Loss of eastern hemlock affects peak flows after extreme storm events

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The loss of eastern hemlock could affect water yield and storm flow from forest watersheds in the southern Appalachians, according to a new study by U.S. Forest Service scientists at the Coweeta Hydrologic Laboratory (Coweeta) located in Otto, North Carolina. The article was just published online in the journal *Ecohydrology*.

"Eastern hemlock trees have died throughout much of their range due to the hemlock woolly adelgid, an exotic invasive insect," said Steven Brantley, a post-doctoral researcher at Coweeta and lead author of the paper. "Though this insect has decimated whole stands of eastern hemlock along streams in the southern Appalachians, few studies have addressed the effects of this insect outbreak on landscape-level watershed processes such as stream flow."

Because of its dense evergreen foliage, eastern hemlock plays an important role in the water cycle of southern Appalachian forests, regulating stream flow year round. Although eastern hemlock rarely dominates the region's forests, the tree is considered a foundation species in the streamside areas called riparian zones.

Previous research by the Coweeta scientists led them to suspect that the loss of eastern hemlock would cause stream flow to increase over the short-term, especially in the dormant fall/winter season, then decrease over the longer term, with small effects annually. They also thought that peak flows after storms would increase, especially in the dormant season.

For this study, Coweeta researchers used a paired watershed approach—one watershed with a major hemlock component in the riparian forest area, the other reference watershed with very little—to determine the effects of hemlock mortality on stream flow and peak flow following storms. Since hemlock woolly adelgid was first detected in 2003, all the eastern hemlock trees in both watersheds died, resulting in a loss of 26 percent of forest basal area (that area occupied by tree trunks and stems) in the riparian area of the first watershed compared to a 4 percent loss in the reference watershed riparian forest.

"Instead of finding that stream flow increased after hemlock mortality, we found no real change in any year after infestation," said Brantley. "We did find, however, that peak stream flow after the largest storm events increased by more than 20 percent."

"The fact that hemlock loss didn't increase water yield in the short-term was due to the rapid growth response of co-occurring trees and shrubs in the riparian forests; and peak flows were likely higher after hemlock loss due to lower interception by the evergreen canopy in the riparian zone," said Brantley. "This latter finding suggests that riparian trees may play a disproportionally important role in regulating watershed processes than trees that aren't adjacent to the riparian zone."

"It also has implications for the more extreme rain events predicted under climate change," he added. "Losing foundation species in forested riparian zones could amplify the effects of altered precipitation regimes."

More information: *Ecohydrology*, www.treesearch.fs.fed.us/pubs/46230

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