



# See *k*

RESEARCH MAGAZINE FOR KANSAS STATE UNIVERSITY

*FALL • 2021*

## Cause or effect

How researchers are analyzing misinformation

## Greater spaces, better places

Making the experience worth the visit

## Riding the wave

Interdisciplinary teams find water solutions

## Park and go

This photo — taken by a drone — shows the trails at the Top of the World, which is a scenic overlook area northwest of Manhattan, Kansas, in Washington Marlatt Memorial Park.

Kansas State University researchers are involved in multiple park-focused research projects.

See page 11 to learn how researchers in the College of Health and Human Sciences are studying how park prescriptions could be a part of mental health treatment plans.

See page 20 to learn how the Applied Park Science Lab is enhancing visitor experiences at state and national parks while conserving natural and cultural resources.





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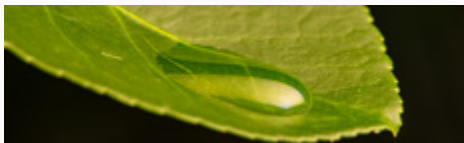
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Greetings from Manhattan and the Office of the Vice President for Research. I can't tell you how excited I am to be joining Kansas State University at this time and in this role. The opportunity to join one of the nation's premier land-grant universities at a time of such *opportunity* and *need* for research, discovery and innovation, both energizes and excites me. K-State is favorably positioned in all ways — expertise, facilities and energies — to advance its research mission, impact and visibility. The culture here is second to none. That is our ace in the hole. *Together* we can achieve great things. And I am excited to champion that mission, to help create new opportunities and to celebrate our successes.

By way of background, prior to joining K-State, I served for six years as provost and senior vice president at the University of Vermont, where I led significant growth in the research enterprise, the launch of several new transdisciplinary centers and institutes, and the creation of a universitywide innovation and entrepreneurship ecosystem. I am excited to continue that work to drive research, innovation and economic development at K-State. I will also work to connect and leverage our teaching, research and service missions, and to create additional opportunities for undergraduate students to engage in research and scholarly activities.

This issue of Seek magazine offers a glimpse into the impressive array of research being conducted at K-State — from the use of drones to monitor state and national parks to interdisciplinary water research that brings together faculty from three K-State colleges. Additional stories feature the use of artificial intelligence to track worldwide bee populations, important initiatives around public health and mental health in Kansas and understanding the role of social media in propagating disinformation and misinformation. This magazine issue tackles pressing challenges both statewide and nationally *and* the use of advanced technologies to address those challenges.

This issue also features outstanding faculty, undergraduate and graduate students, and new industry engagements. We have so much to celebrate at K-State and I look forward to continuing to find ways to both recognize and promote our achievements, our stars and our points of pride.

Go 'Cats!

D. Rosowsky, Vice President for Research

### About Seek

*Seek is Kansas State University's flagship research magazine and invites readers to "See" "K"-State's research, scholarly and creative activities, and discoveries. Seek is produced by the Office of the Vice President for Research and the Division of Communications and Marketing.*

## Seek contributors

### Creative director

*Benjamin Cleveland*

### Graphic designer

*Ryan Barten*

### Photography editor

*Tommy Theis*

### Photographer

*Jeff Moore*

### Editor

*Jennifer Tidball*

### Writers

*Beth Bohn*

*Michelle Geering*

*Chelsi Medved*

*Pat Melgares*

*Katie Messerla*

*Taylor Provine*

*Courtney Roszak*

*Livy Seirer*

*Malorie Soug  y*

### Production manager

*Erin Pennington*

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**KANSAS STATE**  
UNIVERSITY



## A community approach to climate change

A biology team is scaling up to understand the ecological effects of climate change.

Climate change continues to affect individual organisms, populations of plants and animals, and ecological communities, but we don't yet know if these effects will be larger in tropical or temperate areas, said Allison Louthan, assistant professor in the Division of Biology in the Kansas State University College of Arts and Sciences.

Louthan and collaborators from the University of Georgia and the University of Wyoming have outlined a series of mechanisms that might modulate the effect of climate change across latitudes.

While tropical organisms are strongly affected by even small increases in temperature, climate change predictions indicate that the temperature will not warm much in the tropics — and the exact opposite is true in temperate areas. Louthan and her collaborators outline how the degree of climate change and temperature sensitivity might interact with other factors that vary across latitudes, such as the impact of species interactions, to modulate effects of climate change on populations and communities.

“Our work tries to exhaustively outline all the factors that could possibly generate latitudinal variation in climate change impacts, which I think is a step forward from just thinking about individual organisms’ temperature responses,” Louthan said.

The study has been published in the journal *Trends in Ecology and Evolution*. The research was supported by the National Science Foundation and the U.S. Department of Agriculture National Institute of Food and Agriculture.



*K-State researchers are creating innovative outreach tools to help veterinarians address toxicology problems in livestock.*

## New K-State hotline helps diagnose toxic animal emergencies

Rapid response to animal health emergencies has prompted the creation of a new veterinary toxicology training program at Kansas State University. A \$248,000 U.S. Department of Agriculture grant is enhancing the ability of researchers in the College of Veterinary Medicine to answer calls for help.

The goal of the program, developed by Steve Ensley, clinical veterinary toxicologist, and Bob Larson, professor of production medicine, is to create innovative outreach tools. This will better enable livestock veterinarians to recognize and address toxicology problems in food animal species, especially cattle, small ruminants and pigs.

The project uses veterinary telemedicine and other distance-based education resources, including a toxicology call-in hotline for practicing veterinarians called CONSULT — Collaborative, Online, Novel, Science-based, User-friendly, Learning Tool — for common livestock toxicology problems, and YouTube training videos.

## Developing adolescent social media citizenship

A Kansas State University researcher is providing school teachers and administrators with tools to help youth become good social media citizens.

Jana Thomas, professor of practice in the A.Q. Miller School of Journalism and Mass Communications, studies media usage among 10- to 18-year-olds. She has partnered with K-State Research and Extension to measure middle school and high school students' social media citizenship behaviors and to provide learning resources for the classroom.

Students in seventh to 12th grades from five Kansas school districts participated in a pilot study through an anonymous online survey. The survey scored students in eight areas of social media citizenship behavior: digital harassment, psychological health and well-being, security and safety, misuse of technology, communication and conflict management, problem-solving and collaboration, media literacy and digital identity management.

Preliminary survey results among the schools vary. Each school has a unique combination of social media citizenship behaviors where students excel and other behaviors where students can improve. That shows the need for relevant and student-centered citizenship education.

Once students have taken the survey, the researchers share the results and customized educational resources with school administrators and educators to identify educational opportunities related to students' social media use.

"The popularity of social media like Instagram, Snapchat, YouTube and TikTok among today's youth fuels the need for technology and citizenship education that helps students navigate potential risks and prioritizes skills in digital communication and content creation," Thomas said.

See page 16 to read more about research related to digital literacy.



## K-State Salina leads national first responder UAS challenge

The Kansas State University Salina Aerospace and Technology Campus continues to be a national leader in unmanned aircraft systems, or UAS. K-State Salina has been selected to lead the third UAS prize competition by the U.S. Department of Commerce National Institute of Standards and Technology, or NIST.

Named the First Responder UAS Triple Challenge, this prize competition will focus on the advancement of UAS technology to support first responders and to help them save lives more quickly. The competition is comprised of three challenges where participants use their UAS ingenuity to deliver creative solutions to advance first responder operations.

K-State Salina is coordinating the UAS Triple Challenge in partnership with Mississippi State University and live competitions will be in Starkville, Mississippi, and Salina in spring/summer 2022.

“This project has been a long time in the making for our team at K-State,” said Kurt Barnhart, professor of aviation and lead of the K-State grant team. “We are privileged to partner with the challenge team at NIST in its ongoing effort to push innovative technologies forward for all first responders, providing life-saving help when needed the most. We’re also excited to be working with the excellent team at Mississippi State University’s Raspet Flight Laboratory to jointly develop and deliver this competition.”



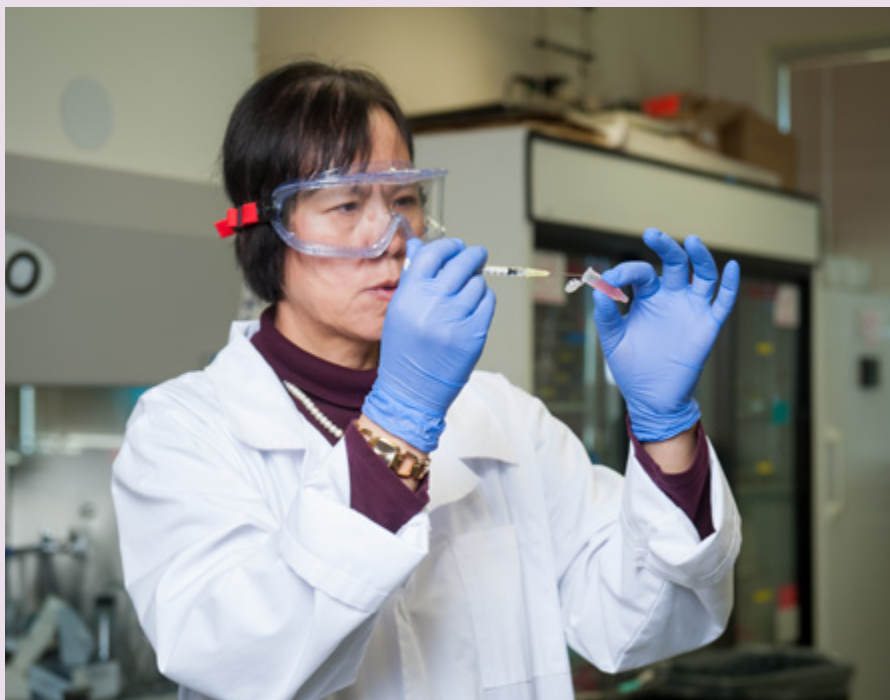
## State gains first aerospace and technology campus with rebranding of Salina campus

With a focus on national expansion, meeting the demands of the aerospace industry and a recognition of the niche mission of the campus, Kansas State University’s Polytechnic Campus is rebranding to be Kansas State University Salina Aerospace and Technology Campus.

“This change establishes the first aerospace and technology campus in Kansas and shows our Salina campus is ready to take on the accelerating needs of the aerospace and advanced manufacturing industries,” said Richard Myers, K-State president. “The Aerospace and Technology Campus will be a national leader in advanced aviation and aerospace training, education and engineering through research, innovation and instruction.”

Since joining the Kansas State University system in 1991, the campus has housed the university’s aviation and engineering technology programs. These are niche programs, separate from any programs offered on the other K-State campuses. The historical lineage of the campus — a two-year technical institution that merged with a public university — uniquely positions it to serve all career-entry points into the aerospace and advanced manufacturing industries.

K-State Salina will continue its focus on research programs that build the aerospace and technology industries. Through the Global Aeronautics Initiative, K-State Salina is advancing global aviation through research, innovation and training. The Applied Aviation Research Center is a national leader in unmanned aircraft systems research and training. The Bulk Solids Innovation Center is one of the only facilities in the world to handle bulk solids materials, testing and training.



