

THE LINK

BIOLOGICAL AND AGRICULTURAL ENGINEERING

FALL 2017

COLLEGE OF ENGINEERING



KANSAS STATE
UNIVERSITY

FROM THE DEPARTMENT HEAD

During the past 30 months, construction fences have been a normal sight around at least one side of the west wing of Seaton Hall. Of course, the department of biological and agricultural engineering (BAE) is located in the west wing. BAE has been impacted by on-campus construction but students, faculty, professionals, guests and alumni have grown accustomed to “DETOURS.” There have been 36-hour periods when there were multiple changes to the entrance into Seaton Hall. The simplest way to describe navigating around Seaton Hall is summarized by Jason Schwartzman: “Whereas I think in New York, every step is a detour in every direction.” To paraphrase, “Whereas I think at Kansas State University”

I am extremely thankful for those in the BAE community for not allowing roadblocks and detours to serve as excuses, as during these months, the tradition of excellence established by others has continued. Faculty, alumni and students have excelled on multiple fronts. Our undergraduate and graduate students are to be commended for their efforts during this “detour period” as they moved forward with their creative inquiry and research efforts. Delays or detours often occurred due to limited vehicle access into Seaton Court. People manually moved equipment and supplies up a flight of stairs, or used an elevator to reach vehicles en route for field research or testing. This took extra time but progress was not impeded. Collectively everyone took the advice of Barbara Bush, “When you come to a roadblock, take a detour.” I am really appreciative of everyone’s patience and seeking alternative ways to accomplish tasks at hand during this time period. Thanks to all of our friends and alumni who continued to traverse Seaton Hall in spite of the detours, and work with our undergraduates, graduates, faculty and professional staff.

Reaching the goals outlined in Vision 2025 is now only eight years away. As noted, during the past 30 months, we have learned not to allow roadblocks or detours to hinder progress. Reaching our destination required working together and recently, extra steps have been necessary. We are looking forward to straighter paths and removal of construction fences in fall 2017, but we recognize there will still be obstacles ahead and we need to remain focused on our Vision 2025 goals.

We hope you will be able to set aside those obstacles in your life for a few minutes and enjoy reading the highlights in the 2017 LINK. H. Jackson Brown, Jr. said, “See any detour as an opportunity to experience new things.” Often the experiences of faculty and students featured in the articles are the result of an unexpected detour or encounter with others. Behind each article are finances, time and connections contributed by alumni and friends. Thank you.



Joseph P. Harner III
Department head and professor



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WILKEN PART OF K-STATE TEAM ATTENDING SUMMER INSTITUTE



WILKEN WITH GOLDY GOPHER, UNIVERSITY OF MINNESOTA MASCOT



FROM LEFT, BRETT DEPAOLA, SHAWNA JORDAN AND LISA WILKEN WERE NAMED 2017-18 SCIENTIFIC TEACHING FELLOWS BY THE YALE CENTER FOR TEACHING AND LEARNING.

Lisa Wilken, BAE assistant professor, attended the 2017 Northstar Summer Institutes on Scientific Teaching at the University of Minnesota June 5-10. Wilken was a member of K-State's institutional team, which also included Brett DePaola, professor and interim head of the department of physics; and Shawna Jordan, assistant professor in the department of food, nutrition, dietetics and health, and assistant dean for student support in the College of Human Ecology.

The institutes are aimed at transforming and improving the quality and effectiveness of undergraduate STEM

education by modeling evidence-based teaching and innovative instructional methods. Participants learned and implemented current scientific research and pedagogical approaches to develop instructional materials and strategies to actively engage students.

The one-week intensive training program included topics on understanding how people learn, creating a diverse and inclusive classroom, aligning learning goals with assessment and integrating active learning strategies in the classroom. At the program conclusion, the K-State team developed a strategic dissemination plan. Members will collaborate with their respective colleges, and the K-State Teaching and Learning Center, to develop



LISA WILKEN AND SHAWNA JORDAN (CENTER) PRESENTED THE TEACHING UNIT "FROM ATOMS TO ECOSYSTEMS" WITH THEIR PEER WORKING GROUP.

and provide training programs using the scientific teaching framework for graduate students and faculty.

