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# USU Scientist Seeks Vulnerable 'Hot Spots' in Well-Trafficked River

USU watershed scientist Patrick Belmont is a principal investigator on a multi-university study of the Minnesota River funded by the National Science Foundation Foundation's Water, Sustainability and Climate program.


From the Minnesota-South Dakota border, the Minnesota River flows some 335 miles to its confluence with the Mississippi River near St. Paul. Vital to the agricultural region, it's one of the nation's most polluted rivers. Map courtesy of Karl Musser.

The Minnesota River Basin, which stretches across southern Minnesota into neighboring South Dakota and Iowa, fuels the upper Midwest's breadbasket. The lifeblood of the rich agricultural region, the river has become one of the nation's most polluted waterways.

Fingers point to intensive farming practices and the resultant runoff, but Utah State University scientist Patrick Belmont says the causes are much more complex.

"A web of human and natural interactions, including a changing climate and the river's geologic history, has altered the basin," says Belmont, assistant professor in USU's Department of Watershed Sciences.

Belmont and colleagues from University of Minnesota, University of Illinois, Johns Hopkins University, Iowa State University and University of Washington recently received a $4.3 million grant through the National Science Foundation's Water, Sustainability and Climate program to develop tools to identify "hot spots" of environmental sensitivity. The research team, based at UM, will offer this information to target remediation efforts.

"We're using a human-amplified natural change or 'HANC' approach," Belmont says. "This hypothesis says areas of the landscape most susceptible to human, climatic and other external changes are those undergoing the highest rates of natural change."

The ability to identify hot spots of sensitivity to change would enable river managers to target remediation and other management measures where they could do the most good, he says.

“The Minnesota River and its tributaries have an unusually heavy sediment load,” says Belmont, who is affiliated with the NSF-funded National Center for Earth-surface Dynamics. “Millions of dollars have been spent on conservation practices to decrease agricultural soil erosion, but that’s not the only contributing factor.”

Changes in precipitation patterns, he says, have caused a significant increase in river discharge.

“It’s gotten wetter and more water is routed to the river more quickly than ever before,” Belmont says. “That results in more erosion.”

To conduct the study, the team is employing geochemical fingerprinting along with a suite of geomorphic change-detection techniques, including both ground-based and aerial LiDAR (Light Detection and Ranging), a high-definition laser scanning tool used to map geologic surfaces.

“These tools allow us to examine areas at much higher resolution than has ever been possible,” Belmont says. “With this information, we’ll develop a HANC-based analytical toolbox for evaluating areas prone to rapid change in the landscape.”

Such a toolbox, he says, will help with predictions of the river basin’s future under changing climatic conditions and human actions.

“Our aim is to determine the land and water management options needed to produce a sustainable, resilient the thriving system that balances human and environmental needs,” Belmont says.

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USU Department of Watershed Sciences

USU College of Natural Resources

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