*Left: Xiuzhi “Susan” Sun, university distinguished professor of grain science and industry, and a collaborative team have developed a universal peptide hydrogel.*

*Below: These images show how the universal peptide hydrogel can be 3D-bioprinted into different patterns, from a simple star, far left, to a kidney-like organ, far right. (Image credit: Susan Sun)*



## Building a better stem cell gel

Kansas State University researchers have developed a universal peptide hydrogel that can help improve 3D bioprinting and stem cell research. The collaborative work is providing powerful biotools for drug discovery and disease modeling and is improving platforms for regenerative medicine and stem cell therapeutics.

“Stem cells can self-renew indefinitely in theory and differentiate into almost all somatic cell types and have huge potential to improve human health,” said Xiuzhi “Susan” Sun, university distinguished professor of grain science and industry in the College of Agriculture.

Sun and collaborators recently published their work in the journal *Advanced Functional Materials*.

For more than a decade, human-induced pluripotent stem cells, or hiPSCs, have been cultured as single layers on flat surfaces in 2D form.

That often leads to problems, such as poor maintenance of pluripotency, which is the stem cell’s ability to develop into different cell types, Sun said.

The K-State-developed universal peptide hydrogel enables researchers to scale the physiological formation of stem cells and to 3D-bioprint hiPSC patterns, such as spheroids and organoids. These spheroids have better performance and integrity than existing 3D technologies.

The universal peptide hydrogel has valuable properties — tunable gel strength, viscosity and self-healing kinetics — that make it suitable for either pipetting or bioprinting without additional chemicals or cross-linking agents.

The work has involved other K-State researchers in the College of Agriculture, the Carl R. Ice College of Engineering and the College of Veterinary Medicine. Other collaborators include Harvard Medical School, Harvard University, Applied StemCell Inc., Wake Forest University and Virginia Tech.

# THE HIDDEN CRISIS

*A student uses an Anatomage Table,  
which is a 3D anatomy visualization and  
virtual dissection tool.*



## Through public health programs, K-State helps communities

By Chelsi Medved

As the COVID-19 pandemic has affected communities across the world, it also has amplified long-existing problems in communities at home. A shortage of health care providers. A lack of mental health resources. The need for strong community and public health research initiatives.

Professionals in human health careers have felt the burden. Doctors, nurses and physician assistants provide nonstop health care. Therapists and counselors work overtime to offer mental health support. Researchers, health communicators and epidemiologists deliver data around the clock.

Kansas State University is addressing this often-hidden crisis in public health and community health. University leaders are creating new academic programs to provide more health-focused professionals. Researchers are tackling multiple topics related to public health.

“The COVID-19 pandemic has strained our health care system and scientific communities,” said Brad Behnke, associate dean of research and graduate studies for the College of Health and Human Sciences. “Yet both health care providers and scientists rapidly combated the multiple insults of the disease to meet patient demands. Public health research is crucial to collect and disseminate accurate information to combat the immediate and long-term impact of this disease. At K-State, we are fortunate to have not only a multitude of public health experts, but also undergraduate and graduate programs in public health to train and equip the next generation of experts.”

Read the following highlights of interdisciplinary health-related projects that are helping communities during the COVID-19 pandemic and preparing us for a post-pandemic world.



*K-State research is helping hospitality employees cope with stress on the job.*

### Mindfulness in the hospitality industry

A K-State researcher and collaborators are studying how mindfulness in the workplace can help hospitality employees cope with daily stress on the job and increase engagement at work.

The success of hospitality firms — such as restaurants, hotels, casinos and event centers — depends largely on the quality of frontline employees who generate and maintain positive relationships with customers.

But the hospitality industry working environment is characterized by long hours, low job security, low pay and emotional demands. It can be even more stressful when confronting difficult customers.

In a study with casino employees in South Korea, Jichul Jang, K-State associate professor of hospitality management, and two international collaborators found that more mindful employees are able to cope with customer incivility and maintain their level of work engagement. The research suggests that mindfulness training programs, such as meditation, have improved employees’ mental health by reducing their perceived level of stress.

Organizational support is key, the researchers said. To see long-lasting effects of mindfulness, hospitality firms can make resources readily available to employees by setting up a quiet room for mindfulness practice, by including practice time as part of the work shift or by offering group sessions with certified trainers.



*Left and middle photos: Several new academic and research programs are helping prepare students for health careers.*

## New academic programs for health careers

Several Kansas State University colleges — including Health and Human Sciences, Arts and Sciences, and Veterinary Medicine — have created new academic tracks for health care professionals.

These new programs include:

- Pathway to Nursing Program, a bachelor's degree collaboration with Wichita State University.
- Master's degree in physician assistant studies.
- Master's degree in athletic training.
- Bachelor's degree in integrative physiology.
- Bachelor's degree in public health.
- Bachelor's degree in biology with new specializations in human health biology and medical microbiology.
- Integrated health studies secondary major.
- Global health, medicine and society certificate program.
- One-year graduate program in biomedical science.
- Online Master of Public Health degree.
- Online bachelor's degree in kinesiology.

## Helping the shortage of health care workers

For years, K-State has offered the interdisciplinary Master of Public Health program to prepare individuals to address health issues on local, state, national and international levels.

“K-State has been training graduate students in public health since 2003,” said Ellyn Mulcahy, director of the Master of Public Health program and associate professor in the College of Veterinary Medicine. “We have prepared our graduates for careers in public health ranging from local health departments in Kansas to federal and international public health agencies. Our new programming in online graduate public health combined with the new undergraduate programs focused on public health places us in an exceptional position to provide access to excellent public health education for K-Staters and impact public health globally.”

To address state and national shortages of health care workers, K-State continues to develop new programs to prepare students for health careers.

The College of Health and Human Sciences has created two new programs for nurses and physician assistants. The Pathway to Nursing Program will begin in fall 2022 in collaboration with Wichita State University and will allow students to pursue a nursing bachelor's degree and a K-State bachelor's degree while on the K-State Manhattan campus.

The Master of Science in physician assistant studies program — set to begin in January 2022 — will prepare students to be nationally certified and licensed medical professionals who work on health care teams with physicians and other providers. Their jobs will be in demand, too: The Bureau of Labor Statistics projects a 31% increase in physician assistant jobs by 2026, compared to a 4% increase in physician jobs.



*Above photos: Interior design and gerontology researchers are assessing household design in skilled care settings. Student researchers involved include, from left, Madison Parker, master's student in gerontology; Samantha Gibson, senior in social work; and Ashlyn Zachgo, senior in kinesiology.*

## Improving care environments

Migette Kaup, K-State professor of interior design, and co-investigator Margaret Calkins of the IDEAS Institute are using a National Institutes of Health grant to improve living environments for individuals with dementia and other older adults who live in planned care settings.

The researchers are validating the Environmental Audit Screening Evaluation, or EASE, tool, which assesses elements of household design in skilled care settings, such as nursing homes. The assessment tool connects to evidence-based design research and relates to clinical care and behavioral health outcomes.

“This research addresses limitations of existing assessment instruments by identifying which elements of nursing home environments can be planned for or improved to support the desired specific outcomes for residents, staff and organizations,” Kaup said.

The researchers also are contributing to knowledge on health and interior design. They have received COVID-19 supplemental funding from NIH to collect environmental and operational data on variables associated with potential transmission of infections.

*Spending time outdoors can benefit people of all ages. K-State researchers are helping to develop mental health treatment plans that include nature-based physical activity.*



## Park prescriptions for mental health

Almost 1 in 5 adults, or 46.6 million Americans, live with a mental illness, according to the Substance Abuse and Mental Health Services Administration. During the pandemic many people have struggled with mental health issues, such as anxiety, depression and chronic stress.

But what if a prescription for a mental illness involved a visit to your neighborhood park?

Both physical activity and time in nature can improve mental health, and several K-State researchers are developing a training intervention that helps mental health practitioners promote nature-based physical activity as part of clients' treatment plans.

The project involves kinesiology researchers Emily Mailey, associate professor, and Gina Besenyi, assistant professor, as well as Jared Durtschi, associate professor in couple and family therapy.

"Outdoor physical activity can increase energy and self-esteem, and reduce tension, anger, anxiety and depression," Besenyi said. "Given the many benefits, researchers and practitioners acknowledge physical activity is an integral component of mental health treatment and recovery, but what we need are evidence-based, scalable interventions."

The researchers worked with therapists across the U.S. — including K-State Counseling and Psychological Services

and the couple and family therapy program practitioners at the university — and found that mental health practitioners are receptive to the idea of delivering "park prescriptions," but want further training to feel comfortable recommending physical activity to clients.

The researchers continue to study clients' perspectives on park prescriptions and to develop preliminary training for mental health practitioners.


"We hope to shine a light on parks as valuable and affordable physical activity and public health resources that can expand mental health services' capacity and reach to prevent and treat mental health disorders," Besenyi said.

## Educating for healthy communities

Lisa Ross, Master of Public Health student, is helping nutrition educators across the state engage with communities and partners.

Ross recently evaluated a professional development course for Supplemental Nutrition Assistance Program Education, or SNAP-Ed, staff. Kansas SNAP-Ed — managed by K-State Research and Extension — supports low-income Kansans in making healthy choices. Ross serves as the Kansas SNAP-ED coordinator.

Ross' research shows that participants who completed the course felt more comfortable and better with the skills needed to engage in the SNAP-Ed policy, system and environment approaches within their communities.

"The evaluation showed that the course was successful in teaching public health professionals how to think, see and do effective systems-level change work," Ross said. "Because of these great results, Kansas will be providing this training to all state SNAP-Ed staff." 

### ➤ Seek more

Read more about K-State public health and community health programs.

[k-state.edu/seek](https://k-state.edu/seek)





# Breaking a bottleneck in bee research

**Computer vision model gets entomologists, bumblebee buffs all abuzz**

*By Pat Melgares*

A Kansas State University project that harnesses the power of artificial intelligence and the curiosity of nature lovers may just be the bee's knees for saving one of the world's most efficient pollinators.

K-State entomologist Brian Spiesman is leading the project, called BeeMachine, which uses computer vision to identify North American bumblebee species with images submitted from public databases and ordinary citizens.

As of summer 2021, the database has more than 125,000 images and feeds a computer algorithm that Spiesman hopes will break a bottleneck in getting important research data to conservationists and others who put that knowledge to use.

“The way research currently works is you go out into the field, capture a lot of bees and bring them back to the lab to identify them,” said Spiesman, research assistant professor of entomology in the College of Agriculture.

Lab workers then identify the bees under a microscope one at a time. Spiesman said researchers often collect bees all summer, identify them during the winter, then analyze and write data for publication — a process that can sometimes take years.

“BeeMachine, and what will likely be future iterations of the use of artificial intelligence for insect identification, will transform the field of bee and insect conservation more broadly,” said Claudio Gratton, professor of entomology at the University of Wisconsin-Madison, who has used the program with his students to confirm the identities of species. “The possibility of having species-level identifications from numerous places will finally give us the ability to accurately and rapidly monitor bee occurrence, population sizes and how they fluctuate over time.”

*Photos courtesy of BeeMachine.*



## A citizen science approach

There are more than 20,000 native bee species — including bumblebees — around the world. It is commonly believed among scientists that the population of bumblebees in North America is declining. One species — *Bombus pensylvanicus* — once was widely spread across the eastern U.S., but its range has greatly contracted, according to Spiesman. While the species still exists in Kansas, it has not been seen in many places around the U.S., including Pennsylvania.

