Rivers, lakes impact ability of forests to store carbon

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River Kvirila at Sachkhere, Georgia. Credit: Wikipedia

Forests help remove carbon dioxide from the atmosphere by storing it in

trees, but a sizeable amount of the greenhouse gas actually escapes through the soil and into rivers and streams.

That's the main finding of a paper to appear Monday in the *Proceedings of the National Academy of Sciences*. It's the first study to comprehensively look at how carbon moves in freshwater across the entire U.S.

The researchers found that across the country, the ability of forests to store carbon is not as robust once freshwater is factored into the equation. They hope to introduce this as an important concept to consider when modeling how much carbon is stored in terrestrial landscapes.

"If our goal is to use forests as a way to manage carbon stocks, we should know what is leaking into streams, rivers and lakes," said lead author David Butman, an assistant professor in the School of Environmental and Forest Sciences and in the Department of Civil and Environmental Engineering at the University of Washington.

"Our research suggests that in fact these landscapes might not be taking up as much carbon as we think because we're not accounting for what's being lost in aquatic systems."

Butman, who is also an affiliate researcher with the U.S. Geological Survey, along with collaborators from the federal agency and the Wisconsin Department of Natural Resources, scoured all existing data and studies that accounted for carbon in freshwater rivers, lakes and reservoirs around the country, then synthesized the data and created new models to take a first-ever countrywide look at how much carbon is moving in the water.

They found that freshwater rivers and streams transport or store more

than 220 billion pounds of carbon each year. This carbon ends up in the ocean, in the sediment at the bottom of lakes and reservoirs, or in the atmosphere as a greenhouse gas. With these new U.S.-wide numbers, scientists may be overestimating the ability of terrestrial landscapes to store carbon by almost 30 percent, the study found.

"We're suggesting that once you account for the carbon that's leaking out of landscapes into aquatic environments, the amount of actual carbon storage is decreased by almost 30 percent," Butman said. "That's a high number, and it has to help inform the larger conversation of where carbon is stored."

The researchers presented the findings at this month's American Geophysical Union Fall Meeting and their results will contribute to the next federal State of the Carbon Cycle Report. The first report, released in 2007, didn't include freshwater ecosystems as part of a national carbon assessment, Butman said.

Results varied by region, but researchers found that the Pacific Northwest's high volume of rainfall each year moves carbon relatively quickly through the landscape and to coastal waters faster than in other regions. These forests are usually thought of as vast storage sinks for carbon, so these new results may have particular significance for the region, Butman said.

The U.S. Geological Survey spent four years on this countrywide carbon assessment, which began with Department of Homeland Security funding to try to understand and calculate carbon stocks and fluxes in the natural environment. Butman joined the project as part of his postdoctoral work at Yale University, specifically looking at how carbon moves in freshwater.

Butman is currently focused on how carbon enters freshwater

ecosystems in the Pacific Northwest. His recent paper in Nature Geoscience suggests that the size of the river or stream helps dictate the origin of carbon—either seeping in from groundwater and carbon-rich soils, or being released from aquatic organisms that respire and decay—in these waterways.

More information: Aquatic carbon cycling in the conterminous United States and implications for terrestrial carbon accounting, *Proceedings of the National Academy of Sciences*, www.pnas.org/cgi/doi/10.1073/pnas.1512651112

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