In connection with the program, Wilken was invited to present "Scientific Teaching: Perspectives from an Early Career Teacher" as part of receiving the ASEE 2017 Award for Early Achievement in Education from the Biological and Agricultural Engineering Division at the 2017 ASEE Annual Conference in Columbus, Ohio, June 25-28.

The Northstar Summer Institutes are sponsored by the Howard Hughes Medical Institute, Helmsley Charitable Trust and Yale Center for Teaching. Additional travel support was provided by the Office of the Provost at K-State. Additional information can be found at summerinstitutes.org.



WILKEN, CENTER, ACCEPTING ASEE 2017 AWARD FOR EARLY ACHIEVEMENT IN EDUCATION.

K-STATE TEAM WINS EPA 2016 CHALLENGE



Two BAE engineering graduate students – Kelsey McDonough and Erica Schmitz – were members of a K-State team awarded first place for its demonstration project category submission in the 2016 EPA Campus RainWorks Challenge. The team’s winning submission, “Stronger Quinlan,”



was up against more than 60 teams from 30 states before earning top honors in the fifth annual design competition.

The competition tasked students with designing an innovative green infrastructure project for their college campus, while meeting environmental, educational and economic objectives. The K-State team proposed repairing a historic campus nature area with green infrastructure elements to reduce storm water pollution and flash flooding of Campus Creek.

The team utilized a combination of rainwater

cisterns, permeable pavement and a nested bioretention cell/detention basin in its design, and retrofitted the majority of the site with native plants and trees. The students estimated their design could reduce storm water runoff by 46 percent and capture approximately 600,000 gallons of water per year for irrigation reuse.

Additional team members were Conner Bruns and Tsz Wai Wong, landscape architecture; Joe Krauska, entomology; and Joseph Weeks, agronomy. Trisha Moore, BAE assistant professor, and Lee Skabelund, professor of landscape architecture, served as faculty mentors.

FULBRIGHT OPPORTUNITY OFFERS BROAD INTERNATIONAL EXPERIENCE

In October 2016, Stacy Hutchinson, BAE professor, served as a Fulbright Specialist in engineering education at the National Mining University, Dnipro, Ukraine. She was hosted by the department of international relations for her five-week stay in Dnipro.

During her time at the university, she shared technical engineering expertise on surface hydrology, and watershed assessment and management; conducted teaching workshops on active learning techniques, assessment, engineering accreditation and curriculum design; and participated in numerous activities across campus including the English language drama club, basketball and volleyball.

She spoke at the fall 2016 mining forum with faculty from across Ukraine and Europe, and met with several

visiting faculty from European universities. She also had the opportunity to enjoy Ukrainian culture and history with visits to a Ukrainian folk art museum in Petrikovsky, Cossack Island Museum at the Khortitsa National Sanctuary, the Dnipro ballet and the Dnipro Opera House.

The Fulbright program provided an outstanding opportunity for Hutchinson to learn more about the National Mining University, Ukraine and

global engineering education, while sharing American culture, education, ideals and friendship.



Making a splash

FOUNTAIN WARS TEAM TAKES THIRD IN INTERNATIONAL COMPETITION

By Mary Rankin and Trisha Moore



Another year, another strong finish. For the sixth time in past seven years, a team from K-State finished in the top three in the Fountain Wars Competition, a segment of the American Society of Agricultural and Biological Engineers G.B. Gunlogson Student Environmental Design Competition.

The July outdoor event is a hands-on, real-time design contest in which students design and model their entry during the annual international meeting, held this year July 16-19 in Spokane, Washington.

Awards are based on the combined scores of the team's written report, video abstract, oral presentation, construction, performance of technical tasks and an aesthetic display. The K-State Fountain Wars Team, advised by Trisha Moore, BAE assistant professor, received a cash prize and trophy for its entry in the competition.

The first of the technical tasks required to the team launch a beach ball powered by water from the fountain up to 30 feet and catch it in a fish net held by a team member. Catch locations were set by judges at the competition, so the team devised a rotating catapult to enable the flexibility needed to accomplish the task.

The second technical task required the team to toss an egg back and forth, using water power and without breaking the egg along a travel path that had to include, among other stipulations, at least two feet of freefall. The team accomplished this task with a water wheel to control the egg's motion.