“Bumblebees are great pollinators, especially for things like tomatoes and blueberries and other crops that require buzz pollination,” Spiesman said. “They vibrate very rapidly and that helps them more effectively deposit pollen on the flowers that require that.”

Rich Hatfield, a senior conservation biologist with the Xerces Society for Invertebrate Conservation, has contributed thousands of images to BeeMachine from his own site, Bumble Bee Watch, which gathers images submitted by citizens and has them reviewed by an expert taxonomist.

That process — best known as citizen science — is valuable to researchers because it connects them to an endless number of interested citizens who are contributing to scientific knowledge.

But current efforts to engage the public in bee research fall short because of the amount of time it takes to accept samples and then wait for an expert taxonomist to identify the species and provide feedback. Often, people submitting the samples simply want quick answers on what they have seen.

Spiesman said BeeMachine shows promise for bridging that gap. One idea is that BeeMachine’s computer vision system could be integrated with Bumble Bee Watch and similar sites to provide quicker feedback to those submitting pictures.

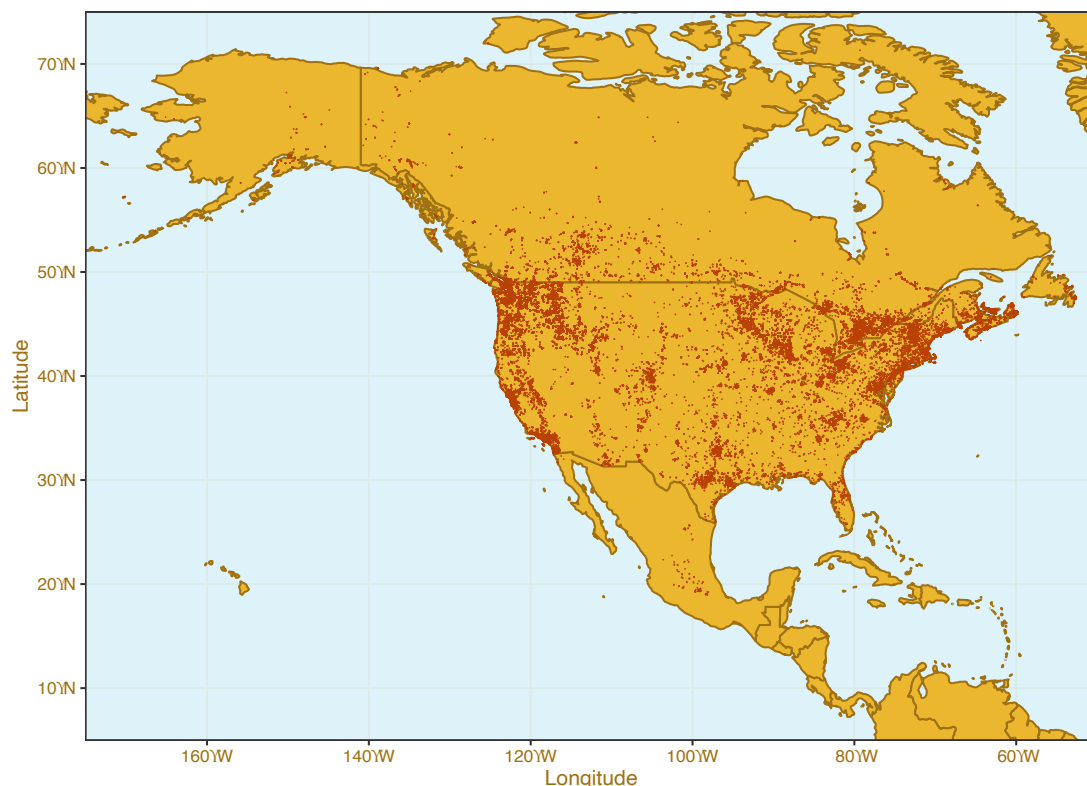
## The power of artificial intelligence

K-State computer scientist William Hsu with the Center for Artificial Intelligence and Data Science is developing the computer vision that is key to making quicker identification a reality.

“Computer vision is the scientific field of using machines to understand images and videos, meaning that we have a picture or sequence of pictures captured on a camera, phone or other device, and we might want to name all the objects or people, mark out the borders of objects, label and track living organisms, or even explain events or actions that are happening,” said Hsu, professor of computer science in the Carl R. Ice College of Engineering.

As computer programs analyze images, Hsu said, those programs store the information for use in identifying similar images sometime in the future. Initially, images may be identified by a human being, and that information is stored alongside the image.

“The learning system we use is a deep neural network, a mathematical model resembling some parts of the visual processing system of the human brain,” Hsu said. “This model is modified to make it better at predicting the labels that people already put on images. This is called training and the result is a trained model that we can use on bees we haven’t seen before.”




*This heat map shows the locations where bumblebee observations were submitted to citizen science programs. Photos from these observations were used to train the BeeMachine algorithm now being developed at K-State.*

## Future buzz

While 120,000 images currently in the BeeMachine database seems like a lot, it's still not enough. The more that the program is fed, the better it gets at identifying the correct species.

“An expert taxonomist usually has to look at two or three images of the same individual bee that are taken at different angles,” Spiesman said. “In the artificial intelligence model, we are realizing that it needs that, too. If it has a really good look at it, it will give us a good result. If you want to make sure you have the right answer, you have to load in two or three or four images of the same bee.”

In the year since BeeMachine debuted, Spiesman said the K-State researchers have increased the number of species identified in the database from 36 to 41. There are an estimated 45 species of bumblebees in North America. Eventually, BeeMachine could be used to identify bumblebees around the world, and then — much more long term — any of the 20,000 native bee species found across the globe.

Getting there means advancing the technology even further. Already, Hsu said researchers are looking at other ways to gather images, such as using thermal sensors, drone-mounted cameras, wearable or implantable sensors and other devices. Spiesman said something as simple as mounting motion-sensitive cameras in a field to track bees as they pollinate flowers also could be valuable — similar to remote wildlife cameras. 

### Seek more

Citizens are encouraged to contribute to BeeMachine. Learn more about the project and how to participate.  
[k-state.edu/seek](https://k-state.edu/seek)

*K-State entomologists also are using computer vision modeling to detect other insects in crop fields.*

## A computer vision model for farmers

Kansas State University entomologist Brian McCornack half-jokingly says he's counted close to a billion aphids — a minute, sap-sucking bug that feeds on plants — in his career of 20-plus years, and he's just plain tired of doing it.

So, he's pretty happy that computers may soon be able to do it for him. Computer vision modeling also could be used to aid farmers in their crop fields.

“Counting insects, especially across large geographic regions, is time-consuming and sometimes impractical,” said McCornack, professor and head of the entomology department. “Insects are quite mobile, and populations can change drastically from one week to the next. Farmers simply can't walk every single acre of a field as frequently as needed to make management decisions. Machines can reduce the workload while improving the reliability in pest or natural enemy density estimates, which are the basis of all treatment thresholds. The exciting part is that we are not that far away from seeing these tools in the hands of farmers and consultants.”

K-State entomologists, agronomists and biological engineers are developing technologies, such as drones, to identify defoliated soybean leaves or to identify lady beetles on sorghum.

But automation does not mean removing people from production agriculture, McCornack said.

“It does mean that we need to be sure that our students and stakeholders know that these tools have a place in decision-making, and that we teach them how to use this technology to solve some of the grand challenges facing agriculture,” McCornack said.



# CAUSE OR EFFECT

How researchers are analyzing misinformation

By Michelle Geering

It is easier than ever to produce and consume information — it just requires a scroll, swipe or click. Information is at our fingertips every hour of every day.

This also means it is easier than ever to come across misinformation or even disinformation. Misinformation is false information that is shared without the intent to mislead, whereas disinformation is false messaging, such as propaganda, that is purposefully created and shared with the intent to deceive.

“Some studies have shown that misinformation is often more clicked on, read or engaged with than real or factual news,” said Jacob Groshek, associate professor and Ross Beach chair of emerging media research in the Kansas State University A.Q. Miller School of Journalism and Mass Communications. “There are a number of reasons — from the commercialization aspect of it to the personalization of news and information online — that have been driving us more and more toward being exposed to and perhaps influenced by misinformation.”

Researchers at Kansas State University are analyzing and exploring how communication technologies and the use of social media platforms and other digital media influence our daily lives from interpersonal communications to decision-making.

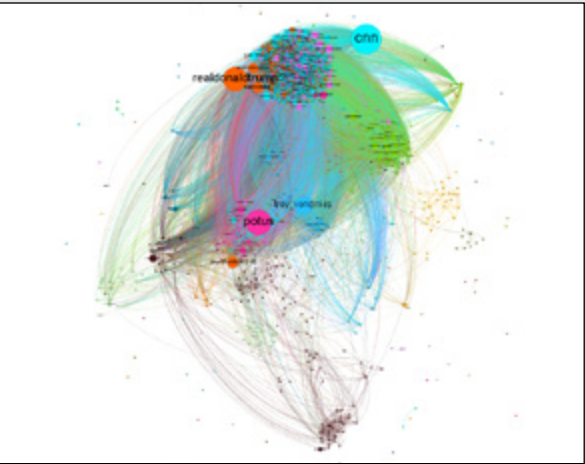
## Social media and politics

Groshek and his team of graduate students study how online and mobile media technologies influence decisions related to not only politics and health, but also sports and culture. This research also helps people understand how and why they are receiving specific information from their personal social media feeds and recommendation systems.

In one example, in the 2016 election cycle, Groshek studied how differing forms of social media use related to support for different presidential candidates. He found that some voters weren't necessarily influenced by passive forms of social media use, but many had their candidate preference influenced by traditional news outlets reporting on social media activity.

Another of Groshek's research projects analyzed the use of the #fakenews hashtag on Twitter by modeling the top 50 accounts on the platform over a year's time. The study determined that the sharing of information often circulated among a small number of highly influential users in order to overwhelm that system and create a cycle of perpetuating misinformation. Just as important, the majority of Twitter accounts in the study were classified as bots, or nonhuman agents posting or reposting tweets created by others.

"Whether or not you are seeing information that is from a real person, a bit of code or a combination of the two, that volume of what's being received, interpreted and perhaps acted upon can be skewed and can make that picture look vastly different," Groshek said. "Even the appearance of certain viewpoints being dominant can then influence the way that users think about and respond to that information."



*This network graph visualizes social media user influence by both human and nonhuman actors in more than 14 million tweets sent by more than 2.4 million Twitter users in 2018. Jacob Groshek, associate professor of journalism and mass communications, created this graphic.*

The study also found that fake news discussions on Twitter influenced audiences' understanding of what is true or false and the credibility of legacy media channels.

"It is absolutely essential for citizens who are living in a media-saturated environment, particularly in online environments, to understand these flows of information and how they can be altered, adjusted and influenced by a wide variety of actors both domestically and internationally," Groshek said. "We can truly serve the public interest by helping people work together on shared problems, which is what democracy is really all about."

## The power of memes

Memes are entertaining and give us opportunities to chuckle, but these small bits of communication can be full of powerful messaging.

Heather Suzanne Woods, assistant professor of communication studies in the College of Arts and Sciences, specializes in rhetoric and technology and is a co-author of a book about memes. Woods studies how technology and culture influence each other, and she includes meme literacy in classrooms and in workshops.

