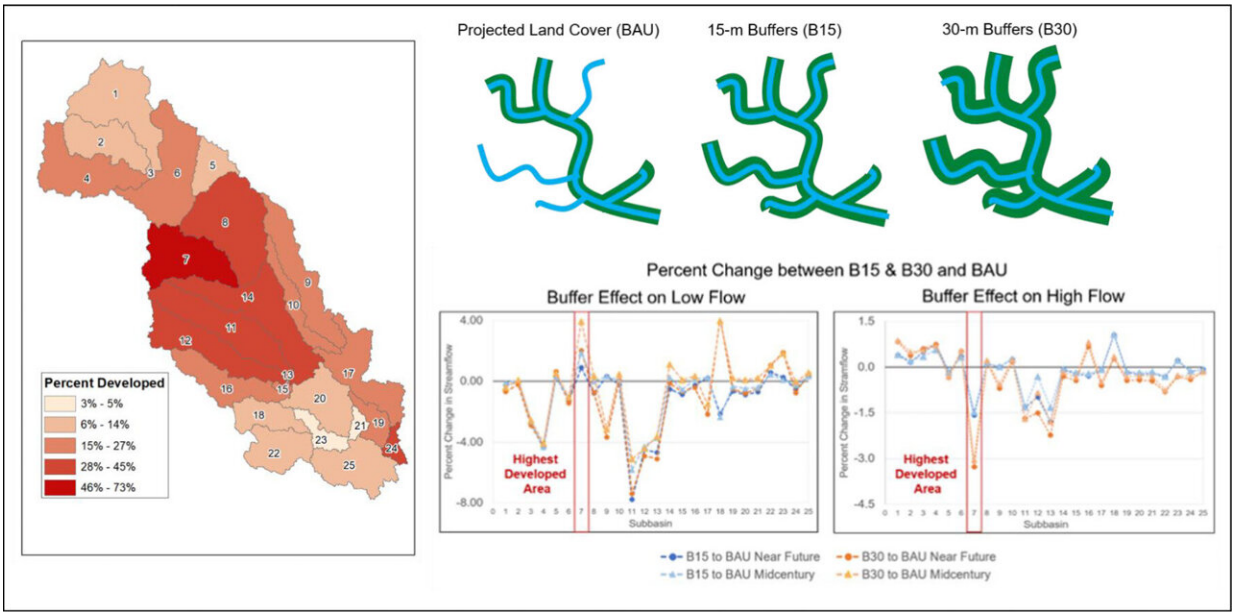
Forests can help manage water amid development, climate change

January 10 2023



Graphical abstract. Credit: *Science of The Total Environment* (2022). DOI: 10.1016/j.scitotenv.2022.160834

In areas near Raleigh projected to see heavier future development, keeping buffers of trees or other greenery around waterways could help slow rushing streams during wet conditions, and keep them flowing during dry ones. However, North Carolina State University researchers behind a recent study warned these so-called "riparian buffers" would not be a magic bullet for managing water as development increases and

the climate grows warmer and wetter.

"Buffers are good for watersheds—there's a lot of literature that shows that they're great for water quantity and also for quality," said the study's lead author Elly T. Gay, a graduate student in forestry and environmental resources at NC State. "But in the future, buffers in isolation may not be viable as the only option to mitigate negative consequences that increased development and more variable climate might have on water quantity; they need to be coupled with other management strategies."

Forests can filter water, and they can also slow water down to prevent floods or keep water levels up during droughts, said the study's co-author Katherine Martin, assistant professor of forestry and environmental resources at NC State. Alternatively, stream flows can be more extreme in urban areas with more paved surfaces. Riparian buffers are one tool to help manage water in urban areas.

"Urban hydrology is a lot more flashy," Martin said. "When it rains, and you have an area with a lot of buildings and roads, the rainfall goes immediately into the streams. There's not a lot of time for it to seep into the ground. In forests, the water is filtered through the soil, and used by plants. It's a slower process of getting the water to the stream, even if it's not raining. That's important for aquatic species, so they have enough water. When stream levels are low, pollutants get concentrated."

In the study, researchers projected average stream flow between 2017 and 2060 for the Upper Neuse River Watershed, the watershed that starts in Durham, feeds into Falls Lake to supply water to Raleigh, and drains through to Goldsboro. They modeled the impact of three different scenarios for riparian buffers to see how they'd impact stream flow: They tested a "business as usual" scenario with existing forest or greenspace, which includes a 50-foot state mandated buffer area, as well as many areas that were exempted. They also looked at a scenario with

50 feet of forested buffers throughout the entire watershed; and a scenario where forest buffers were extended to 100 feet.

They also projected the impact of climate change on precipitation and temperature, and if low-intensity development were to continue to grow.

"We modeled a higher greenhouse gas emissions scenario, but precipitation was not particularly extreme," said Martin. "We were also interested in testing how expanded development would affect stream flow because of this link between increased impervious surface, and the impact it has on water quantity and quality."

They found that on average, daily streamflow across the watershed would increase. They projected average daily stream flow to increase by as much a 28% in some areas without buffers.

In wetter conditions, they saw that buffers linked with larger reductions in stream flow in some of the most developed areas.

During dry spells, they saw that buffers had mixed results. In some areas, buffers were actually linked with reductions in daily stream flow during dry spells—so the opposite of what they would hope to see. But, buffers did seem to help maintain water levels in areas at either end of the development spectrum: buffers helped maintain stream flow in an area of the watershed with the highest amount of future development, and they also helped maintain water levels in areas that are not yet developed.

"We found that buffers can increase flow during the lowest flow events, and they can decrease flow during the highest flow events in more localized areas," Gay said. "These localized areas are typically in the places with the highest levels of development—we found buffers had the largest effect in those areas."

However, researchers said the effects weren't as striking as they expected, and there was little difference when they compared the 50-foot and 100-foot buffers.

"This suggests there is a role for buffers in mitigating extremes for stream flow, but it can't be the only strategy," Martin said. "We need a comprehensive plan for the future if we want to maintain high water quality that includes not only riparian buffers, but more, and larger, green spaces, which have an abundance of benefits beyond just water."

The study, "Riparian buffers increase future baseflow and reduce peakflows in a developing watershed," was published online in *Science of The Total Environment*.

More information: Elly T. Gay et al, Riparian buffers increase future baseflow and reduce peakflows in a developing watershed, *Science of The Total Environment* (2022). DOI: 10.1016/j.scitotenv.2022.160834

Provided by North Carolina State University