The team integrated a Lord of the Rings-themed aesthetic display around the "Twin Towers" that comprised the beach ball catapult and egg toss infrastructure. To hear the team talk more about their design, view its video abstract at youtu.be/y-ygLupxZVk.



MEMBERS OF THE 2017 FOUNTAIN WARS TEAM POSE WITH THEIR THIRD-PLACE TROPHY, FROM LEFT, TEDDY GILLESPIE, AARON AKIN, ALEXANDER COON, DEVON BANDAD, CODY DEAS, CHARLES HAMILTON AND JESSICA STANTON



THE K-STATE FOUNTAIN WARS TEAM AT THE ASABE COMPETITION IN SPOKANE, WASHINGTON, FROM LEFT, CHARLES HAMILTON, JESSE LANING, AARON AKIN, T-YING LIN, TEDDY GILLESPIE, JESSICA STANTON, CODY DEAS, ALEXANDER COON AND DEVON BANDAD



BLOOD-BASED DIAGNOSTIC PROVES A WINNER FOR DESIGN TEAM

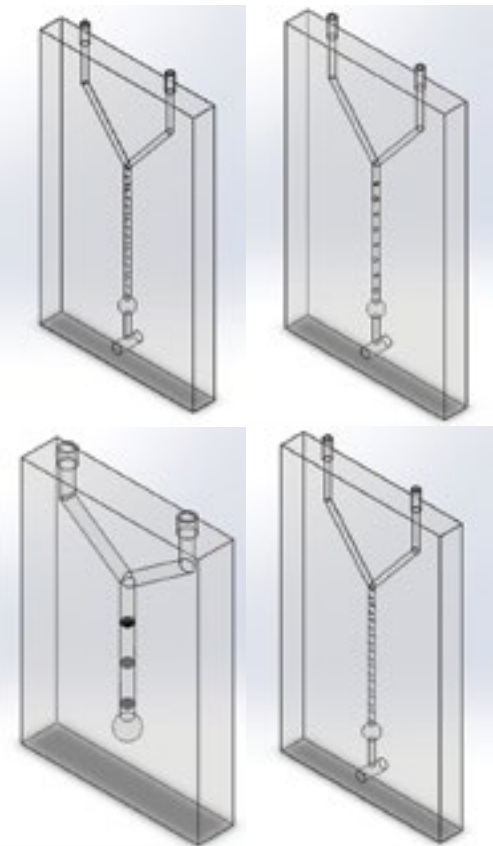
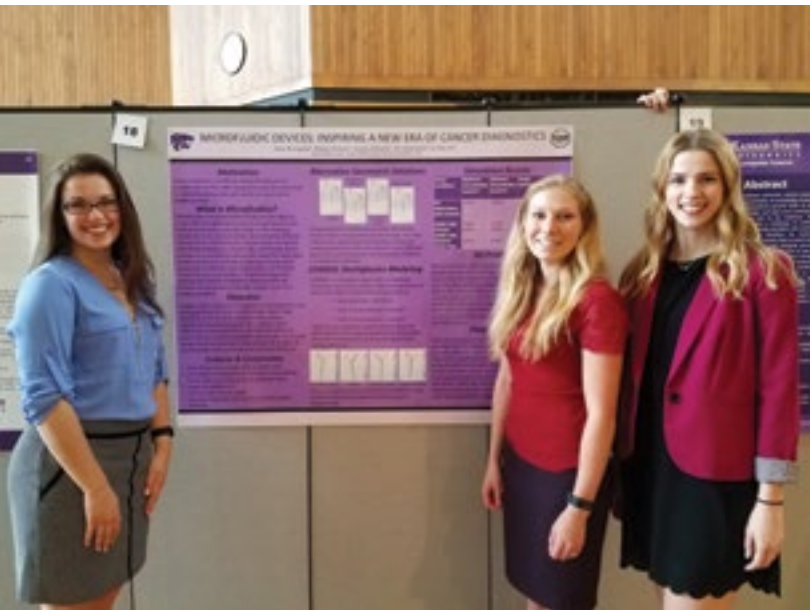
BAE senior design project teams undertake unique and varied projects each year. In 2017, the senior design team, One Drop, continued this tradition with its project to miniaturize a blood-based diagnostic assay for the diagnosis of ovarian and breast cancers.