**"When I teach about memes, I ask students to understand and unpack messaging inside a meme so that they can be critical thinkers and digitally literate."**

**— Heather Suzanne Woods, assistant professor of communication studies**

"When I teach about memes, I ask students to understand and unpack messaging inside a meme so that they can be critical thinkers and digitally literate," Woods said. "Those skills are important for building future civic leaders and people who can participate in a democracy."

Memes bring together cultures and communities to create something new in an engaging format. But this hyper-condensed communication does have drawbacks, Woods said.

"Memes can be on the edge of internet culture and their humorous elements mean no one really fact checks a meme," Woods said. "The form of a meme does not lend itself to the same element of scrutiny and consideration as other forms of communication or discourse might. Misinformation or disinformation can move fairly rapidly in memetic format without people knowing that it's happening."

## Stickiness and social vigilante tendencies

Don Saucier, university distinguished teaching scholar and professor of psychological sciences, researches prejudice and persuasion. His work helps to understand how people process information and why misinformation is sometimes difficult to overcome.

Biased assimilation is the processing of information through our own prior knowledge and beliefs so it makes sense. His research shows people take information and make it tell the story they want it to tell. This is one of the ways that misinformation sticks.

"You see a news story, you see an interview, you read something on social media — it will become what you want it to become through biased assimilation," Saucier said. "Sometimes it is sticky because we like it, sometimes it is sticky because we want to work against it."

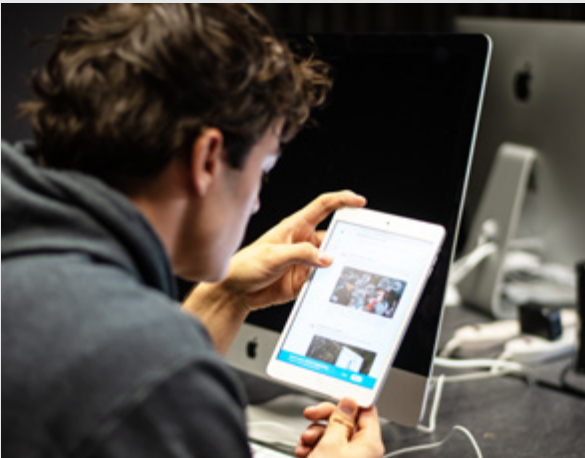
Saucier also has investigated social vigilantism — people's tendencies to think their beliefs are superior and that others should believe what they believe for the same reasons.

He found that individuals lower in social vigilantism paid more attention to information they agreed with. This behavior is selective exposure or the tendency to favor information that reinforces preexisting beliefs. In contrast, individuals higher in social vigilantism paid more attention to the other side of the argument in order to defeat the other viewpoint.

"There is this motivational component that they will pay attention to information on the other side of their perspective, but they are not listening to it on its merits," Saucier said. "They will not be persuaded."

Saucier's research sheds light on how information is processed and he offers strategies to interact with others during disagreeable conversations.

"Disengaging from a person high in social vigilantism might save you some time, emotional energy and aggravation," Saucier said. "If you find someone like this, you aren't going to change their minds. So, unless you enjoy the battle, get out of it."





K-State librarians, from left, Carol Sevin, Daniel Ireton and Sara K. Kearns, have created a free, online resource guide for personal media literacy and more diverse news habits.

## Media literacy resources

Mobile devices are today’s equivalent of a printing press and a newspaper that we carry around in our pockets. Understanding what information we are consuming and sharing is a critical step to stopping the spread of misinformation.


Kelly Glasscock, instructor of journalism and mass communications and executive director of the Journalism Education Association, says misinformation seeps into our daily lives when we stop thinking critically about news and information sources.

“There’s always going to be misinformation and disinformation,” Glasscock said. “Media literacy is that protection against it. It’s a critical element to our daily lives and a skill set that everybody needs to be well versed in — to be able to identify or know when someone is trying to manipulate you.”

Sara K. Kearns, Carol Sevin and Daniel Ireton —

all librarians with K-State Libraries — saw a need for media literacy training and now offer a free, online library resource guide called “Breaking your news bubble.” This how-to guide offers tools to think critically about the news you read and share and includes tips to diversify your news sources. Training workshops also are available by request.

The librarians recommend starting with small steps. These small steps could be finding a local news source, recognizing that news changes over time to reflect new information learned on an issue, reading an alternative viewpoint once a week or fully reading an article before sharing.

“You need to be able to evaluate news for yourself,” Kearns said. “It is very nice to have your views affirmed, but that doesn’t mean that is how everything is actually happening in the world. One of the things we have to do is take a step outside of our comfort zones and try to see what is happening from a different perspective.” 

### Media and information literacy checklist

The K-State Libraries team offers the following tips to think critically about the news:

- ✓ Learn about the news cycle and good journalistic standards.
- ✓ Evaluate your current news sources to identify any bias.
- ✓ Decide if the information is fact or opinion.
- ✓ Review and change social media settings.
- ✓ Audit personal news habits.

## Saving local news

Picture your community without a local newspaper. Where do you turn for credible local news and information?

Across the country, news deserts — communities without a newspaper or with decreased access to local news — are becoming more common. From 2004 to 2019, Kansas lost 14% of its daily and weekly newspapers, according to the U.S. News Deserts Database.

Faculty and students from the A.Q. Miller School of Journalism and Mass Communications have been conducting research and outreach to help communities find ways to fill these voids. What they discovered is that newspapers are part of the social fabric of the community.

“Newspapers have always been the central point of information to communities,” said Steve Smethers, director of the A.Q. Miller School of Journalism and Mass Communications. “You may not like the editor’s choices of news story or comment, but in the end the newspaper is an indispensable community commodity and that is why losing a community newspaper is so difficult.”

According to Smethers, replacing a community newspaper does not have a one-size-fits-all solution. In some communities, volunteer journalists have been the solution. Additionally, internet access limitations and social media create a fragmented community with no central source of local news.

“If I am out there picking my own news sources and one of those is not a local newspaper, I have no idea what is going on in my community,” Smethers said. “We’re losing the ability to build community consensus and the ability to build a community definition of news.”

### ➤ Seek more

Find the full “Breaking your news bubble” resource guide.  
[k-state.edu/seek](https://k-state.edu/seek)



# Greater spaces, better places

Lab works to make the  
experience worth the visit

*By Beth Bohn*

The long, dusty road snakes through a windswept prairie where cattle graze and wheat and corn grow. It's a familiar sight in western Kansas until the road ends and the earth opens, revealing the effects of more than 80 million years of wind and erosion on land that was once a seabed. Sedimentary outcroppings, some towering more than 100 feet, stretch for a mile, resembling ruins from an ancient walled city such as Jerusalem.

As Dorothy once said, "Toto, I've a feeling we're not in Kansas anymore."

But you are. Welcome to Little Jerusalem Badlands State Park in Logan County, the newest state park in Kansas and a place where the Kansas State University Applied Park Science Lab is helping visitors enjoy the state's largest Cretaceous-age Niobrara chalk formation while conserving the natural wonder. The lab is a part of the

park management and conservation program offered by the horticulture and natural resources department in the College of Agriculture. It is involved in various funded projects to enhance the visitor experience at parks and other protected areas while conserving their natural and cultural resources. This work, often involving the latest technology and techniques, takes place in Kansas and across the U.S. at state and national parks and forests, wildlife refuges, historical and cultural sites and other protected places.

"Most of the work we do is trying to understand that balance between visitor use, which is usually mandated in most of these protected areas, with conservation," said Ryan Sharp, associate professor of park management and conservation and lab director. "The more people we have in a place, the more impacts there will be, whether ecological or social."

*The Applied Park Science Lab at K-State is conducting long-term monitoring on the effects of recreational use at Little Jerusalem Badlands State Park in Logan County, Kansas.*



## Ancient land, new experience

At Little Jerusalem, the lab is conducting a long-term monitoring project on the effects of recreational use on the park. The Nature Conservancy owns the park and funds the project. The park is managed by the Kansas Department of Wildlife and Parks.

The lab started working at Little Jerusalem before the park opened in October 2019, with Sharp and team members helping plan the park's layout and trails. Because many park areas — including bluffs with nooks, crannies and crevices, and the towering outcroppings — are not all accessible by foot, the team got permission to use a drone to get baseline data and close-up views. Drone use inside most state and national parks in the U.S. is not allowed without permission.

Two years later, Rachel Shively, doctoral student in the lab, is managing the project. She flies a drone over the park — early in the morning when there are fewer visitors — twice a year and checks monthly satellite images to monitor how recreational use is affecting the landscape.

“This way, we can track how trails are getting wider or if vegetation is decreasing as more and more visitors use the area,” Shively said. “Park officials can use this information to determine if they need to make changes to protect the environment.”

So far, so good at Little Jerusalem. Shively said while the trails are widening through use, the vegetation is thriving, which is important. The park is home to the most wild buckwheat in the world, a native plant only found on the chalk bluffs of the Kansas prairie.



*Wild buckwheat is a native plant that grows on the chalk bluffs of the Kansas prairie.*



*The Applied Park Science Lab at K-State works to enhance the visitor experience while conserving natural resources at protected areas across the country. These photos show projects at state and national parks and monuments in Kansas, Alaska, California, Kentucky, New Mexico and North Dakota.*



*Visitors enjoy one of the trails at the Tallgrass National Prairie Preserve near Strong City, Kansas.*

# Navigating seas of grass

Much of the lab’s work is social science: understanding visitors’ attitudes, values and perceptions and how to reduce conflicts between what a protected area allows and what visitors want to do.

This social science focus is part of two other Kansas projects that Shively manages: the Tallgrass National Prairie Preserve near Strong City in east central Kansas and the Cimarron National Grassland in southwest Kansas.

The lab is conducting a comprehensive visitor use study at Tallgrass. The preserve, owned by The Nature Conservancy, is a part of the National Park Service and showcases some of the last remaining tallgrass prairie in North America. For the first part of the study, GPS devices were given to visitors to track where they went and for how long. Park officials are then able to reconfigure signage to influence where visitors go.

For the second part of the study, Shively, fellow graduate students in the lab and undergraduates are talking to park visitors and handing out cards with a link to an online survey they can complete at their convenience. The survey results help the researchers understand what visitors liked and disliked about the park.

“The survey results help identify if signage is confusing, why people like to visit the preserve and if there’s anything they would like to change about it,” Shively said.

At Cimarron National Grassland, a site managed by the U.S. Forest Service, multiple recreational uses are available, including hiking, biking and fishing, but the site is little used. Through support from the College of Agriculture, the lab is studying the amounts and types of recreational use at the park. Researchers set up human behavior cameras and counters in strategic areas. Information collected will help park managers better protect the site while enhancing the different types of recreation.

“It’s kind of like we’re taking a pulse, really trying to understand what’s going on within those natural spaces,” said Sarah Jackson, doctoral student in the lab. “This way, we can provide informed data to managers and try to help them understand what’s going on in their parks.”

