KANSAS NSF EPSCoR

Spotlight on Community

WINTER 2025

Expanding the research ecosystem in Kansas

On the cover:
Faculty, staff, students, industry partners, and other collaborators of Kansas NSF EPSCoR gathered at K-State Olathe on April 11, 2024.

Photo by: Antonique' Flemons (KU)

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KANSAS NSF EPSCoR
ADVANCING GEOGRAPHIC DIVERSITY IN STEM

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KANSAS NSF EPSCoR

Letter from the Director

For more than three decades, our office has been building research capacity in Kansas. We do this in partnership with the Kansas Board of Regents and the Kansas Department of Commerce in priority areas outlined by the Kansas State Science & Technology Plan.

In this publication, I invite you to learn more about our recent activities and accomplishments in Kansas. These efforts go beyond traditional research metrics—which are by themselves impressive, with a 2.4 to 1 return on investment. You will learn about our programs that jumpstart early-careers (First Awards), educate students (Research Experiences for Undergraduates), inspire youth and families (Build Your Future), drive workforce and economic growth (Kansas Data Science Consortium), and engage communities from Western to Eastern Kansas (ARISE project). I am inspired by the impact these activities are having, and I am excited to build on the momentum to grow the state's research ecosystem.

Our strong track record positions Kansas to take full advantage of new federal initiatives. For example, in response to the CHIPS and Science Act, the National Science Foundation is committed to funding a higher percentage of proposals from EPSCoR jurisdictions. There are also fresh opportunities through NSF's E-CORE, E-RISE, and FEC programs, and our office is ready to help build competitive teams across the state to secure these funds. If you are preparing a multi-institutional large proposal, I encourage you to reach out to us. Our experienced staff members are here to collaborate on projects and connect you with our network of researchers and educators.

As our state motto declares *Ad Astra per Aspera*, we can overcome challenges and reach great heights. Our mission is to grow the research and innovation capacity in Kansas. This is a team effort, and I look forward to cultivating collaborations and enthusiastically welcome partners to work together.

Belinda Sturm
Director

WHO WE ARE

At Kansas NSF EPSCoR, our knowledgeable team develops, manages, and sustains projects funded by the U. S. National Science Foundation's (NSF) Established Program to Stimulate Competitive Research (EPSCoR). Our main office staff, located at the University of Kansas, work closely with academic partners at Kansas State University, Wichita State University, and dozens of other academic, government, and business institutions statewide.

WHAT WE DO

With NSF and the Kansas Board of Regents as our partners, we play a pivotal role in strengthening the state's research ecosystem. Our stable leadership drives initiatives designed for long-term success. This effort enhances both research capacity and talent development. Additionally, by building trust across organizations, we act as neutral advisors engaged with state leaders to foster innovation and new opportunities.

A DRIVING FORCE FOR KANSAS
Partnerships are pivotal for a vibrant research ecosystem

Here's how the numbers stack up

INVESTMENT SINCE 2006

$73 million
NSF EPSCoR RII Track-1 Awards

>$8.1 million
Seed grants for novel research and education initiatives in Kansas

2.4 to 1
Return on Investment (R.O.I.)

RESEARCH IMPACTS

173
Junior faculty careers jump-started with First Awards

12
Faculty hires at four universities in Kansas

>1,450
Publications anchored to Kansas science & technology priorities

EDUCATION IMPACTS

764
College students gained research experience

55
Secondary teachers gained professional development

121
Native scholars gained research experience; 45 went on to graduate school

Anchored to State Priorities

All our projects are anchored to the Kansas Science and Technology Plan. Endorsed by the chief research officers of Kansas research universities and the Kansas Board of Regents EPSCoR committee, this S&T plan seeks to increase the impact of higher education and grow the Kansas economy.

Return on Investment

Kansas scientists have become more competitive in acquiring federal funding because of EPSCoR. Our return on investment says it all. For every dollar pumped into research by NSF EPSCoR since 2006, Kansas scientists have secured more than double that in additional research funding.

STRONG TRACK RECORD

Kansas NSF EPSCoR develops and manages large-scale Track-1 awards from the National Science Foundation. Our office has a proven history of excelling in this competitive arena, **having successfully secured eight such awards since 1992**.

Our current Track-1 initiative, **Adaptive & Resilient Infrastructures driven by Social Equity (ARISE)**, is a $24M, five-year project launched in 2022. With partners from 18 academic institutions in the state, this project directly engages communities in five counties: Ford, Finney, Seward, Johnson and Wyandotte.

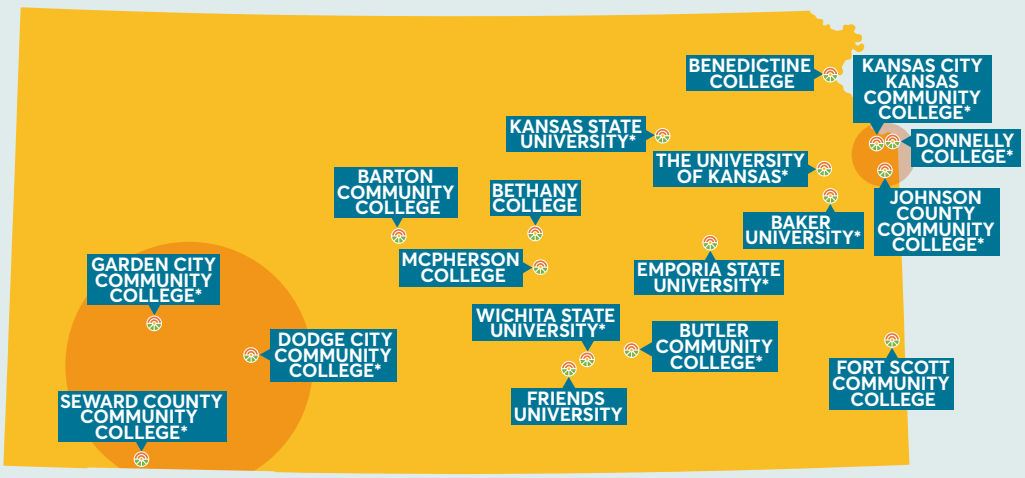
Professor Belinda Sturm at the University of Kansas co-leads the project with Professors Bala Natarajan (K-State) and Elaina Sutley (KU). Together, with scientists at K-State, KU, and WSU, the team is pioneering efforts to build a disaster-resilient Kansas. In addition to strengthening infrastructure, this team is nurturing a talented workforce and unlocking new economic opportunities for the state.

