Seek

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Sustaining the Plains

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"By coordinating fish biodiversity sampling in the Smoky Hill River with geomorphology, hydrology and land use, our research team will better understand how humans impact aquatic systems. This information can be combined with human surveys of use and value to advance science and increase the efficiency of conservation efforts."

*— **Martha Mather,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*

Martha Mather

Marcellus Caldas

Melinda Daniels

Matthew Sanderson

"Variations, impacts or loss of water in Great Plains water systems have the capability of producing cascading effects. Humans and other biota are constantly adapting to these effects, but there is likely a threshold where the aquatic and wetland systems start to fail and this will have negative impacts throughout the Great Plains. Our goal is to quantify these thresholds."

*— **David Haukos,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*

The interdisciplinary team includes researchers from:

College of Arts and Sciences

Principal investigators from the **College of Arts and Sciences** include:

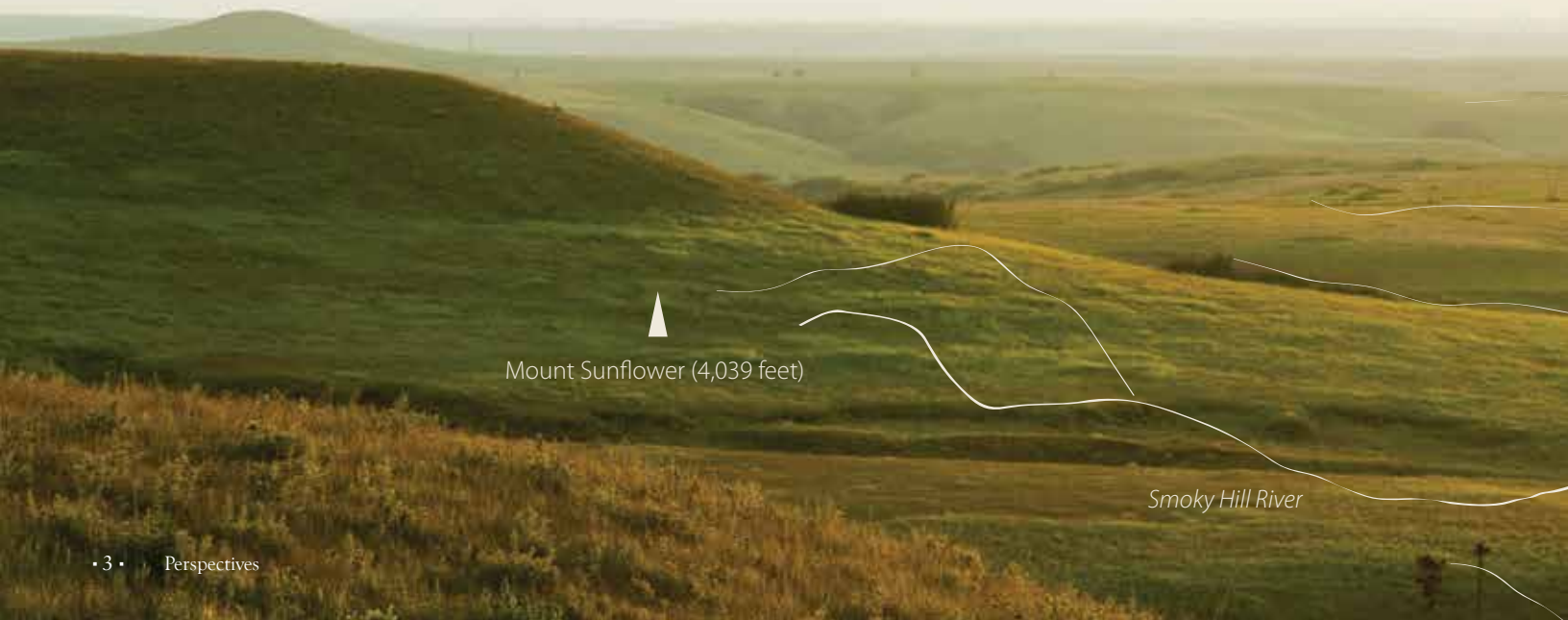
- ***Marcellus Caldas,** associate professor of geography*
- ***Melinda Daniels,** adjunct professor of geography at Kansas State University and associate research scientist at the Stroud Water Research Center in Pennsylvania*
- ***Dave Haukos,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*
- ***Martha Mather,** adjunct associate professor of biology and researcher with the Kansas Cooperative Fish and Wildlife Research Unit*
- ***Matthew Sanderson,** associate professor of sociology*

"From a social science perspective, this project has the potential to significantly advance knowledge of the human-environment nexus because it explicitly incorporates the natural systems component of the relationship in the models — something that is not very common in the social sciences."