*Photos on right: Graduate and undergraduate students from the Applied Park Science Lab meet with visitors at Tallgrass National Prairie Preserve to find out why they came to visit and where they want to go in the preserve.*

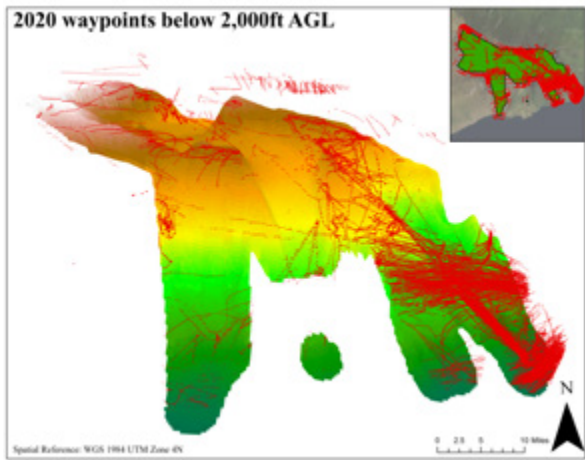


# From rural to urban

One of the lab’s largest projects is taking place around Washington, D.C. Jessica Fefer, lab co-director and assistant professor, is lead investigator on a National Park Service project. Working with a social scientist from Old Dominion University, Fefer is gathering information about visitors, their motivations and preferences for park experiences, and patterns and trends of park use across Region 1 of the National Capital Area. This region includes the Chesapeake and Ohio Canal National Historical Park, Harpers Ferry National Historical Park, Monocacy National Battlefield, Potomac Heritage National Scenic Trail, Prince William Forest Park,

Rock Creek Park and Wolf Trap National Park for the Performing Arts. The work is challenging because these sites together attract millions of visitors each year and cover lots of area across multiple states. The researchers use cellphone and vehicle GPS location data, available through the independent platform StreetLight InSight, to anonymously track movement on roads and trails. They also are using Public Participation GIS, a survey method that connects with visitors using the parks. “We use the cellphone and GPS data to estimate vehicular, bike and pedestrian use in the park units,” Fefer said. “We can zone roads and trails within the parks and understand mobility behaviors of visitors over a five-year span.”

Fefer said this part of the project will provide park use estimates, relative use across urban and rural contexts, and use trends across times of day, seasons and years. The GIS, or geographic information system, data is particularly useful for the Potomac Heritage National Scenic Trail as it covers 822 miles across four states and Washington, D.C. “The data collected will help us understand the most highly visited and valued sections of the trail, what motivates visitors to use those areas, and to what extent the user motivations are fulfilled,” Fefer said.



## Research taking flight

Not all visitors may want to view a park only from the ground. Brian Peterson, assistant professor and newest member of the Applied Park Science Lab, is using a National Park Service cooperative agreement to gather data on overflights at national parks stretching from coast to coast and in Alaska and Hawaii. The project includes monitoring the Great Smoky Mountains, Grand Canyon and Olympic national parks, three of the top 10 visited parks — on the ground — in 2020, according to the National Park Service.

Peterson is assisting the National Park Service Natural Sounds and Night Skies Division in assessing all flights using airspace — up to 30,000 feet above ground level — over national parks’ units, including the number, routes, altitudes and flight travel patterns above the parks. The data will help determine when and where these flights could be affecting park resources and visitors’ experiences on the ground. Peterson’s analysis covers all types of aircraft, including helicopters, small airplanes and jumbo jetliners.

“Consideration of low-level overflights is important for the National Park Service to fulfill its mission of providing public enjoyment while preserving cultural and natural resources,” Peterson said. “But these flights pose risks as they can degrade the acoustic environment of a park. Too many flights overhead may spoil the experience for visitors in the park and affect the park’s wildlife and more.”

For his project, Peterson uses Automatic Dependent Surveillance-Broadcast, or ADS-B, technology to track the overflights. ADS-B uses a radio signal broadcasted from aircraft for monitoring purposes. It has higher precision and broader coverage than radar technology and is more effective in remote areas that lack radar coverage, such as in Alaska.

The lab is designing a multi-module custom GIS toolbox that processes, analyzes and creates visualizations of the overflights from the ADS-B data.

“This is the first time the National Park Service has funded a lab to analyze ADS-B data,” Peterson said.



#### ➤ Seek more

View additional photos and learn more about the Applied Park Science Lab.

[k-state.edu/seek](https://k-state.edu/seek)

## At work across US

While many Applied Park Science Lab projects share similarities and research methods, Sharp said every project is different. That is evident in the other projects currently being conducted by the lab:

- Understanding how rock climbers would like to use Harpers Ferry National Historical Park in West Virginia and Maryland, and providing data to park management to develop a climbing management plan. Recent closures because of resource and wildlife concerns have led to conflicts between rock climbers and management. Funded by the National Park Service, the project is in collaboration with Old Dominion University.

- Studying how terrestrial and aquatic trails are used in Mammoth Cave National Park in Kentucky, the longest-known cave system in the world. This study will help develop indicators and thresholds for long-term monitoring. The National Park Service is funding the project, which is in collaboration with Clemson University.
- Conducting visitor surveys at Joshua Tree National Park in California. The number of visitors to the park increased from 1.4 million in 2010 to 2.9 million in 2019, raising concerns about resource and experience protection. The lab uses cellphone data to understand how visitors move around the park, specifically in backcountry areas. The National Park Service funds the project and the work in collaboration with Clemson University.
- Developing a visitor use monitoring plan for Petroglyph National Monument in Albuquerque, New Mexico. The plan will help the park maintain its natural and cultural resources as well as the visitor experience.

Some Applied Park Science Lab projects study the experience of virtual visitors.

A recently completed project studied if people watching brown bears live via a webcam at Katmai National Park in Alaska formed emotional connections with the bears. An ongoing project is looking at the health benefits of virtual live, interactive safaris in South Africa.

“The good thing about what we do at the Applied Park Science Lab is that there is so much variety,” Sharp said. “Sometimes it’s brown bears and sometimes it’s historic parks. Sometimes it’s horseback riding, hiking, mountain biking, car tours, whatever.” k

*Page 26, top left: Applied Park Science Lab’s Jessica Fefer, first on the right, on-site at Prince William Forest Park in Virginia.*

*Page 26, top middle: Applied Park Science Lab’s Ryan Sharp and Jessica Fefer work at Great Falls Park along the Potomac River in McLean, Virginia. The park is part of Region 1 of the National Capital Area.*

*Page 26, top right: This graphic shows overflight data over Haleakalā National Park, in Maui, Hawaii, collected by the Applied Park Science Lab’s Brian Peterson.*

*Page 26, bottom left: Brian Peterson trail running in Colorado.*



# Riding the wave

Interdisciplinary teams study water to find solutions

*By Taylor Provine*

Kansas State University researchers are diving in to find solutions to some of our biggest water problems.

It takes an interdisciplinary approach: The water research spans colleges and departments across the university. The work involves a variety of topics, too. Researchers want to understand water quantity and quality, to increase efficiency and to preserve one of our most precious natural resources.

K-State teams have garnered grants from federal agencies such as the Department of Energy, the Department of Agriculture, the Department of the Interior, NASA and the National Science Foundation.

Read on to learn how K-State teams are engaged in interdisciplinary water research.



*Prathap Parameswaran, associate professor of civil engineering, prepares to collect a wastewater sample for analysis.*



## Misplaced resources

Achieving total resource recovery for animal wastewater through a new treatment technology and converting it into valuable resources is the focus of a project led by Prathap Parameswaran, associate professor and Fornelli engineering professorship designee in the Carl R. Ice College of Engineering civil engineering department.

“Typically, in the U.S. and in many other countries the primary focus has been on producing one product from wastewater treatment and that’s water,” Parameswaran said. “Now we are saying animal wastewater is not waste. It’s actually a misplaced resource. What kind of technology platforms do we need to recover it so it can be reused in the economy?”

Recovered products from animal wastewater could include methane-rich biogas, fertilizers, soil amendments or even organic acid precursors for plastics or chemicals, which are also essential for a society that relies so heavily on fossil fuels, Parameswaran said.

Parameswaran’s collaborators include Stacy Hutchinson, associate dean of the Office of Research and Graduate Programs in the college and professor in the Carl and Melinda Helwig Department of Biological and Agricultural Engineering; Lawrence Berkeley National Laboratory; the University of Pittsburgh; and the University of Kansas. The researchers are using \$2 million from the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy to merge Anaerobic Membrane Bioreactor, or AnMBR, technology and ecological, natural-based systems, such as wetlands.

AnMBR combines membrane technology with anaerobic biotechnology, meaning that the wastewater is treated in the absence of oxygen, which normally consumes a lot of energy. The researchers said wetlands can be used as a buffer during heavy rainfall events to further the water quality without overwhelming the system.

“Engineered systems are typically designed for optimal performance within a relatively narrow range of flow rate and concentration — making it more difficult to treat the variable animal waste,” Hutchinson said. “While natural systems are more flexible and can handle different flow rates and concentrations, they take a lot of space and time to treat high levels of waste. By merging both systems, we hope to optimize the best components of each system.”

*K-State engineering researchers are studying blue-green algae to prevent outbreaks and help keep freshwaters fresh.*



*Trisha Moore, associate professor of biological and agricultural engineering, center, and a team gather around the prototype water quality sampling robot they will deploy and develop further.*



## Keeping freshwaters fresh

You’ve likely heard about it in the news, especially during the hot summer months when many families want to take a trip to the lake: blue-green algae.

Cyanobacteria, known as blue-green algae, can be toxic and harmful to people, pets and livestock. A blue-green algae outbreak, known as a bloom, can do more than ruin a day at the lake. In addition to the health risks, there are also economic impacts for surrounding areas because lakes must close to the public.

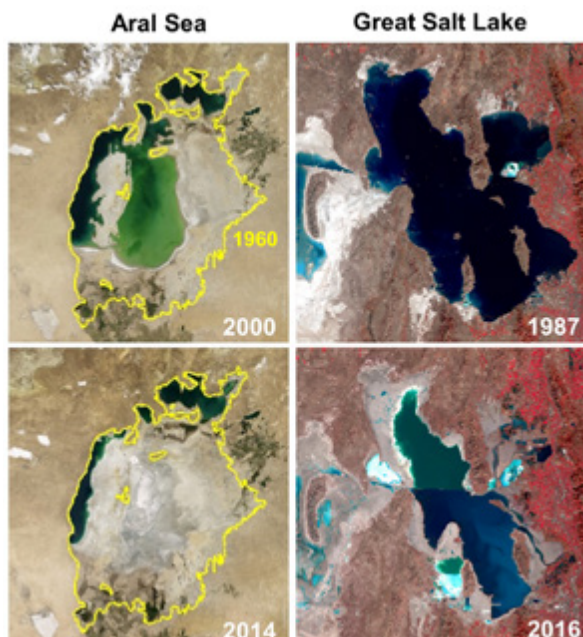
Trisha Moore, associate professor of biological and agricultural engineering, is studying water quality and what triggers blue-green algae outbreaks.

Moore is leading a project funded by the U.S. Department of the Interior U.S. Geological Survey to monitor and model cyanobacteria growth and bloom dynamics in water bodies in Kansas and New York.

“We’d like to advance our understanding to where we aren’t just reacting to it but that we can better predict and then also understand some better ways of treating it,” said Moore, also a Peggy and Gary Edwards Cornerstone teaching scholar. “For example, rather than relying on in-lake algaecides or treatments in our drinking water plants, we’d like to identify more holistic approaches to modify environmental conditions in the lake to reduce the frequency or severity of blooms.”

The team wants to go beyond the lake and understand what is going on in the surrounding landscape that might give the algae the nutrients or food needed to bloom and cause harmful outbreaks.