PARTNER WITH US

NSF recently announced new opportunities for critical research and talent development in EPSCoR states. But to succeed in this competitive arena, proposals will need strong partnerships.

We are here to help! For over 30 years, our office has been proudly connecting partners across the state. Whether you are an educator or an innovator, city planner or business manager, tribal leader or community organizer—reach out to us for assistance securing these funds for Kansas.

CURRENT ACADEMIC AND COMMUNITY PARTNERS



Shaded circles represent location of partner communities in five Kansas counties: Ford, Finney, Seward, Johnson, and Wyandotte.

*Funded partners

Meet a Researcher Jude Kastens

By looking at past disasters in Kansas, Kastens is building real-time flood maps.

Jude Kastens is an associate research professor at the University of Kansas. He links the ARISE project to the Kansas Applied Remote Sensing program, where he works as a numerical analyst and all-purpose data modeler. But that's just scratching the surface.

In this interview, Dr. Kastens discusses the real-world impacts of his research and the partnerships that have helped bring them to life.

Kastens said that helping Kansans will always be his top priority, but he's confident that the approach can have durable value elsewhere considering the unsettled state of real-time flood mapping technology. "Thanks to ARISE, we're taking another step to bringing our work to the public sector and emergency management officials."

Q. Could you share a bit about how you got your start in flood mapping?

A. Back in '07, during the severe flood in southeastern Kansas, I was in the throes of developing a hydrologically-informed model called FLDPLN (pronounced "floodplain") to identify floodplains, or river valleys, using elevation data. A colleague—also a student at KU—was working with emergency management to identify floodwaters in satellite imagery. This is tricky because usually it takes at least a day or two to access a new image, and often there are clouds obscuring what's happening on the ground.

To help focus the flooded image mapping process, we used the local stream gauge data to calibrate a FLDPLN model delineation of river valley lowlands, which is where most Kansas flooding occurs. After the flood, through comparisons to flooded imagery, we realized that the gauge-calibrated model was doing a very respectable job of mapping the actual flood itself.

Q. Can you tell us about some of the specific events you've worked on?

A. Following the 2007 event, we were awarded a sequence of GIS policy board projects to build our Kansas flood-mapping library. We assembled the data and the information, but we still needed to develop a delivery mechanism to make it accessible.

When the 2019 flood hit, we got the opportunity to test our mapping methods in a live situation. Working extended hours for many days while events unfolded, I made several real-time and forecast flood

maps for the Kansas Division of Emergency Management (KDEM) and Kansas Water Office (KWO). Our efforts were generally viewed as a success, and subsequently we received more funding from KWO to build out automated flood mapping tools. The system is now very fast and can update in just a couple minutes, with results featured in the Kansas Flood Mapping Dashboard that is accessible to anyone through the Kansas Applied Remote Sensing (KARS) website.

Q. The 2011 Missouri River flood was a peculiar, prolonged disaster situation. What made it unique in your career?

A. In the summer of 2011, the lower Missouri river experienced a three-month flood from the slow release of massive amounts of stored floodwater out of upstream reservoirs. The river valley by Nebraska was inundated, while crops in the uplands just outside the flooded area were suffering from drought.

State emergency managers in Kansas were getting calls from people wanting to know if the Missouri flooding would cause water to back up on the Kansas River. The answer was probably not a lot, and almost certainly not like in 1993 when the Kansas River was flooding on its own (not the case in 2011). Through our simulations, we were able to verify our assumptions for only minor flooding along the Kansas were correct, assuaging some concerns.

Q. Your projects sound very collaborative. Can you tell us about your team?

A. We've had great team members the whole time to help move things forward, including colleagues who have moved on as well as another who is now at the University of Alabama and remains actively involved while providing a bridge to our burgeoning involvement with NOAA's national flood inundation mapping efforts.

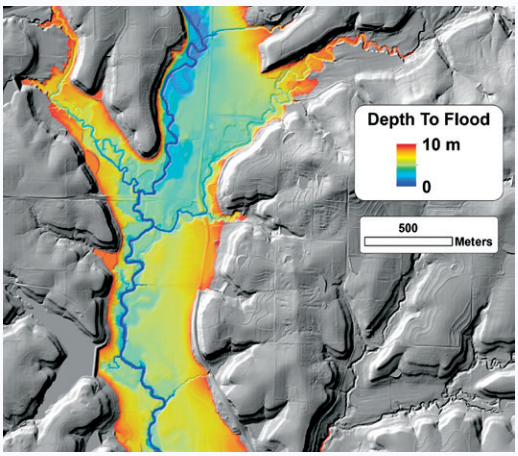
Under Belinda Sturm's Kansas NSF EPSCoR leadership, the ARISE project started to coalesce not long after the 2019 flood. Considering our established flood mapping capabilities and long-time work with KDEM, all this work blended well with the community impact and natural disaster focus of ARISE.