*— **Matthew Sanderson,** associate professor of sociology*

Principal investigators from other institutes include:

- ***Joseph Aistrup,** dean of Auburn University's College of Liberal Arts and Sciences and former professor of political science at Kansas State University*
- ***Kyle Mankin,** senior hydrologist with the U.S. Fish and Wildlife Service and former professor of biological and agricultural engineering at Kansas State University*



College of Agriculture

The principal investigator from the **College of Agriculture** is:

- ***Jason Bergtold,*** *associate professor of agricultural economics*

Jason Bergtold

"Our project should help the members of the Kansas community better understand the social, economic, biological and environmental linkages between ourselves and the environment and how we can manage our natural resources to enhance our quality of life while protecting our environment and biodiversity in the state."

*— **Jason Bergtold,** associate professor of agricultural economics*

Sustaining the plains

Collaborative project helps Great Plains stay afloat of water problems

Central Great Plains water systems are a complicated puzzle that an interdisciplinary Kansas State University team is solving piece by piece.

The eight-member team is studying how human activity, climate change and land use interact and affect water systems in the Central Great Plains. The researchers, who include geographers, engineers, biologists, economists and sociologists, are collaborating to prevent future water scarcity and water quality problems.

"These are the kind of problems you cannot solve in just one discipline," said Marcellus Caldas, associate professor of geography and project co-leader. "One factor affects another. Each person is connected in his or her own field and contributing a piece to solve this puzzle."

The researchers want to accomplish two goals: understanding the connection between humans and their environments and developing policies that can help Central Great Plains water usage. A three-year $1.4 million grant from the National Science Foundation's Dynamics of Coupled Natural and Human Systems program is supporting them.

The team is focusing on the Smoky Hill Watershed as a case study. The watershed extends from eastern Colorado to near Manhattan, Kansas, where it joins the Kansas River. It is a narrow basin that stretches across Kansas' strong east-west precipitation gradient, which is drier in western Kansas and gets wetter further east. Other watersheds north and south of the Smoky Hill are similar, which makes it a good model for other Great Plains watersheds.

The Great Plains region has longstanding water quality and quantity concerns from extreme climate variability, intensive water uses and land uses. Through collaboration, the researchers can study related components.

For example, they can understand how crop pricing influences land cover, which influences water runoff and groundwater recharge.

College of Engineering

"The integrative policy optimization models will be large-scale, complex mathematical representations of the entire water system. My hope is that our research will lead to advances in the extent to which local culture and decision objectives can be represented in models of this type. The goal is to identify water system management strategies that simultaneously support a healthy ecosystem and rural livelihoods."

*— **Jessica Heier Stamm,** assistant professor of industrial and manufacturing systems engineering*

Jessica Heier Stamm

Principal investigators from the **College of Engineering** include:

- ***Jessica Heier Stamm,** assistant professor of industrial and manufacturing systems engineering*
- ***Aleksey Sheshukov,** assistant professor of biological and agricultural engineering*

"We expect to get a better understanding of how dynamics between climate variation, human land- and water-use decisions, and aquatic ecosystem affect surface runoff, hill slope erosion, groundwater recharge and stream flow regimes."

*— **Aleksey Sheshukov,** assistant professor of biological and agricultural engineering*

This affects the amount of water flowing to the rivers, which influences how fish are able to reproduce that year, said Daniels, project co-leader and adjunct professor of geography.

"Our project ties together the factors that drive land-use decisions and water-use decisions in an attempt to build resiliency in both human and natural systems so that the region can thrive economically and culturally, and still produce invaluable ecosystems services like drinking water supply, groundwater recharge, biodiversity and recreation," Daniels said.

The project includes four parts:

- **Hydrosystems.** Researchers are measuring how climate, human activity and land use affect water quantity and water quality. They are developing watershed models to integrate aspects such as surface runoff, hill slope erosion and groundwater recharge.
- **Aquatic ecosystems.** These systems provide stream water, water recharge and flood control. Aquatic ecosystems also provide fish and wildlife that are important for migratory waterfowl, fishery support and recreation. Biologists are investigating how water level changes affect fish, plants and wildlife in streams and wetlands of the Smoky Hill basin.
- **Land- and water-use decisions.** By interviewing landowners and water users, researchers are understanding how humans respond — through land- and water-use decisions — to climate-induced changes in water supply, water quality and ecosystem. For example, researchers want to understand why and when a farmer may switch from rain-fed crops to center-pivot crops. Social scientists also are modeling how water quality and availability influence community members' use of water at home and influence recreation in the region's rivers, streams, ponds and reservoirs.
- **Policy modeling.** Researchers are combining the water, ecological and human components of the study to understand how they are linked and how different policies may benefit all components. Engineers are applying simulation models to explore policy-making processes that achieve sustainability.

— By Jennifer Tidball, Division of Communications and Marketing