Moore is working with experts in algae dynamics and growth, water quality monitoring and process modeling, robotics and data science



*These images show drastic shrinkage of the Aral Sea in Central Asia and the Great Salt Lake in Utah over several decades. (Image credit: Jida Wang)*

## Unlocking water data in landlocked regions

Understanding how Earth's total water storage is changing is a research focus of Jida Wang, associate professor of geography and geospatial sciences in the College of Arts and Sciences. Wang and collaborators are studying water loss in landlocked regions, which are boundaries that don't have direct access to the ocean.

The team's findings indicate that global landlocked regions have experienced a very substantial net water mass decline since the early 2000s.

"The declining rate is about 100 billion tons per year, so every year you are losing a total that is equivalent to four Great Salt Lakes in the global landlocked region, which is already dry," Wang said. "The drying global landlocked basin means there are fewer water resources available for local people to consume and for ecological systems to sustain."

Wang says the global water system is connected — landlocked or not.

"In theory, the decreasing water mass in a landlocked basin might be functioning as a potential source for sea level rise, which has a global impact," Wang said. "That also gives people a perspective that we need to perhaps pay more attention to water conservation strategies and management of the dry regions."



*A K-State-led collaborative study is improving water use efficiency and soil health for rainfed agriculture in the southern Great Plains.*

Wang's team includes researchers from the NASA Jet Propulsion Laboratory at the California Institute of Technology; University of California at Los Angeles; the University of Grenoble Alpes and the Laboratory of Space Geophysical and Oceanographic Studies, or LEGOS, in France; and the Institute of Physical Geography at Goethe University and the Senckenberg Biodiversity and Climate Research Center in Germany.

## Increasing the efficiency of water

Charles Rice, university distinguished professor of agronomy in the College of Agriculture, is leading a five-year, \$10 million U.S. Department of Agriculture National Institute of Food and Agriculture collaborative study focused on improving water use efficiency and soil health for rainfed agriculture in dryland systems in the southern Great Plains.

"This region is particularly constrained because of the variable rainfall," Rice said. "Some years or even within a season they get drought or too much water and also about 50% of the precipitation is lost due to nonproductive uses either through evaporation from the soil surface or transpiration through weeds."

One goal of the project is to increase water and nitrogen use efficiencies by 50% and maintain or improve soil health.

"What we're trying to do is intensify and diversify those systems," Rice said. "In the years with more water, can we double-crop instead of having it bare over the summer? Another way to intensify and diversify is to add cover crops that could also be grazed to feed livestock."

To achieve this, the team is applying different strategies to 17 different rotation systems in Kansas and Oklahoma. The researchers are adjusting the nitrogen/fertilizer rate: If it looks like it's going to be a dry spring, less nitrogen is added; for a wet year, more nitrogen is added.

"If you have improved soil health, then water from intense rainstorms is infiltrating into the soil rather than running off the field and causing erosion," Rice said. "That allows for the crops to use that water, increasing precipitation use efficiency."

The researchers also are looking at weather forecasting to help project the probability of a wet or dry season, which could help farmers decide what crops to plant to lower their risk and stabilize their income.

"There are areas around the world that are similar to this region, so hopefully, we will not only have an impact in the central part of the U.S. but around the world and have a greater global impact," Rice said.

The team involves the USDA Agricultural Research Service, Oklahoma State University and the University of Maryland and includes soil microbiologists, soil fertility experts, cropping system specialists, weed ecologists, modelers, economists and sociologists.



## Mapping microbiomes of streams, soils and plants

If a person takes antibiotics it can sometimes disrupt the microbiome in the gut. Does the same thing happen when land use, pollution and climate change alter our plant and water systems?

Walter Dodds, university distinguished professor in the Division of Biology, is leading the Microbiomes of Aquatic, Plant and Soil Systems, or MAPS, program that studies how ecosystems are linked.

MAPS includes Dodds and a team of interdisciplinary researchers from the University of Kansas, Fort Hays State University and Wichita State University. The researchers are looking at how the microbes — which include bacteria and other organisms such as fungi — influence the way that the ecosystems work and the things they provide us.

The team is sampling soils and streams across Kansas for background factors such as nutrients and pH as well as the microbiomes themselves. They use advanced molecular and bioinformatics methods to characterize the tens of thousands of species in the microbiomes.

“The idea is that the systems are linked to each other, that things like plant productivity are mediated in part by the interactions with microbes,” Dodds said. “What happens in the soil is related to the microbes that are there and their interactions with the plants.”

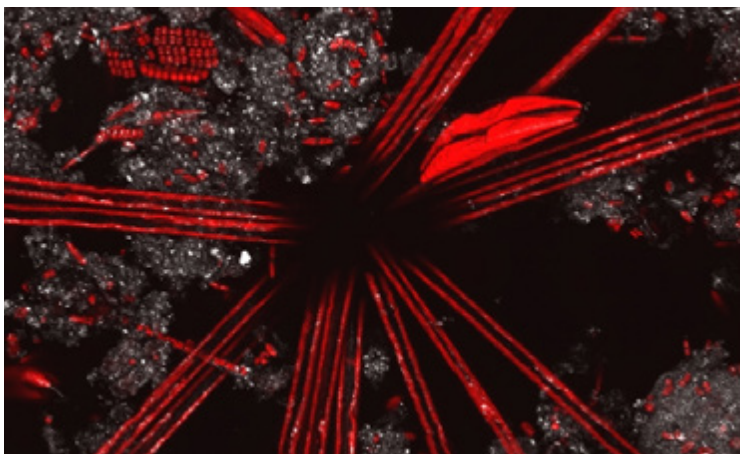
The researchers have expanded their work to other related topics.

“We are also interested in learning how much pollution washes off cropland into the water, how much greenhouse gas is produced in the soils, how much carbon is stored there and how microbiomes mediate these processes,” Dodds said. “Then, once the materials get into the water, how that influences water quality. That includes toxic algal blooms and how they are related to the other aquatic microbes.”

*Top: Walter Dodds, university distinguished professor of biology, studies a rock that has billions of microbes growing on it. Some of these microbes can influence the water we drink.*

*Middle: Potentially toxic cyanobacteria, or blue-green algae, forms a scum on a Kansas farm pond.*

*Bottom: This image shows a microscopic view of algae attached to a rock from a stream. The chlorophyll is shown in red in several different species of attached algae. These algae are essential to stream ecosystem function, but if they grow too profusely, they cause aesthetic problems.*



## River shapes and landscapes

Abigail Langston, assistant professor of geography and geospatial sciences, is researching the ways that rivers evolve. She is using a National Science Foundation Geomorphology and Land-use Dynamics Program grant to study the development of the Buffalo River in northwest Arkansas.

“Rivers shape landscapes by incising deep canyons and carving both wide and narrow valleys, determining where people live and where floodwaters go,” Langston said. “Little is known about how, when and why rivers carve wide versus narrow valleys as they flow through landscapes.”

Langston is working with a University of Arkansas collaborator and several graduate students to study controls on the development bedrock valleys on the Buffalo River — America’s first national river.

“Despite the intuitive idea that rivers create wide valleys in soft bedrock and narrow valleys in hard bedrock, my earlier research suggests that creating wide bedrock valleys is more complex than just the hardness or softness of the bedrock,” Langston said.

Understanding the how and why bedrock valleys widen will allow researchers, land-use planners and environmental scientists to interpret how river systems in the past, present and future have and will respond to changes in river sediment, Langston said.

The researchers also are engaging with teachers, K-12 students and Girl Scouts to develop an interactive mapping tool that highlights the intersection of the Buffalo River and the diverse people using the watershed. [\*k\*](#)

*Photos on right: Abigail Langston, assistant professor of geography and geospatial sciences, studies the development of the Buffalo River in northwest Arkansas.*



### ➤ Seek more

Read additional stories about K-State water research.  
[k-state.edu/seek](https://k-state.edu/seek)

## Engaging success

*Two university programs lead to new corporate partnerships*

### Building the foundation for a new tech startup

By *Livy Seirer*

A Kansas State University software development team that created the nationally used PEARS software program is now putting down roots in Manhattan.

The team has opened Canopy, a public benefit limited liability company that will continue to grow PEARS and serve new clients with community-focused programs.

“Our vision is to help social impact programs by providing the technical tools and evaluation resources needed to maximize their success,” said Aaron Schroeder, Canopy president and member of the K-State team that developed PEARS. “Our team has the privilege to serve some amazing clients who are dedicated to community-focused programs. We’re thrilled to continue that work and expand our reach in collaboration with both K-State and industry partners.”

PEARS — Program Evaluation and Reporting System — is a university-patented, web-based data management software that helps nutrition education professionals and extension administrators manage program data and demonstrate impact.

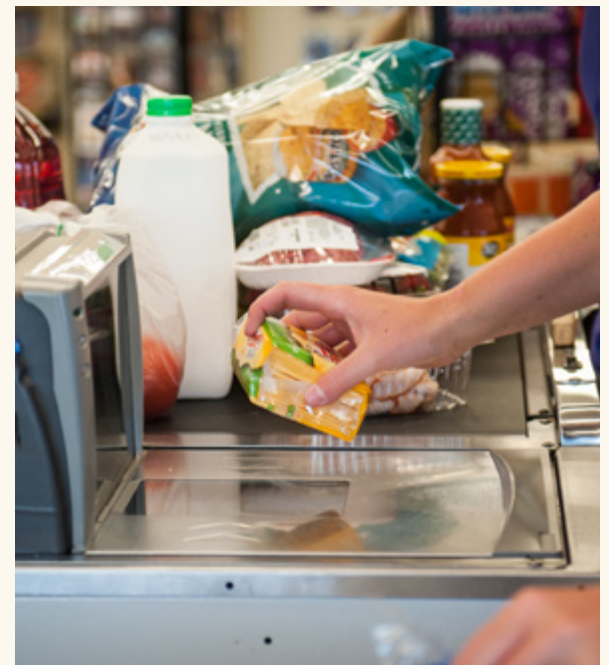
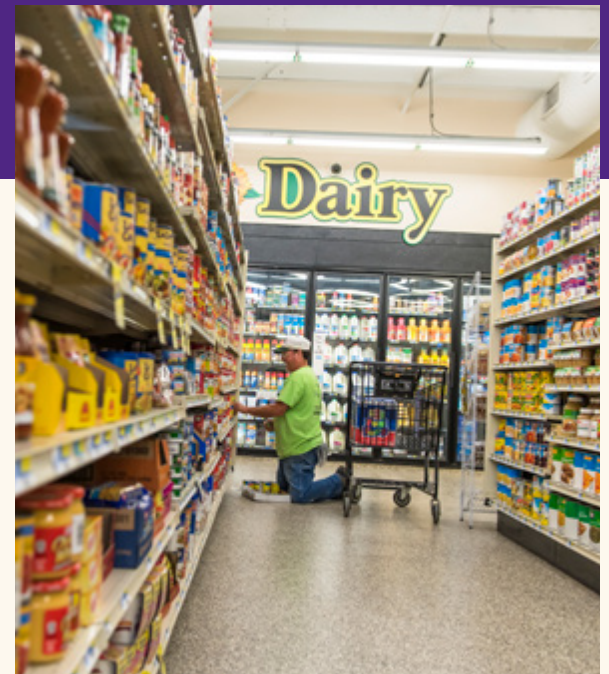
The PEARS system was originally developed through a collaboration between the Office of Educational Innovation and Evaluation, or OEIE, in the College of Education and K-State Research and Extension in 2015. It was initially created to help Kansas manage its SNAP-Ed, or Supplemental Nutrition Assistance Program Education, reporting system.