The One Drop team worked with Mei He, BAE assistant professor, on a project to help medical doctors in remote developing nations to quickly and economically diagnose these cancers. Expanding upon the “lab on a chip” technology that He had been developing, team One Drop designed and tested a microfluidic device that mixes a single drop of blood with a reagent to detect certain proteins in blood related to tumors.

The key to making a diagnostic assay work with a single drop of blood is a thorough and efficient mixing of the blood and reagent on the microscale. Mixing is usually accomplished in large volumes of liquid by creating

a turbulent flow of the two liquids. On a micron scale, fluids behave differently and mixing must be achieved by molecular diffusion. Team One Drop developed a number of different micro-sized mixing-tube ideas, which were then modeled in SolidWorks 3-D modeling software and tested using COMSOL simulation software. The best-performing design idea in the COMSOL simulations was then 3-D printed for prototype testing.

Team One Drop won a number of awards for its efforts — the Innovation Display Award at the K-State Engineering Open House, first place in the Design/Build/Team/Class Project category during the 2017 College of Engineering Undergraduate Research Poster Competition and honorable mention for the K-State Kirmser Undergraduate Research Award.



CHINA TRIP PROVIDES ADVENTURE AND LEARNING



On May 30, 2017, K-State professors Stacy (BAE) and Shawn (geography) Hutchinson departed Kansas with four K-State students — Colin Bailey (geography), Emily Nottingham (BAE), Chenna Padmanabhan (IMSE), and Chuncheng Wang (BAE) — for an 18-day Study Abroad trip to China.

The group spent the first few days in Beijing learning about Chinese culture and history. They toured the Great Wall, Tiananmen Square, the Forbidden City, the Temple of Heaven and the Summer Palace. They also enjoyed a kung fu show, a class in traditional paper cutting, a tai chi class and a cooking lesson in a hutong.

The group boarded a train for Changchun in northeast China. A medium-sized city of 8 million, Changchun is the provincial capital of Jilin Province, an area of major agricultural production. There the group joined forces with the Jilin University College of Environment and Resources for a joint two-week technical class on watershed hydrology and management. The students worked together to better understand surface hydrology, geospatial data analysis and surface runoff modeling, culminating with a runoff modeling team project.



MAGHIRANG RECOGNIZED FOR EXCELLENCE IN UNDERGRADUATE TEACHING

By Tiffany Roney



FROM LEFT, PRESIDENT RICHARD MYERS, RONALDO MAGHIRANG AND PROVOST APRIL MASON

Ronaldo Maghirang, BAE professor and associate dean for research and graduate programs in the College of Engineering, received the Kansas State University Presidential Award for Excellence in Undergraduate Teaching.

The award recognizes educators who serve students with compassion,

dedication and creativity. It includes a \$5,000 honorarium sponsored by the university president's office and Curtin Property Company, a real estate development firm with offices in Manhattan and Kansas City.

Maghirang appreciates opportunities to help students learn complex systems,

make a difference in their lives and watch them become successful in their future careers. He has taught a variety of courses including Air Pollution Engineering, Structures and Environment Engineering, and Agricultural Building Systems.

He also advises students in the biological systems engineering and agricultural technology management programs. He is the administrator of the Engineering Leadership and Innovation Program in the College of Engineering.

Maghirang has received several awards including the Robert R. and Lila L. Snell Excellence in Undergraduate Teaching Award, Clair A. Mauch Steel Ring Advisor of the Year, Myers-Alford Memorial Teaching Award, James L. Hollis Award for Excellence in Undergraduate Teaching Award and Frankenhoff Outstanding Research Award in the College of Engineering.

He earned his bachelor's and master's degrees from the University of the Philippines Los Baños, and his doctorate from Pennsylvania State University.

AIR QUALITY CONCERN OF BAE PROFESSOR

Zifei Liu, BAE assistant professor, is leading an integrated research and extension program to assist Kansans in addressing critical air quality concerns that impact the sustainability of their local communities.



ZIFEI LIU HOSTS SMOKE MANAGEMENT WORKSHOP.

