Dams -- what goes up must come down, and then what?

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Time can take its toll on a dam. As dams age, they are more costly to repair and the risk of a catastrophic dam break increases--putting property and lives at risk. But, removing them can mean big changes to the community, and the environment.

"A lot of communities now are trying to wrestle with the decision of whether or not to support dam removal. And part of that uncertainty is our lack of scientific knowledge of what's going to happen when you take a dam out," says Dartmouth College geographer Frank Magilligan.

With support from the National Science Foundation (NSF), Magilligan studies river systems to learn how dam removal might affect them. His "lab" has been the relatively small Homestead Dam along the Ashuelot River in Swanzey, N. H., 60 miles south of his campus office. The Homestead Dam was built more than 200 years ago along the Ashuelot. It's long outlived its purpose, once serving as a power source for a local mill that is long gone.

When Magilligan heard the dam was going to be taken down in July 2010, he rushed with a team of researchers to the dam site. "We were really fortunate because we were able to get in several months before the dam came out to get all the necessary pre-removal data," says Magilligan.

One set of data is LIDAR imagery of the Ashuelot. LIDAR uses a laser-based ranging tool mounted on the bottom of a small plane. It can peer

beneath vegetation showing the Ashuelot's former riverbed from centuries ago.

"LIDAR is a very sophisticated laser system. What [we're] able to do is pick up very detailed, centimeter-scale topographic elevation," says Magilligan. LIDAR can get those precise measurements in just a few hours, giving a more accurate snapshot of the river's flow at any given point in time. It's the kind of work that might take months to complete by ground surveillance.

A year after the dam's removal, the team has now returned to the Ashuelot to get new LIDAR measurements to pinpoint where the river is currently flowing.

"We'll be able to document a topographic snapshot before the dam was removed and a topographic snapshot a year after the dam was removed," says Magilligan. LIDAR doesn't penetrate water, so grad student John Gartner resorts to a little help from a GPS device.

"As part of the GPS analysis we're able to get centimeter-scale topographical information," explains Magilligan, who also studies the riverbed sediment to track how the path of the river is changing. Magilligan finds there have been notable differences since the dam's removal. "What we have seen from some of our field analysis is that there's been a couple of feet of bank erosion in some places. In other places, we see a couple of feet of bank deposition as well," he notes.

For Magilligan, it's all about "shoring up" what we know about how rivers flow, in order to make smart choices when it is time for a dam to come down.

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