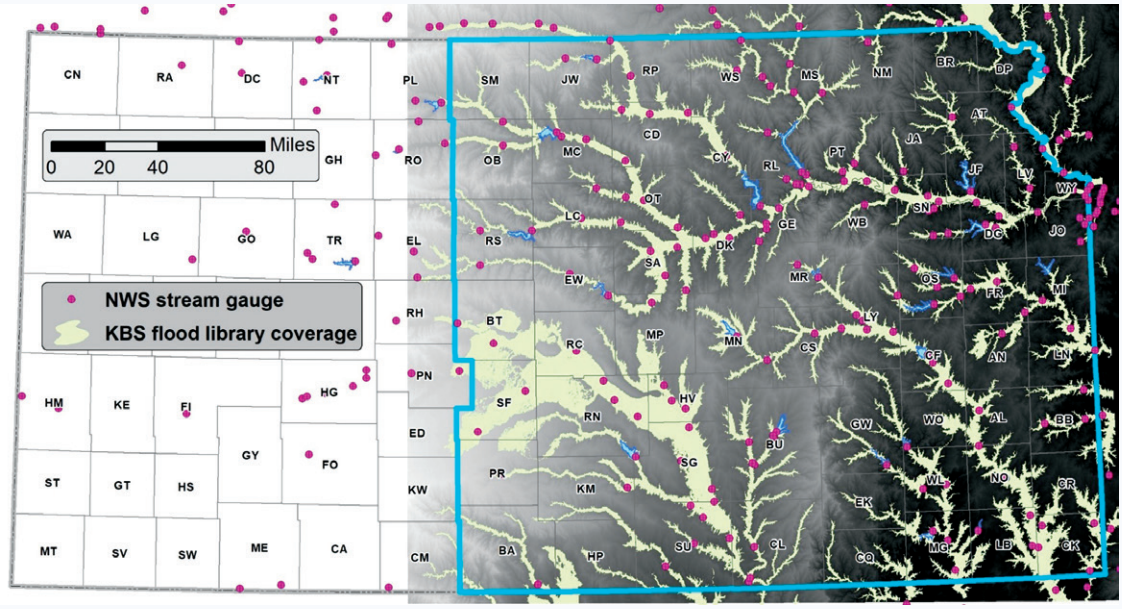
Concurrently with our ARISE involvement, Professor Xingong Li here at KU has been fantastic. Our labs began a partnership in 2021 that has kicked into high gear all our flood-mapping developments. Xingong has overseen

automation and web-enabling of our most critical mapping services and applications, including the development of open-source tools that make the general implementation of our entire approach accessible to others wanting to evaluate the system.

Graduate student Kenneth Ekpetere, who finished his PhD last spring, and now Master's student Abu Sabiq Mahdi have brought unique and useful talents to the project. Also, PhD student and colleague David Weiss, who, like Dr. Li, isn't directly involved with ARISE but continues to be invaluable to all of our flood-mapping efforts. Our latest flood mapping work is dovetailing nicely with our ARISE objectives, fostering new in-project collaborations that ultimately should enhance the tools we have been developing for the state.

BY MELINDA CORDELL





First Awards

Our First Awards are a game-changer for assistant professors in Kansas. These $50,000 grants, propel faculty careers forward by seeding novel research and sharpening essential grant-writing skills.

Matthew Howland, Assistant Professor
Wichita State University

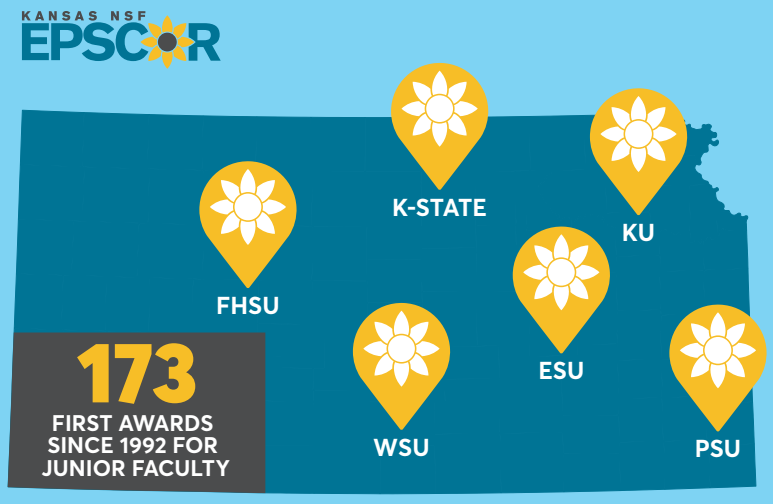
Improving Cultural Heritage Resilience through Modeling and Quantification of Erosion Risks to Heritage Sites

Melinda Adams, Langston Hughes Assistant Professor
Geography & Atmospheric Science and Indigenous Studies, University of Kansas

Indigenous-Led Cultural Burns and Research In Resiliency with Kansas Tribes

Hongyang Sun, Assistant Professor
Electrical and Computer Engineering, University of Kansas

Towards Robust Resilience for Large Computing Infrastructures



Since its inception in 1992, Kansas NSF EPSCoR has invested in 173 assistant professors with its First Award program. These awardees hail from six universities in Kansas. Many have gone on to secure prestigious federal grants and achieve national recognition— hallmarks of the program's success in building a strong, sustainable research ecosystem in Kansas.