“We were able to develop and grow the software package within OEIE to the point that there was enough outside interest to license and commercialize the project,” said Debbie Mercer, dean of the College of Education. “This was a unique opportunity to collaborate with K-State Innovation Partners to commercially deploy a software package in a way that we’ve never done before.”

During a five-year incubation period within the university, the PEARS system was adopted by SNAP-Ed programs in 37 states and eight statewide extension programs. In 2021, PEARS was selected as the national SNAP-Ed reporting system by the U.S. Department of Agriculture Food and Nutrition Service. As a stand-alone entity, Canopy will be able to support existing PEARS users, further grow and deploy the PEARS software in new markets and develop new innovative technologies.

“We’re proud of the role we played in getting PEARS up and running,” said Ernie Minton, dean of the College of Agriculture and director of K-State Research and Extension. “The success of this project will undoubtedly pave the way for other technical innovations coming out of K-State.”

The unique licensing and commercialization process carried out by K-State Innovation Partners and the PEARS team establishes a framework for future technologies coming out of K-State. [!\[\]\(a1426dc43632382cdf960acce99e36f7\_img.jpg\)](#)



*A K-State-patented data management software called PEARS is assisting community-focused programs. PEARS was initially created to help Kansas manage its SNAP-Ed, or Supplemental Nutrition Assistance Program Education, reporting system.*



*A new strategic alliance agreement between K-State and Elanco Animal Health Inc. focuses on research to improve the health of companion animals and livestock.*

## A strategic alliance to improve animal health

*By Erin Pennington*

Kansas State University and Elanco Animal Health Inc. are combining efforts to tackle innovation for companion animal and livestock health.

A five-year strategic alliance agreement between the university and Elanco will allow for collaborative research and intellectual property licensing for commercialization activities. Researchers will focus on activities supporting sustainable practices in livestock production and pet health; vector-borne and emerging disease prevention and treatment; and advanced understanding of the microbiome in animals. Elanco's research and development model includes attracting leading innovators as a partner of choice. They have chosen K-State as a primary key veterinary partner.


"K-State and Elanco have many areas of shared strengths and goals. The alignment is a natural fit," said Bonnie Rush, dean of the K-State College of Veterinary Medicine. "The exchange of scientific expertise between talented scientists from both entities will create a special environment for rapid advancements. The cumulative experience and balance of science and commercialization ensure technologic advancements will achieve practical application."

One of the key objectives of the partnership is to establish novel approaches to increase sustainable practices, reducing the carbon footprint of livestock production, with the ultimate goal of providing

innovative solutions to veterinarians and producers to maintain healthy animals using safe and efficient solutions.

Elanco will collaborate with K-State faculty, embed scientists in K-State laboratories and utilize specialized research resources to engage in fundamental and applied collaborative research. Through the partnership, Elanco will support K-State graduate students, fellows and faculty and facilitate an exchange of expertise through researcher exchange programs.

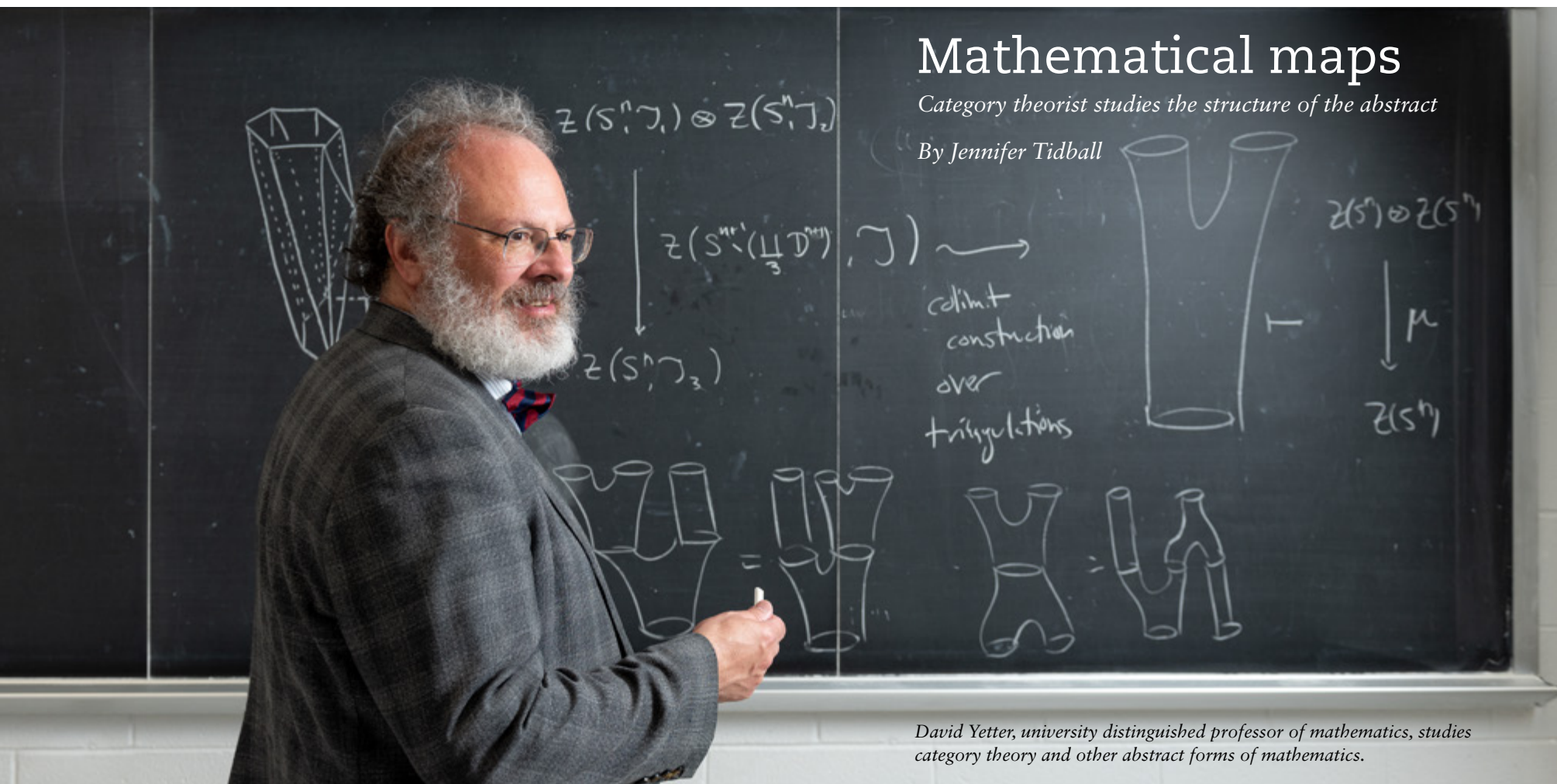
"An alliance with Kansas State University is truly a win-win for both organizations," said Jose Simas, executive vice president of the U.S. Farm Animal business for Elanco. "It provides Elanco with an opportunity to engage with experts beyond our own walls, focusing on timely innovation and practical solutions. Meanwhile, K-State has the opportunity to utilize the commercial expertise of a leading animal health organization with nearly 70 years of industry experience."

The collaboration allows research that is at the forefront of innovation for the monitoring of new diseases to tailor research programs and provide product solutions, as well as development of innovative approaches to existing vector-borne diseases by leveraging common strengths. 

# Mathematical maps

*Category theorist studies the structure of the abstract*

*By Jennifer Tidball*



*David Yetter, university distinguished professor of mathematics, studies category theory and other abstract forms of mathematics.*

In the mathematical research frontier, David Yetter considers himself a fur trapper of sorts.

“The fur trappers used to be the ones who would go out on the frontier, explore uninhabited areas and bring back news of what was out there,” said Yetter, Kansas State University distinguished professor of mathematics in the College of Arts and Sciences. “A lot of my work has, like the old fur trappers, been in areas where no one else was working yet and afterward other mathematicians discovered that things I found first were far more important than I could ever have guessed.”

Yetter primarily studies category theory, which is an abstract form of mathematics focused on mathematical structure. It has applications to other areas of mathematics and to computer science and theoretical physics.

“The key insight of category theory is that maps between mathematical objects are as important as the mathematical objects themselves,” Yetter said.

Yetter has published papers in knot theory, geometry, graph theory, logic and functional analysis, all either

applying category theory to those areas or solving problems that only came to light from applying category theory to another area of mathematics. Some of his current work involves applying category theory to geometric problems. His research relates to quantum field theory as well.

“It turns out that category theory is very closely related to the way mathematicians try to formalize quantum field theory,” Yetter said. “In topological quantum field theory, the key idea is to cut a geometric shape into simple pieces and the assembly of those pieces has an algebraic structure that is governed by some sort of category.”

Several topological quantum field theories are named for him: the Yetter model, which can be defined in any dimension, and the Crane-Yetter model, a four-dimensional topological quantum field theory that he developed with Louis Crane, K-State professor emeritus of mathematics. Modifications of the Crane-Yetter model are the basis for the Barrett-Crane and EPRL models of quantum gravity. Yetter continues to collaborate with Crane on applying category theory to fundamental physics.

In addition to his own research, Yetter is the co-director of K-State’s mathematics Research Experiences for Undergraduates program called SUMaR, or the Summer Undergraduate Mathematics Research program. The National Science Foundation funds the program, which offers undergraduates across the country the opportunity to visit K-State and work on projects in knot theory and other topics.

Yetter came to K-State in 1991. Throughout his career, his work has been supported by more than \$1.5 million in NSF research grants. He has published 47 journal or refereed proceedings articles and has written 11 widely distributed unpublished manuscripts as well as the monograph “Functorial Knot Theory.”

He has held research positions with the Institute for Advanced Study, McGill University, the Groupe Interuniversitaire en Études Catégoriques in Montreal and the Mathematical Sciences Research Institute. He has been a visiting fellow in mathematics at Macquarie University in Australia and a visiting researcher at the University of Sheffield in the United Kingdom. [k](#)

# The isolation of selling

*Marketing researchers analyze social isolation and job performance*

*By Courtney Roszak*

When Edward Nowlin and Doug Walker sat down with a whiteboard in 2016 to explore social isolation and its effects on sales representatives' work performance, a worldwide pandemic was not on their radar. Nor did the Kansas State University College of Business Administration researchers expect the phrase "social isolation" to be mainstream or know how it would affect the direction of their research.

"Before the COVID-19 pandemic, Doug and I thought we were really smart to link sales with the idea of social isolation because nobody was using the term at the time," said Nowlin, associate professor of marketing. "Then we didn't seem so smart after COVID-19 began because the term was being used everywhere."

A salesperson's role has always been to build relationships with customers and grow new or existing business, but doing so can require frequent travel and remote work, which can create an isolated environment. When the COVID-19 pandemic began, environments became even more isolated for external sales representatives because operations transitioned from in person to virtual. Employees handled customer relations by phone or video conferencing, which are impersonal forms of communication.

As an employee becomes more isolated, it is more difficult to connect with co-workers or the organization.

