

Green stormwater control measures clean up urban streams

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A rain garden constructed near the headwaters of Little Stringybark Creek in Mt. Evelyn, Melbourne, Australia. Credit: Waterways Ecosystem Research Group, The University of Melbourne

Catching urban runoff in raingardens and rainwater capture tanks improves the water quality of nearby streams and rivers and lowers water temperatures that have risen in the region due to climate change and the urban heat island effect, according to a new report spanning two decades in the greater Melbourne metropolitan area of Australia.

When [natural landscapes](#) are replaced with urban infrastructure environments, the temperature of an area also increases, a phenomenon known as the [urban heat island effect](#). As water runs through [urban areas](#) with impervious surfaces, it picks up pollutants and heat before discharging into waterways. The compound effects of urban expansion and [climate change](#) in the study region have increased the water temperature of nearby streams by as much as 5 degrees Celsius (9 degrees Fahrenheit).

Raingardens and rainwater tanks were able to restore degraded streams by filtering and cooling runoff before it entered the waterway, according to the study in *Water Resources Research*. Green stormwater infrastructure reduced the streams' peak summer temperatures by about 5 degrees Celsius (9 degrees Fahrenheit), effectively counteracting the regional warming.

These catchment systems also filtered runoff from human activities, such as car washing, spilled gasoline, sewage, fertilization and irrigation, and prevented [excess nutrients](#) from entering the stream ecosystems.

The study, one of the longest and largest to be completed on green stormwater control measures, found that raingardens and rainwater capture tanks were effective at reducing [water temperatures](#) and pollution in nearby streams at least 90% of the year.

"In areas where we had green infrastructure systems in place, we saw significant water quality improvements," said Christopher Walsh, an

ecosystem scientist at the University of Melbourne and lead author of the study.

Reducing heat and pollution

Green stormwater control measures come in many forms and are designed in accordance with the unique layout of each urban area. This study had two designs: raingardens and rainwater capture tanks strategically placed in locations where runoff from roofs and roads could be intercepted.

Raingardens were constructed and filled with high-filtration soils to remove pollutants before municipal runoff flowed into nearby streams. Rainwater capture tanks reduced total runoff and often directed water into neighboring raingardens for filtering before flowing into the streams.

Unlike roofs and roads, soils are porous and are filled with air pockets that can hold water. According to Walsh, on average, only about 10% of the rainwater that landed on soils in the study region flowed into nearby waterways. Soils absorb and distribute most of the water to trees and vegetation. The water that isn't taken up by plants is filtered and cooled as it slowly flows through the ground towards the stream.

When water temperatures and nutrients are higher than what is typical of a healthy stream, ecosystems can degrade as plants and animals are not adapted to the changing conditions. Excess algal growth and decreased [oxygen levels](#) are just two of the potential effects of abnormally warm and nutrient-flooded streams. When left unchecked, these conditions can be fatal for life that depends on the stream for survival. Fishing and [recreational activities](#) are popular at the streams examined in the study, and maintaining a healthy stream ecosystem is central to carrying on with these pursuits, Walsh said.

The future of green stormwater control infrastructure

Green stormwater control measures can improve the health of aquatic ecosystems that we depend on. This study covered a lot of ground in both time and space but was limited in infrastructure development due to incompatibilities with current municipal layouts.

"An existing urban area is very difficult to retrofit," Walsh said. "If you are able have enough [raingardens and [rainwater](#) tanks] in an area that's not already urbanized, you should be able to protect streams and their water quality."

More information: Christopher J. Walsh et al, Dispersed Urban-Stormwater Control Improved Stream Water Quality in a Catchment-Scale Experiment, *Water Resources Research* (2022). [DOI: 10.1029/2022WR032041](#)

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