Approximately one-third of the 7 million acres of rangeland in the Flint Hills region are burned each year, as a long-standing practice for ecosystem management. Smoke from the fires causes air quality concerns, and

requirements on smoke management are growing under new U.S. ozone and particulate matter standards.

Liu's program aims to establish a practical

decision support system for smoke management in the Flint Hills region, by integrating resources and analyses from ground, drone and satellite measurements. Workshops have been held annually since 2015 to provide up-to-date science-based information on smoke management to a large variety of stakeholders, including land managers, researchers and regulators.

BAE GRADUATE STUDENT EARNS SCHOLARSHIP AT CAMPUSWIDE RESEARCH FORUM

Seventy graduate students participated in the 2017 graduate student research forum, K-State Graduate Research, Arts and Discovery, or GRAD Forum, on March 30, in the K-State Student Union.

Sarocho "Mimi" Pradyawong, BAE doctoral candidate, Thailand, received first place in the Engineering/Math/Physical Sciences Poster category. Her poster title was "Effect of pH and pH-Shifting on Lignin-Protein Interactions and Adhesion Performance of Lignin-Protein Polymer." Pradyawong's major professor is Donghai Wang.

Winners received scholarships of \$500 for first place. Their names will be

engraved on a perpetual plaque to be displayed in their departments.

The forum provided graduate students from all disciplines an opportunity to share their work with the K-State community and to gain experience presenting their work in a professional setting. The event included oral presentations and poster presentations from research topics including engineering, social sciences, humanities, education, agricultural sciences, math, physical sciences, biological sciences and interdisciplinary research.

University faculty judges selected the top presenters in each session. An



awards ceremony included a special presentation from Sarah Hancock, communications coordinator for the Office of Vice President for Research.

The GRAD Forum is sponsored by the Graduate School, the Graduate Student Council, and the offices of the president and provost.

SHARDA LEADS MACHINERY SYSTEMS RESEARCH

The Machinery System and Precision Ag Research Lab headed by Ajay Sharda, BAE assistant professor, is leading multiple sponsored projects to enhance food production and profitability of U.S. producers. The broader goal of the lab is to engage undergraduates and graduate students in research, teaching and outreach activities.

Students are encouraged to develop critical skills for lab and field-scale machinery systems research, real-time large-scale data acquisition and control, cutting-edge sensing and automation for precision ag, mechatronics and imaging for unmanned systems. Currently students are engaged in projects on precision planters downforce control system validation and optimization; optimal control strategies for real-time planter downforce control during field applications; tractor system validation during real-time hay harvesting; seed



flowability using newer bio-based seed lubricants in precision seed-metering systems for environmental sustainability; pulse-width modulation nozzle-body flow and pressure dynamics; thermal infrared imaging systems for water stress and screening drought-resistant varieties; and quantifying accuracy of hay moisture sensors for balers.

Current research collaboration includes partners in India, Germany, Italy, U.S., and state and federal agencies. Sharda

said one of the exciting parts of the lab is seeing students interacting within a group to develop skills, and extend help during lab and field projects. Students learn to work in a team environment, discover projects done by different students, and develop communication and writing skills. They frequently represent the group during industry professional visits, and regional and international meetings.

"It is an exciting time in the BAE department, as we develop our program to be one of the best in the country," Sharda said.



FOOD PROCESSING AUTOMATION FOCUS OF NORWAY MEETING



Ajay Sharda, BAE assistant professor, traveled to Trondheim, Norway, June 6-10, 2017, to participate in the annual meeting of the multi-million dollar project "iProcess — Innovative and Flexible Food Processing Technology in Norway," funded by the Research Council of Norway, and led by Marit Aursand, SINTEF Fisheries and Aquaculture.

Sharda is a member of the associated scientific board that meets once a year, providing continuous input to the project to

ensure high scientific standards and technological innovation. While there, he also gave a seminar on sensing and automation activities within his lab, and explored collaborative research opportunities around sensing and robotics applications.

"There is great potential to develop collaborative research activities through this group and I am excited to go back to Norway next year," Sharda said.