First Award spotlight

Mapping the Future

How Satellite Data and AI Drive Groundbreaking Drought Research in Kansas

WSU Geologist Zelalem Demissie is one of six assistant professors who received First Awards from Kansas NSF EPSCoR in 2023. He used his $50,000 seed grant to develop techniques to forecast early-stage drought in Kansas.

"We use a type of radar imaging that's mounted on the European Space Agency's Sentinel satellites," Demissie explained. "These satellites revisit specific areas every six to twelve days, capturing data."

To process this radar data, he uses artificial intelligence and other sophisticated techniques.

"We're bringing a new concept to the scientific community called the terrestrial index. In this era of climate change, hydrological and meteorological datasets might fluctuate and generate errors when you're trying to forecast global climate," Demissie said. "Here we're bringing the earth itself into play."

To explain how his method works, he said that water supports the earth, like a structural column of a building. When you extract water, the earth's surface sinks. When precipitation replenishes the aquifer, the surface rises. The terrestrial index is the surface fluctuation of the earth.

With satellite data collected since 2014, he can measure surface behavior with millimeter precision. Moreover, he can forecast early-stage drought in Kansas by training AI models on this data. "We've also developed an app

"We're bringing the earth itself into play."

that maps injection wells in real-time. This app helps determine if injection activities might be linked to local seismic events by monitoring how much material is injected into wells."

Demissie involves high school students, undergraduates, and graduate students in his research, many from underserved or underrepresented backgrounds. He said, "We train them on coding, AI algorithms, and the scientific aspects of the project. Last summer, we held a camp with professors and even the provost to encourage students to pursue geoscience. It's about building interest and skills in the next generation."

Because of his research he has made several realizations. "The situation is grave. We must use water very responsibly because of our excessive over-extraction of groundwater. If you don't have money in your bank account, you can't withdraw it, right? That's what's happening right now with the aquifers."

BY MELINDA CORDELL

Research and Education Innovation (REI) Awards

Our REI Awards drive innovation at Kansas universities by providing resources for groundbreaking research. Faculty use the $50,000 grants to collect data, build expertise, and foster collaborations, paving the way for landing larger national grants and boosting the state's economy.

Xiaolong Guo, Assistant Professor
Electrical and Computer Engineering, Kansas State University

Guarding the Gatekeepers: Ensuring the Safety of IoT Sensors in Essential Infrastructure

Andrew Swindle, Associate Professor of Hydrogeology
Environmental Geochemistry, Wichita State University

Enhanced resilience of drinking water accessibility in Kansas using probabilistic machine learning

John Symons, Professor of Philosophy
University of Kansas Institute for Information Sciences

Advancing fairness in machine learning: a multidisciplinary approach

REI Award spotlight

K-State's Dr. Guo captures career milestone with NSF award

Xiaolong Guo, Kansas State University assistant professor of electrical and computer engineering, was selected for a $490,000 National Science Foundation Faculty Early Career Development Program award, known as a CAREER award, to develop a tool that aims to save time and money for semiconductor manufacturers.

This major milestone comes on the heels of Dr. Guo winning a $50,000 First Award from ARISE Kansas NSF EPSCoR in 2023 and an REI Award in 2024.

"The First Award from KS EPSCoR made significant contributions to advancing the research in my lab, paving the way for this NSF Career Award," Guo said. "It allowed me to progress in the direction of generative AI, which is a major focus of my current project."

RESEARCH EXPERIENCES FOR UNDERGRADUATES

In summer 2024, the ARISE project launched its first Research Experiences for Undergraduates (REU) program. All but one of the 12 students came from Kansas, including two students from community colleges. All were matched with mentors at three universities: 5 at KU, 5 at K-State, and 2 at WSU.

Following a 3-day orientation, students dedicated nine weeks to in-depth research with ARISE faculty. Weekly "Percolator" sessions spurred in-depth conversations about research and career paths. Specialized training in data science visualization, regressions, statistical analysis, and science communications enhanced students' professional skills.

A community service field trip to Kansas City nonprofit UrbanWorks gave students a chance to interact with Wyandotte County residents. Co-founders of the space shared their stories and the philosophy: "No agendas, just community." Despite the rain, the students lent a helping hand with organizing art supplies, building a park bench, and making meaningful connections to their research.

REU participant Julian Chavez reflected, "It was impactful. We saw resilience in action, not just as a concept, but practiced by real people in their community. It's about access and meeting people where they are."

Students also toured a local wastewater treatment plant and an energy plant. One student observed: "I never thought about the redundancy that has to go into infrastructure to ensure that the local area will still operate normally if disaster strikes."

To showcase their research, students gave a Three-Minute Pitch and presented research posters.

ARISE will lead REU programs again for the next three years.

Meet a Mentor Joel Mendez

"I always enjoy engaging with students," said KU Assistant Professor Joel Mendez.

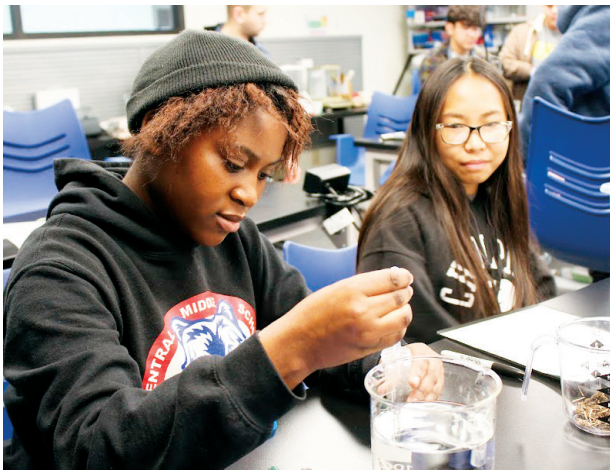
Last summer, Mendez mentored REU student Maddie Souser on a cross-cutting urban planning research project. He said that he always wanted to put himself in positions where he could be a great mentor for somebody else, just like all the professors who helped him when he was a student. "This program helps me do just that."

