provided KNZ investigators an opportunity to interact with land managers, producers, and private organizations in linking basic research with management goals. The KNZ Season of Fire Experiment provides 22-years of data from watersheds burned at different times of the year (Spring, Summer, Fall, and Winter). Most prescribed burning in the Flint Hills takes place during a small window in April. We now have data showing that burning can be done other times of the year in ungrazed watersheds with little adverse effect on plant productivity or desirable species. KNZ investigators have interacted with and advised groups, including the EPA, Natural Resources Conservation Service, the Kansas Farm Bureau, The Nature Conservancy Grassland Community, and others.

KNZ investigators and staff are frequently asked to share data collected at Konza Prairie with a variety of audiences both locally and nationally. For example, in the 2018-2019 funding period, Jeff Taylor (KNZ staff) spoke to the Minnesota Native Plant Society on long-term research in a changing landscape. Jesse Nippert presented LTER science for public presentations about grassland responses to climate change for the Grassland Heritage Foundation in Lawrence, KS (November 2018) and the Iowa Prairie Conference in Pella, IA (August 2019).

Locally, Konza scientists continue to serve as consultants for the Flint Hills Discovery Center, and we participate in Kansas Agricultural Experiment Station public education events by providing information on the ecological consequences of various grassland management practices (e.g., fire frequency and grazing). In 2019, Jeff Taylor (KNZ staff) spoke at the Discovery Center about bison herd management at Konza. KNZ scientists have been instrumental in the development of a management

plan for the Nachusa Grasslands Nature Conservancy Site in Illinois. Sara Baer, John Blair, and Scott Collins have met with Nachusa staff and provided input on the development of a science and management plan. In the international arena, Konza scientists have provided information on grassland management to scientists and park resource managers from South Africa, Botswana, China, Australia, and Hungary, with many of these visits focusing on resource management issues of public concern. The Konza Prairie LTER database is also being used to address other issues relevant to regulatory policy. Long-term data on Konza Prairie stream water quality provides a baseline for regional water quality in the absence of agricultural practices or other disturbances. LTER data on soil chemistry is also being incorporated into ongoing studies to evaluate the potential of grassland management practices to increase soil C sequestration to offset atmospheric CO₂ loading.

In 2018-2019, KNZ scientists and graduate students participated in numerous public outreach events to enhance understanding of LTER science and dissemination of important findings. KNZ investigators presented research findings at local Science Café meetings, as well as 'Science on Tap' at Tallgrass Taphouse. Many KNZ investigators participate in the Kansas Science Communications Initiative, which is teaching scientists how to better communicate their findings to the public. KNZ graduate students at KNZ graduate student, Sarah Winnicki discusses her participation in the Kansas Science Communications Initiative, along with her research in a KSU Seek Research Magazine article (<https://www.k-state.edu/seek/fall-2018/graduate-scholar/>). KSU graduate students are instrumental in the creation and maintenance of a blog entitled Science Snapshots (<https://sciencesnapshots.com>), where students post entries covering other students' research. Our local art museum (Beach Museum of Art) has a Prairie Studies Initiative (<http://beach.k-state.edu/prairestudies>). KNZ scientist, Blair, has acted as consultant, participant, and speaker at many Prairie Studies outreach events. KNZ LTER graduate student Seton Bachle had one of his microscopy images of *Andropogon gerardii* selected for the 2019 'Science to Art' Exhibition at the Kemper Museum in Kansas City.

Konza Prairie hosts numerous artists annually. A featured Konza artist, Erin Wiersma, has gained prominence for her works created at Konza Prairie. Wiersma currently has gallery showings of her Konza artwork at the Robischon Gallery (Denver, CO), Galerie Fenna Wehlau (Munich, Germany), and A.I.R. Gallery (Brooklyn, NY). In Sept 2019, she hosted an exhibition at the Salina Art Center (Salina, KS) titled: "Tracing Watersheds: Konza Prairie". Wiersma uses char from fires (rubbed by hand or in-place on the landscape) to create large-scale drawings. Her process melds her personal experiences on the landscape with the essence of the fire, growth patterns, and site geology/topography).

Finally, in the past year, Dr. Alice Boyle (KSU) developed and presented a major new type of outreach. Boyle uses music to communicate how special and threatened our local tallgrass prairies are. This music is intended to reach the rural Kansan audiences who do not commonly participate in science outreach events. To engage people who might be distrustful of scientists, Boyle developed a musical show together with Robert Rosenberg, choosing music relevant to grasslands, the birds and other creatures that live there, climatic variability (weather!), and the experiences of the humans who also share this environment. In late 2018 and spring of 2019, Boyle and Rosenberg performed their show at 10 venues in different rural communities and have established a web presence: <https://www.facebook.com/KawCreek>.

Changes/Problems

Changes in approach and reason for change

Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them

Nothing to report.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.