IMPACTING STATE WATER ISSUES

ROTH AND GARDEN CITY COMPANY WATER TECHNOLOGY FARM FIELD DAY — THE FARM COMPARES THREE IRRIGATION APPLICATION DEVICES, SOIL WATER SENSORS AND OTHER IRRIGATION TECHNOLOGIES TO REDUCE OVERALL WATER USE.

PHOTO COURTESY OF AMERICAN IRRIGATION



INSTALLING TEST STRIPS AT WATER TECHNOLOGY FARM — THREE OUTER SPANS HAVE HALF-MOBILE DRIP IRRIGATION AND HALF MID-ELEVATION SPRAY APPLICATION.



TOP CENTER, BAE PROFESSOR DANNY ROGERS, AND BOTTOM, BAE ASSISTANT PROFESSOR JONATHAN AGUILAR, BOTH SPEAK AT WATER TECHNOLOGY FARM FIELD DAY.

K-State Research and Extension (KSRE) irrigation engineers from the BAE department continue to work directly with farmers and water agency personnel to address irrigation water issues of the state. Three water technology farms, established in 2016 through the efforts of KSRE, Kansas Water Office, groundwater management districts, commodity groups, irrigation associations and private industries, are comparing several forms of center-pivot application devices, including mobile drip irrigation (MDI) for water application effectiveness, and demonstrating use of various soil-based sensors and ET-based irrigation scheduling tools. The objective is to compare and/or document improved water management strategies for the conditions at each of the demonstration farms. MDI uses driplines, especially designed for use on center-pivot irrigation systems, to deliver irrigation water directly to the soil surface to prevent loss of irrigation water to evaporation from the wetted canopy of the plant.

Two new water technology farms were established for the 2017 growing season. Four of the farms are located over the Ogallala

Aquifer where deficit irrigation strategies are common. One is in south central Kansas on sandy soil where the effect of irrigation on interaction between surface and groundwater is important. Each farm has an additional set of objectives, which may include effectivity of circular planting, advantage of using cover crops, incorporating low-quality ditch water, mitigating wheel-track issues and incorporation of polyacrylamide.

These projects will continue into the future as they also provide the foundational basis for the recently awarded Natural Resources Conservation Service Conservation Innovation Grant, "Using Farmer-based Water Technology Farms to Implement New Irrigation Technologies to Sustain the Rural Economy." This award will allow KSRE continued documentation and evaluation of water savings and economic impact of adopting the new technology. In addition, it will allow continued upgrade of irrigation decision support tools such as KanSched, an ET-based irrigation scheduling tool, and a crop water allocator, a tool to help allocate limited water for various crop land splits.

ONE WATERSHED STORY



Every watershed has a story to tell in a language written by nature and listened to by watershed modelers. Every watershed modeler wants to translate that message for all to understand, that is — watersheds across Kansas face threats from anthropogenic activities, preventing them from providing adequate life-giving ecosystem services.

Biological and agricultural engineering's watershed modeling group led by Aleksey Sheshukov, assistant professor, and doctorate student, Dereatha Cross, explored use of the ESRI Story Map tool, an interactive way to share and communicate Kansas watershed stories to the world utilizing authoritative maps with text, images and multimedia content. Several online story maps were created using Watershed Restoration and Protection Strategy plans, one of which is the story of Milford Lake Reservoir's watershed.

Using the Story Map tool, visitors can utilize interactive web pages to explore threats the Milford Reservoir watershed area faces; learn about its background; explore physical hydrological descriptions, impacts of land use land cover, and total maximum daily loads of pollutants the watershed systems must process; and learn about potential sources of pollutants and remediation strategies. Map elements can be selected, layer links' control information displayed, maps zoomed and panned, and legend items translated to map element meanings.