Inspiring Teens with Data, Soil, and Kool-Aid

To grow talent in Kansas, we partner with the Saturday Academy, a long-running youth program at Kansas City Kansas Community College.

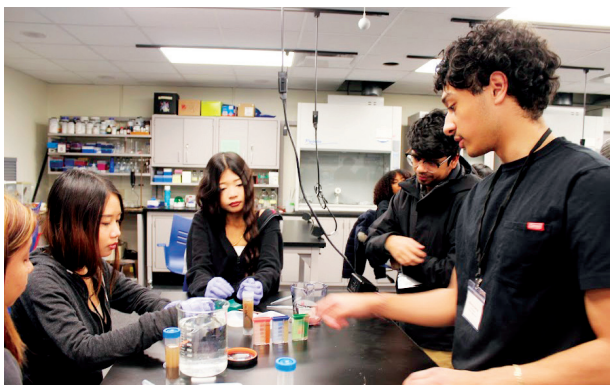
For Mary Patterson, Kool-Aid is more than a colorful thirst quencher. It's one of many lab tools she used this year at the Saturday Academy to inspire Kansas City teens to learn about data science.

The Kansas City Kansas Community College (KCKCC) co-leads the academy with partners from the University of Kansas Medical Center and the USD 500 School District. This K-12 program has a long history of enriching the lives of urban youth in Wyandotte County. It offers a host of learning opportunities every other Saturday from October to May along with a nourishing breakfast and lunch.



Roughly 100 teenagers participated in the academy last year. Patterson taught her students data analysis skills by focusing on soil with funding from the ARISE project.

Her curriculum guided the students through a series of hands-on activities. First they analyzed soil on the KCKCC college campus. Then they made a digital map of the college campus, showing the levels of moisture, pH, nitrogen, phosphorus, and potassium for the soil they collected. The students also collected soil samples from areas around Wyandotte County, and made digital maps showing pH and lead levels.



To learn about ground water, the students mixed soil with Kool-Aid to see which colors bind to the soil. Students then learned how to use a T test method to analyze the results. The key takeaway from these experiments is that compounds that bind to soil rarely make it to the ground water.

Mary said, "It was messy, messy, and took us forever to set up and clean up, but well worth it!!"

The students then constructed a model of ground water and learned about different bioremediation techniques. They also related what they learned about soil contamination to the 2023 Keystone Pipeline oil spill in Washington County, Kansas, that released 500,000 gallons of crude oil onto Kansas farmland and a nearby stream.

Build Your Future Round Two

Our partnership with the University of Kansas Natural History Museum inspires Wyandotte County youth and families to learn how to build a more resilient future.

The ARISE youth outreach program, called Build Your Future, just wrapped up its second round of engagement. For two years in a row, it has given hundreds of Kansas City youth and families an opportunity to learn about disaster resilience.

The program is led by Teresa MacDonald, informal science education director at the University of Kansas Natural History Museum. Her team includes museum staff Eleanor Gardner and Carolyn Kocken, KU's TRIO Talent Search Director Rebecca Dukstein, and several student assistants.

For the 2024 fall program, 20 Wyandotte County students attended three Saturday sessions once a month from September to November. They braved the rain in an outdoor excursion at the Wyandotte County Lake Park on September 19; collecting and analyzing soil temperature, air quality, and biological diversity of natural and built environments.

On October 19 and November 16, the group gathered at the F.L. Schlagle Library in Kansas City, Kansas. Students learned about tornadoes, flooding, extreme heat, and winter storms. They used games and other activities to learn about ways to limit damage from disasters. Like last year, the program ended with each student taking home a basic preparedness kit with an emergency weather radio and a stipend for participation. The team will continue to offer this program again in fall 2025.

A series of 'Family STEM nights' is offered each spring at Kansas City Kansas Community College. These evening sessions engage youth and families in activities that explore

the connections between infrastructure, environment, and well-being. Along with pizza and prizes, the events feature several community partners. For example, professional engineer Juan Carlos Banuelas, who also happens to be an alum of the Saturday Academy program, led an activity. KU Assistant Professor Justin Hutchison shared a civil engineering exhibit. Several activities were led by the Saturday Academy students. Representatives from the Kansas City Board of Public Utilities, Black & Veatch, and the KU Natural History Museum staff presented exhibits as well.

At the last session, the Wichita State Environmental Finance Center facilitated a role-playing game. The game highlight decisions about how to run the local water utility while responding to emergency situations and economic pressures.

All these events were open to students and families connected to the University of Kansas TRIO program, which supports middle and high school students on their journey to advanced degrees.

Data Science Hub Strengthens Workforce Strategy for Kansas

Dozens of businesses, nonprofits, and other organizations are gleaning data insights, including the Kansas Office of Registered Apprenticeships.

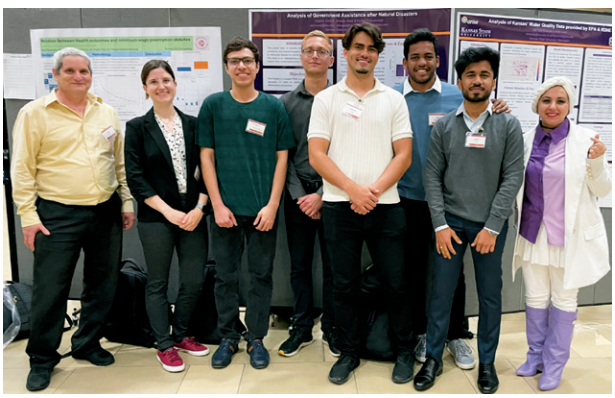
The Kansas Office of Registered Apprenticeship is tapping into over two decades of data, thanks to researchers at the University of Kansas.

