Fluvial geomorphology of mountain streams aids understanding of dynamics of other rivers like Cuyahoga

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Case Western Reserve University visiting professor and researcher Nicholas Sutfin crossing St. Vrain Creek, a 32-mile-long tributary of the South Platte River in north central Colorado. Credit: Nicholas Sutfin

Studying the sediment of a mountain river can reveal thousands of years or more of a waterway's history, including new threats from more frequent wildfires and increased precipitation brought by climate change.

And understanding those challenges may provide insight into other waterways, including the Cuyahoga River.

Those climate-induced threats are among the findings recently published in the journal *Nature Communications* from Nicholas Sutfin, a visiting assistant professor of Earth, Environmental and Planetary Sciences at Case Western Reserve University. Sutfin is a fluvial geomorphologist—a scientist who studies how rivers interact with surrounding landforms, especially in relation to how they move sediment.

Sutfin has focused so far on the streams of the Front Range of the Rocky Mountains, where he conducted research as an extension of his Ph.D. dissertation with mentor and co-author Ellen Wohl, Colorado State University Distinguished Professor.

Those high-elevation mountain streams have often been seen as machines of erosion, wearing down the surrounding landscape. But they also retain sediment along their bottoms and banks for hundreds and sometimes thousands of years; and the higher the stream, the older the sedimentary record.

But that ancient history is being disturbed more frequently. Among the recent findings from Sutfin and Wohl is that three trends in "floodplain disturbance"—forest type, precipitation patterns and frequency and intensity of wildfires—all are expected to shift under a changing climate.

"There will definitely be an influence from climate change," Sutfin said. "Snow pack decreases and melts much sooner; larger floods are likely to occur and large forests fires are becoming more common. Sediment will now likely erode more rapidly."

Wildfires, in particular, may be responsible for reducing how long sediment remains in place because a fire can strip the land of its ability to slowly and effectively filter water, Sutfin said. Instead, surface water from rainfall simply rushes into the river.

How it applies to the Cuyahoga, other rivers

Sutfin's work could help inform a wider and universal understanding of rivers. That includes massive systems like the Mississippi, to more localized rivers like the Cuyahoga.

Suftin is also a Northeast Ohio native with a keen interest in not only the Cuyahoga, but also the Chagrin and the Black rivers (the latter of which flows through his home county of Lorain).

"Urban rivers are generally under-studied," he said. "The increase in frequency and intensity of large storms is true here in Northeast Ohio just as it is in the Rockies."

Even the effects of fire on the landscape and river flow can be applied to understand development and other land-use around urban streams, he said.

"When a site is burned by wildfire, the effect is similar to what happens with urbanization, when we pave over the land with impervious surfaces," Sutfin said. "Then, rainfall goes right into the river, causing more flow, more erosion and more movement of sediment—so the parallels are evident."

Provided by Case Western Reserve University

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