For several years, Nowlin and Walker, also a K-State associate professor of marketing, have collaborated with Nawar Chaker of Louisiana State University and Nwamaka Anaza of Southern Illinois University Carbondale, to conduct multiple studies using 233 surveys and 27 in-depth, personal interviews. The research found salespeople who experience isolation at work lack rich interaction with co-workers. That results in lower levels of job-related knowledge, informal communication and loyalty to the company, which all negatively affect performance.

In their observations, the researchers bridged two theories. The organizational socialization theory looked at how the values of the firm provided guidance in navigating the workplace social structure, while the social learning theory focused on how individuals gained information through social interaction.

"As the salesperson becomes isolated, the camaraderie between co-workers is less common and it's harder to build relationships," Walker said. "If the salesperson feels disconnected from those within the firm, they can feel disconnected from the firm itself and it can affect the loyalty to the firm — which is something that would naturally flow for those connected to co-workers."

The researchers have published their work in the journal *Industrial Marketing Management*. Walker and Nowlin have continued their research throughout the pandemic. They have expanded into the different effects of isolation between external and internal sales departments and the influence managers have on creating a sense of belonging. **k**

See *Faculty Focus*

*Edward Nowlin, left, and Doug Walker, both associate professors of marketing, are looking at how social isolation affects a salesperson's job performance.*

*Tshegofatso Ngwaga, doctoral student in biology, studies how the human immune system detects pathogenic bacteria.*



## Cellular communication

*Biologist researches Legionella pneumophila and immune system responses*

*By Katie Messerla*

Tshegofatso Ngwaga likes to communicate with cells. Cells in the immune system, to be more specific.

Her current project seeks to characterize mechanisms that the host immune system uses to combat *Legionella pneumophila*, the causative agent of Legionnaires' disease.

"I study how this bacterium uses its arsenal of more than 300 effector proteins to manipulate the host and evade host cellular defenses," said Ngwaga, doctoral student in biology in the Kansas State University College of Arts and Sciences.

Her research with *Legionella* effectors — or virulence proteins — is contributing to the growing knowledge of how the human immune system detects pathogenic bacteria. The work helps researchers learn additional ways that immune cells restrict intracellular pathogens like *Legionella pneumophila*.

"This research is important because most cellular

processes and the function of most cellular components were discovered through studying how pathogens manipulate those processes," Ngwaga said. "I hope my research contributes to the development of new therapeutic strategies that do not rely on the use of antibiotics to fight infectious pathogens."

Ngwaga works as a research assistant with Stephanie Shames, assistant professor in the Division of Biology.

"Tshego is leading an exciting project on how bacterial virulence proteins that are required for intracellular replication can paradoxically aid in immune detection of the pathogen," Shames said. "She has made excellent progress and is in the process of preparing her second primary research manuscript on this subject."

Ngwaga won first place in the graduate poster presentation category at this year's joint meeting of the Missouri and Missouri Valley branches of the American Society for Microbiology. [!\[\]\(6c0fdc32a4b638cc57ea75bdb7a23a4a\_img.jpg\)](#)

## Passionate about policy

*Student pursues economic disparity research through Developing Scholars Program*

*By Malorie Soug y*

Bradley Richards knows a thing or two about policy and the effect it can have on a country and its citizens.

“There is a lot of economic disparity in our world, and much of it has been created through policy,” said Richards, a first-generation Kansas State University senior in economics in the College of Arts and Sciences. “I’m really passionate about making change for people who are affected by these policies.”

The Wichita native learned about this firsthand when he traveled to Nyeri, Kenya, through the Staley School of Leadership Studies International Service Teams program. He noticed that numerous local businesses were being bought out by foreign companies.

That experience led him to study the influence of foreign capital on economic growth in sub-Saharan Africa with faculty mentor Michael Flynn, associate professor of political science. Flynn and Richards teamed up through the Developing Scholars Program, or DSP, which is a unit in the larger Office of Undergraduate Research and Creative Inquiry. DSP offers high-achieving, historically underrepresented students the opportunity to conduct research in their fields with faculty mentors.

“I’ve been in the program since my freshman year and it’s been the most transformative process,” said Richards, who is also pursuing minors in statistics and political science and a pre-law designation. “I am extremely thankful for the relationships I’ve been able to build with my mentors and everyone in the DSP family. My mentors are researchers who are challenging existing ideas and developing their own. They’re on the forefront of research and society, and that drives my ambition to do research.”

Richards collaborated with Flynn and used measures of gross national income and gross domestic product in 48 African countries over 10 years to determine economic growth. Then, using his statistics minor, he took a cross-sectional linear regression to see how that growth was affected by foreign direct investment and foreign aid.

“This research could be important to policymakers for these countries,” Richards said. “Depending on the size of their economy, studies like mine can help determine where the focus of their foreign capital policies should be, whether it’s foreign aid or investments.”

Richards presented his research at the Developing Scholars Virtual Research Symposium in spring 2021. His future research goals are to travel and understand people’s perspectives of the foreign capital inflows on local businesses. [k](#)

*Bradley Richards, senior in economics, is studying economic disparity throughout the world to help develop better policies.*

### ➤ Seek more

Read more about the Developing Scholars Program.

[k-state.edu/seek](https://k-state.edu/seek)

## precipitation use efficiency

pri- ,si-pə-'tā-shən 'yüz i-'fi-shən-sē

*Charles Rice, university distinguished professor of agronomy in the College of Agriculture, is leading a large U.S. Department of Agriculture collaborative study to increase water efficiency and soil health. Rice explains, in fewer than 100 words, what precipitation use efficiency is and how it relates to farmland in the southern Great Plains.*

Precipitation use efficiency involves designing cropping systems to use precipitation effectively. The first strategy prevents runoff. Increasing soil health with better soil structure helps intense rainfalls infiltrate the soil rather than run off the field and not be captured by the crop. The second strategy reduces surface evaporation. Keeping residue on the soil surface through no-till reduces wasteful evaporation. The third strategy eliminates nonproductive uptake of soil water by eliminating weeds. Continuous no-till cropping keeps the soil covered, reduces weeds and increases infiltration. Thus, precipitation is used for growing crops for forage or grain rather than for nonproductive uses.

*See page 28 to learn more about the USDA project and other water research at Kansas State University.*



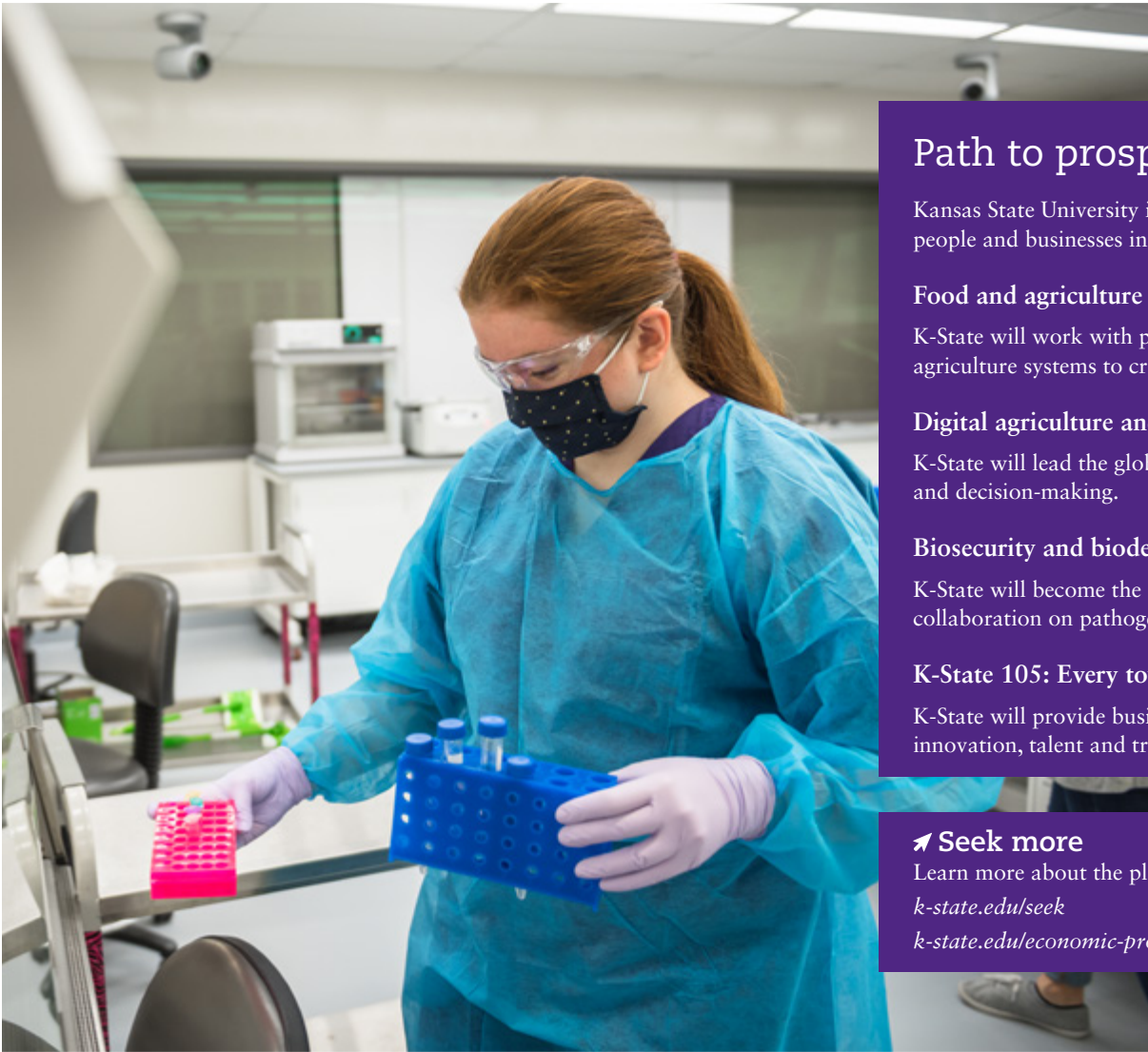


## Information age

Kansas State University first introduced printing techniques as part of its curriculum in 1874. The *Industrialist* began publication the following year to provide students with hands-on printing and publishing experience and to share university news across the state. The *Industrialist* was printed until 1955.

In this 1941 photo, Edgar M. Amos, associate professor, helps students set type as part of the typography lab, where students used handwritten drafts to prepare news stories for printing. See page 16 to learn how K-State research and outreach continues to analyze new communication technologies.

*Photo courtesy of the Richard L. D. and Marjorie J. Morse Department of Special Collections.*



## Path to prosperity

Kansas State University is embarking on a plan to increase economic prosperity for people and businesses in Kansas in four key areas.

### Food and agriculture systems innovation

K-State will work with producers to transform, sustain and adapt food and agriculture systems to create jobs and bring investments to Kansas.

### Digital agriculture and advanced analytics

K-State will lead the global food system through methods based on data, analytics and decision-making.

### Biosecurity and biodefense

K-State will become the foremost U.S. resource for private-public research collaboration on pathogens of global significance, biosecurity and biodefense.

### K-State 105: Every town to gown

K-State will provide businesses and communities with access to university innovation, talent and training.

### ➤ Seek more

Learn more about the plan for economic prosperity.

[k-state.edu/seek](https://k-state.edu/seek)

[k-state.edu/economic-prosperity](https://k-state.edu/economic-prosperity)

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