"We have data on apprentices going back since 2000 and before," said Shonda Anderson, the director of the Kansas Office of Registered Apprenticeships.

With about 70 datapoints for thousands of apprentices, analyzing these data are a challenge, as Anderson admits. "We need the experts to look at the data analytically and help it tell us a story."

When William Duncan, assistant research professor of data science at KU, shared details about the **Kansas Data Science Consortium (KDSC)**, Anderson saw an opportunity. She asked if the KDSC could delve into their data and was met with a resounding *yes*.

The KDSC creates opportunities for college students to learn and practice advanced methods for analyzing digital information shared by businesses, governments, and other organizations. The program is housed at KU, Kansas State University and Wichita State University with funding through the U.S. National Science Foundation Established Program to Stimulate Competitive Research (EPSCoR).



In a project commissioned by the Department of Commerce, Duncan and several students launched research last year to assess the economic impact of high quality, earn-and-learn registered apprenticeships in Kansas.

Their research is revealing interesting results. For example, demographic patterns show strong racial diversity but low gender diversity among the apprentices. Construction made up 60% of the sponsors for apprentices.

"We saw that the number of registered apprenticeships and unique program sponsors is generally increasing in the State of Kansas, which is good," said Ethan Klein, a recent KU graduate who conducted the research with Duncan and Daria Milakhina, associate researcher at KU's Institute for Policy and Social Research.

Klein was drawn to the project. "I think every college student wants to see how what they learn in the classroom setting can be applied to a work setting. One of the really enjoyable parts of this project is seeing how I could be given a data set and apply some of these data visualization and data analysis techniques."

The team also seeks to quantify the return on investment for registered apprenticeships in Kansas. Nationally, the ROI is $1.48 for every dollar invested.

A Revival for Registered Apprenticeships

While apprenticeships date back hundreds of years, their decline in the past century led to a gap between education and employment.

"We've created a system that doesn't allow for everyone to engage," Anderson said. "We are telling folks that you either need to go to college to be successful or you need to just go into the workforce. We believe that both can happen at the same time and it's a win for the economy."

But this earn-and-learn system is enjoying a modern revival, offering a valuable path for those who may not pursue traditional college routes. An executive order from Governor Laura Kelly in 2022 dramatically scaled up apprenticeship efforts in Kansas to meet skilled labor needs, as the state's business investments hit record highs.

"We have this discrepancy between huge growth in our economy, and our greatest asset, which is our people, leaving the state," stated Anderson. "We need our people to make the state prosperous. It would be great if we could get them some additional training, skills, education and a wage at the same time."

Anderson hopes the data-driven insights from KDSC will inform solid policy decisions and expand apprenticeships farther into fields like teaching and nursing, benefiting both the state's economy and its people.

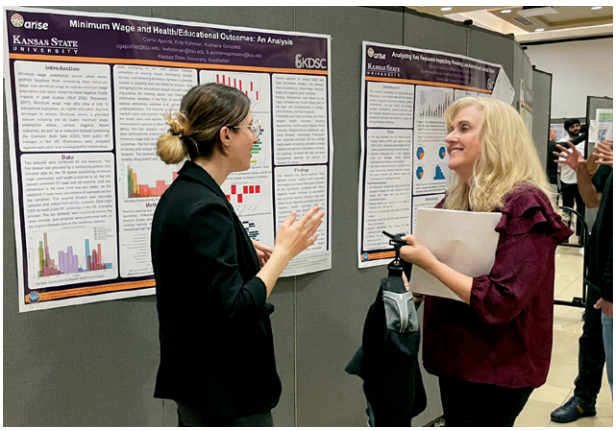
By collaborating with the KDSC, businesses and organizations can unlock valuable insights from their data, much like the office Anderson leads is doing.

Final Thoughts

Anderson is eager to dive into more of the data, as the researchers compile surveys from more than 100 companies who have sponsored apprentices. She has a vision for the program.

"My dad is absolutely, bar none, the smartest human being I know. He can estimate million-dollar projects. He can fix anything. But he apprenticed under his dad's welding business and was told, don't worry, you don't need to go to school, you don't need to get further training."

"I truly believe that if my dad had been given an opportunity to register his apprenticeship program to [reflect] that experience, his life would be very different today."



BUILDING RESILIENCE IN KANSAS WITH COMMUNITY-ENGAGED RESEARCH

Helping Kansans rebound faster and suffer less from large-scale disasters is the aim of a five-year, $24 million EPSCoR initiative known as ARISE, which stands for Adaptive and Resilient Infrastructures Driven by Social Equity.

Now in its third year, ARISE enables more than 70 researchers from the University of Kansas, Kansas State University, and Wichita State University to investigate resilient infrastructure systems. The team also engages with Kansas residents in five counties: Ford, Finney, Seward, Johnson and Wyandotte, empowering them to contribute to research that shapes the future of their neighborhoods and cities.

KU Professor of Engineering Belinda Sturm oversees the project as its principal investigator with engineers Bala Natarajan at K-State and Elaina Sutley at KU. The initiative is funded by the U.S. National Science Foundation Established Program to Stimulate Competitive Research (NSF EPSCoR) and the Kansas Board of Regents.