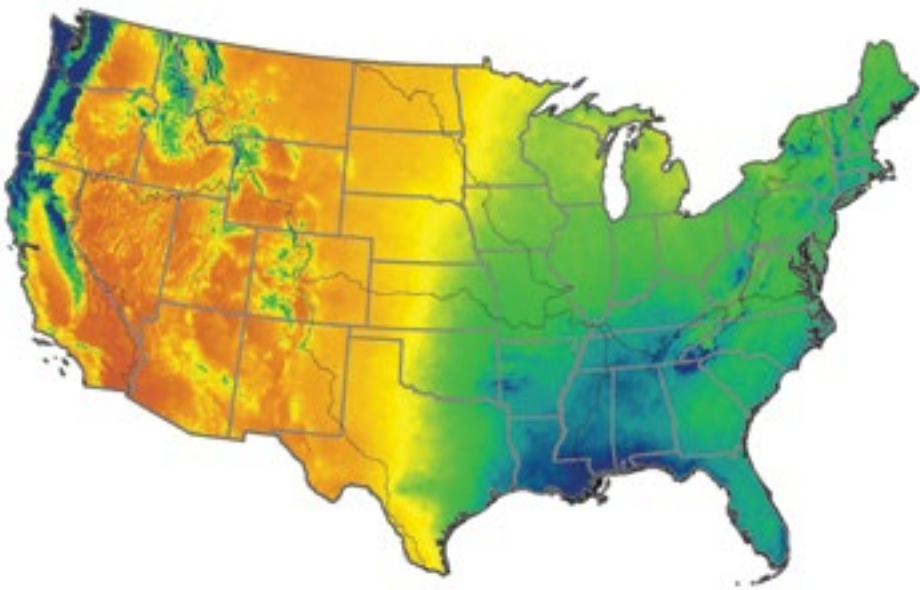
Online story maps provide BAE watershed modelers an effective way to share Kansas watershed stories with the public. More on the Story Map tool can be found at bae.k-state.edu/watershed.



INCORPORATING WEATHER AND CLIMATE INTO GIS CURRICULUM

Vahid Rahmani, BAE assistant professor, was invited to a teaching workshop with the theme “integration of geography and atmospheric sciences” in Boulder, Colorado. Extreme weather and climate change impacts vary among different communities and populations; therefore, addressing these problems requires spatial thinking and knowledge on the integration of climate science and meteorology with Geographic Information Systems (GIS). Significant progress has been made in the past several years in linking GIS with atmospheric and related sciences and their datasets. The intersection of GIS, weather, climate and societal impacts becomes essential when students are learning about interdisciplinary problems their communities face.

The goal of the workshop was to enhance geospatial education by integrating major issues of environmental change into the GIS curricula. This year participants from across the country shared their teaching experiences with a focus on incorporating weather and climate into GIS curricula. Rahmani will use the new materials in courses offered in BAE. Workshop sponsors were the National Science Foundation and National Center for Atmospheric Research.



SHARDA TO PRESENT RESEARCH ON PRECISION PLANTER TECHNOLOGY

The submitted paper of Ajay Sharda, BAE assistant professor, with co-authors Ryan Strasser, BAE graduate student, and Matthias Rothmund, has been accepted for oral presentation at the 75th International Conference on Agricultural Engineering, Land.Technik AgEng 2017, to be held Nov. 10-11, in Hannover, Germany.

One of the premier international agricultural engineering conferences in the world, the meeting attracts a diverse international participation with more than 50 percent of participants being heads of departments, heads of development/engineers, and CEO/managing board and division managers/group leaders/team leaders. The papers go through a rigorous review process, and in 2017 approximately 75 have been selected for oral presentations.

Sharda’s presentation, “Development and Utilization of a Planter Automatic Downforce Evaluation Test Stand to Quantify System Response and Accuracy,” is part of the broader precision planter technology research going on within Sharda’s Horsch Advanced Planting Systems Lab group and, in particular, a result of Strasser’s master’s research.

He contends the automated system developed for planter downforce control system optimization and validation is one of the unique systems within peer research institutions. The learning will help in large field-scale projects to understand planter downsystem control during dynamic field operating scenarios, which is led by his doctoral student, Sylvester Badua.

Sharda said the system developed during the project is an available

tool for undergraduate teaching and outreach activities to further extend the principles of technology. The work being conducted within the planter systems lab has put the BAE department at K-State as one of the leading institutions extending the envelope of planter technology research and innovation.



BAE ALUM RECOGNIZED FOR CAREER SUCCESS

A portrait of a middle-aged man with short, light brown hair, smiling warmly at the camera. He is wearing a dark navy blue suit jacket over a vibrant purple dress shirt and a purple tie with a white diagonal stripe pattern. The background is a solid, dark grey or black.

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Revised July 7, 2015.

