Study of 2011 flood will lead to better preparedness

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This is a photo of an erosional scar at the O'Bryan Ridge in the Bird's Point New Madrid Floodway during the the 2011 Lower Mississippi flood. Credit: Praveen Kumar, University of Illinois

In May 2011, when the U.S. Army Corps of Engineers used explosives to breach a levee south of Cairo, Ill., diverting the rising waters of the Mississippi and Ohio rivers to prevent flooding in the town, about 130,000 acres of Missouri farmland were inundated. It was the largest flood of the lower Mississippi ever recorded, and researchers from the

University of Illinois at Urbana-Champaign took advantage of this "once-in-a-scientific-lifetime" occurrence to study the damage, funded by a National Science Foundation Rapid Response Grant. Their results, published this week in the journal *Environmental Science and Technology*, demonstrate that landscape vulnerabilities can be mapped ahead of time to help communities prepare for extreme flooding.

"There is overwhelming scientific evidence that the characteristics of extreme rainfall under climate change are going to be different," said Praveen Kumar, a professor of civil and environmental engineering (CEE) at Illinois and project leader on the study. "Forecasts of extremes of rainfall and flooding are not sufficient. The most urgent need is appropriate preparedness based on scientific assessment of landscape vulnerability."

The 2011 activation of the Birds Point-New Madrid (BPNM) Floodway resulted in the diversion of floodwater for 35 miles before it was directed back to the Mississippi at New Madrid, Mo. The Corps of Engineers also later opened the Bonnet Carré and Morganza spillways in Louisiana to ease pressure on the New Orleans levee system. The decision to inundate farmland was controversial because several hundred people live on the floodplain and the land is agriculturally valuable, said CEE PhD student Allison Goodwell, lead author of the paper.

"The consensus with BPNM is that it worked really well," Goodwell said. "It had a pretty immediate impact of lowering the levee stages all around the area."

The Illinois team included experts in hydrology, geography and geology, in collaboration with the U.S. Geological Service and the U.S. Army Corps of Engineers. Using a number of sensors they observed changes on the river and throughout the floodplain. They used a unique collection of data from high-resolution pre- and post-flood LIDAR mapping, an

optical remote sensing technology, to analyze erosion and deposition from the flood. Using HydroSED 2D, a computer modeling system developed at the University of Illinois, they incorporated two-dimensional flow modeling, soil characteristics and information about vegetation to analyze the vulnerability of the landscape compared with observed impacts. They also compared sites that were heavily affected due to the flow with those that were not.

"You don't get the chance to do these huge-scale experiments very often," Goodwell said. "You could never do something like this in a lab. This was a chance to assess landscape impact and then back-predict that so before the next flood we have an idea of areas that might need protection. It can be broadly applied to areas along the Mississippi River basin or any area."

More information: The paper, "Assessment of floodplain vulnerability during extreme Mississippi River flood 2011," by Allison E. Goodwell, Zhenduo Zhu, Debsunder Dutta, Jonathan A. Greenberg, Praveen Kumar, Marcelo H. García, Bruce L. Rhoads, Robert R. Holmes, Gary Parker, David P. Berretta and Robert B. Jacobson, is available online.

Provided by University of Illinois at Urbana-Champaign