"I find that the most challenging societal problems typically require solutions that cut across disciplinary boundaries," Natarajan said. "That is why I am excited to work on this unique project."

Here, we highlight scientific achievements made by the ARISE team in the past year.

Surveying Thousands of Kansans

How does infrastructure intersect with social equity in Kansas?

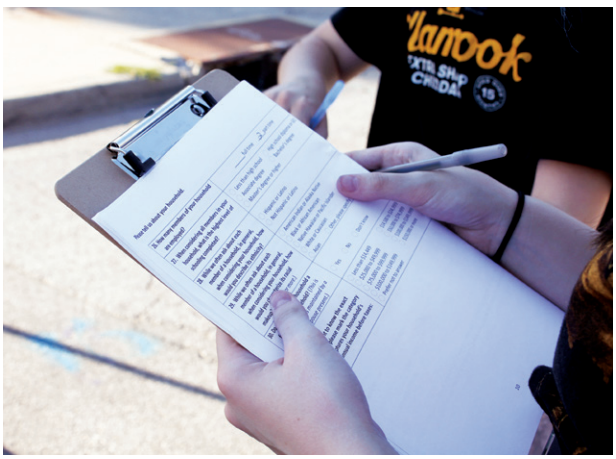
This research question is important because the most socially vulnerable people tend to live and work in the most physically vulnerable areas, such as floodplains, with undersized or undermaintained infrastructure.

To answer this question, the ARISE team designed a 34-question survey, focused on understanding people's past experiences during disasters and severe weather events.

They used several methods to distribute the survey to Kansas residents. First, they sent it virtually statewide. Then they mailed it to 10,000 households and businesses in the counties of Ford, Finney, Seward, Johnson, and Wyandotte. They also gave it out at community events, including the Third Friday Art Walk in Downtown Kansas City.

The team is currently processing this survey data. They hope the results help shine a light on the range of experiences faced by residents across income, gender, ethnicity, geography, and age.

The information will guide other aspects of the ARISE research project, including hazard scenario assessments and infrastructure modeling. It will also provide a steppingstone for Kansas Board of Regents institutions to



seek additional federal research funding to transition Kansas to a Smart State, as envisioned in the Kansas Science & Technology plan.

Simulating Real World Systems

What can a community do to build resilience to severe weather and other disasters?

ARISE investigators aim to answer this question by creating virtual spaces—or testbeds—that simulate real world systems. This increasingly popular approach makes it possible to design experiments that would not be feasible in real life.

After reviewing 103 publications and 22 existing testbeds, KU Postdoc Amin Enderami and Associate Professor Elaina Sutley now have a good grasp on what it takes to develop a functional testbed.

With this groundwork done, they are working with engineers and social scientists at K-State, KU and WSU to build testbeds relevant to Kansas. For example, K-State Postdoc Amulya Sreejith is working with several other students and faculty to develop a smart grid testbed for analyzing power systems.

Unlike conventional testbeds that focus only on physical infrastructure systems—such as pipes, bridges, and powerlines—their new approach blends both physical and human systems. By including social aspects of a community, the team envisions that this research will lead to a first-of-its-kind tool for helping city leaders make holistic resilience analyses.

Ultimately, the team hopes that its tool will help cities consider a range of perspectives, including the needs of the most vulnerable residents, when dealing with emergencies.

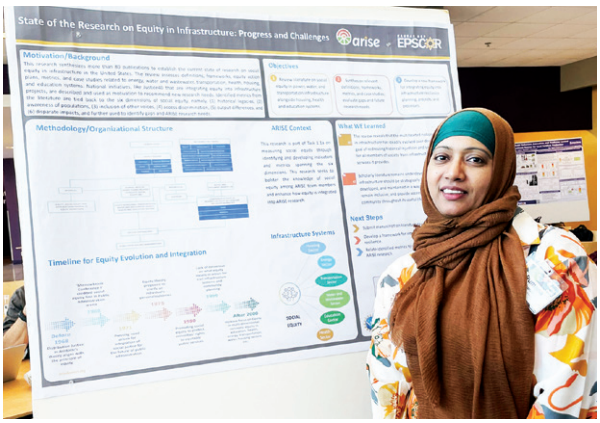
Making Space for Community Conversations

It is rare for everyday folks to talk to academics about real-world challenges. But the ARISE team seeks out these types of conversations by organizing events, called community studios, in Kansas.

From February to June 2024, the team hosted eight studios in five cities. Roughly 85 Kansans attended these events alongside 20 in-state scientists to share stories about disaster resilience and how equity impacts infrastructure investments in their communities.

"We go out to engage communities in our research because they have local knowledge that we don't have," said Jason Bergtold, professor of agricultural economics at Kansas State University.

The reason for this engagement is straightforward: it takes more than technical know-how to solve major societal challenges like safeguarding communities against extreme weather disasters. Knowing about



people's lived experiences is vital, especially given vast differences in urban and rural life.

"Without these critical connections, our research would likely fall short in meeting local needs," Bergtold said. "Each studio… encourages culturally sensitive conversations meant to benefit both the communities and the researchers."

To nurture these connections, Dr. Bergtold teamed up with two leaders of the Environmental Finance Center at Wichita State University, Director Tonya Bronleewe and Program Associate John Colclazier. Alej Martinez, program coordinator at KU, helped organize and lead sessions as well.

An array of folks from Dodge City, Garden City, Liberal, Kansas City, and Overland Park attended the studios. A complementary lunch and $100 cash helped incentivize participation for the three-and-half hours long meetings.

> "Without these critical connections, our research would likely fall short in meeting local needs."

Attendees at the studios were diverse in experiences, ages, cultures, jobs, and languages. To ensure a wide breadth of perspectives was welcome, two studios were also offered in Spanish.

Justin Hutchison, KU assistant professor of engineering who studies drinking water for the ARISE project, attended a studio, saying "It was a unique opportunity to hear so many interesting stories of Kansans from many different aspects of life."

Dr. Bergtold summarized the findings of each studio into a separate report for each community. A key takeaway is that aspects of resilience and social equity vary across Kansas communities, as each has its own priorities and needs. Yet, some aspects were consistently ranked as more important, such as ensuring that everyone has access to clean water, affordable energy, and transportation.

The studios also found that each community has a rich array of resources and assets that can be used to equitably enhance resilience. But the level of influence of built capital, particularly water, energy and transportation infrastructures, varied widely.

"This collaboration marks a significant step in our shared mission to create a more equitable and resilient Kansas."

Researchers are using these findings to support other aspects of the project. Another round of studios is planned in 2025 to explore community goals and actionable steps to become more resilient.

New partners expand reach across Kansas

In 2024, the ARISE team partnered with two University of Kansas Medical Center programs: Communities Organizing to Promote Equity (COPE) and Local Health Equity Action Teams (LHEATs). By coordinating their efforts, these programs will be able to maximize their resources and expand impact more broadly across the state.

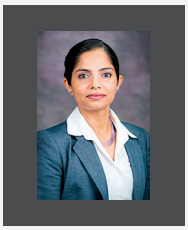
"This collaboration marks a significant step in our shared mission to create a more equitable and resilient Kansas," said Alej Martinez, Kansas NSF EPSCoR program coordinator. "Together, we can focus on delivering the most impactful solutions to Kansas communities by streamlining our efforts and avoiding duplication."

Honors and Recognition

K-State engineer Bala Natarajan was one of two faculty recognized this year at Kansas State University with a distinguished faculty award.

Former Kansas NSF EPSCoR Director Kristin Bowman-James received the 2024 Joseph G. Danek Award recognizing her long-term commitment to enhancing the research infrastructure in Kansas by forging collaborations across institutions and disciplines, a key EPSCoR goal.

William Duncan, University of Kansas assistant professor of data science, was selected by NSF to lead a $650,000 project to develop a new water monitoring technology for Kansas. The National Science Foundation Convergence Accelerator works with partners at the technology company Viaanix and the Kansas Water Office. The team is developing a dashboard for real-time public reporting of water quality, quantity, and equity in Kansas. Once developed, the dashboard will be made available to state and local government agencies. As Kansas faces the challenges of a prolonged drought, a tool like this is a critical step on the path to water sustainability.



K-State engineer Vaishali Sharda received a prestigious NSF CAREER award to help prepare Kansas farmers for future climates. In addition, K-State announced Dr. Sharda's promotion to associate professor with tenure. As a collaborator on the Kansas NSF EPSCoR ARISE project, Dr. Sharda contributes to Theme 3 research, which seeks to understand the real-world relationships between hazards and infrastructure systems using case studies to explore how different decision levers influence social equity in Kansas communities.

KU engineer Elaina Sutley received a $650,910 NSF award to develop strategies for managing retreat from weather-vulnerable areas. This work is part of an international team to develop strategies for relocating people, property, and infrastructure away from areas vulnerable to extreme weather.

The three-year project will analyze past managed retreat initiatives across Canada, the U.S., and Indonesia to understand the complexities, best practices, and decision criteria facing communities at the frontlines of flooding from storms and rising sea levels.

"This is a particularly exciting award (to me) because of the topical area…where we will be able to expand our partnership with Johnson County, Kansas through research on their buyout program," Sutley said.

The grant is awarded to KU with subcontracts to Stony Brook University and Texas Tech University. Canadian and Indonesian partners received their own separate awards from organizations that are equivalent to the NSF.

Doctoral student awarded grant for tornado-ready research
Madison Graham, KU doctoral student in behavioral studies, was awarded a $15,000 research project from the Natural Hazards Center for Tornado Ready Research. Graham submitted as Principal Investigator to the solicitation with two co-investigators on the project. The project is titled "Safe Room Sheltering in Kansas Manufactured Housing Communities: A Behavioral Economic Analysis."

Graduate student Emma Russin recognized with four honors
Emma Russin, engineering graduate student at the University of Kansas, won not one but four awards this year!

Russin won First Place and a $600 prize in the Graduate Division for the Snyder Book Collecting Contest. The KU Libraries honored Emma and eight other finalists for their book collecting passion at their April 30 award ceremony at Watson Library. This is the contest's 66th year, after launching in 1957 by libraries donor Elizabeth Snyder.

Her next research honor came March 25th at the Missouri American Waterworks Association conference in Osage Beach, Missouri, when she won 2nd place in the student poster competition. Her poster, titled "Synthesizing drinking water distribution systems based on readily available data," relates to her research on the ARISE project.

In August, Russin received two more awards: the KWEA Scholarship and the Terry L. McKanna Scholarship.

Celebrating NSF's 75th Anniversary

The National Science Foundation will commemorate its 75th anniversary on May 10, 2025. As this milestone approaches, we recognize NSF's enduring influence in Kansas through the Established Program to Stimulate Competitive Research (EPSCoR).

Since 1992 when K*Star was launched as a $4.4 million research initiative, NSF EPSCoR has elevated research capabilities and innovation in Kansas, making the state a powerhouse in scientific and technological advances. Additionally, EPSCoR has played a key role in improving education for youth, families, Native American scholars, teachers, and others, expanding access to science while fostering new talent.

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