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Grass and trees in urban areas help reduce flood risk

Trees form a valuable part of green infrastructure in cities by helping reduce surface water runoff, recent research finds. Together with grassy areas, significant reductions in surface water flows can be achieved by planting trees, reducing the risk of floods.

Sealed surfaces, such as roads and buildings, in urban areas increase the amount and speed of water flowing overland during and after prolonged or heavy rainfall. Urban runoff typically flows into drainage systems for stormwater, which may not be able to handle large volumes of water, potentially leading to flooding in the area.

Cities are increasingly using sustainable drainage systems (SuDS), including vegetated areas, to control stormwater runoff. Rainwater which lands on trees either evaporates to the air or drips down to the ground below, where it can soak into the soil. Surface water from nearby areas can also flow into the permeable area around the trees, which further increases the amount of water that can soak away and reduces demand on stormwater drains.

In this study, the researchers investigated the role of trees and grass in reducing surface water runoff in urban areas by measuring the amount of rainwater entering a drainage system. They focused on five sites in the city of Manchester, UK.

On each site, they set up three adjacent 3x3 metre experimental plots with typical urban surfaces: one was covered with asphalt, one with grass and one was planted with a field maple (*Acer campestre*) in the centre of a 1 x1 metre pit surrounded with asphalt. Between January and September 2011, surface water runoff was collected under a drain at the corner of each slightly sloping plot. Rainfall and air temperatures were recorded during the study period.

As would be expected, the highest surface runoff was from the asphalt plots, where an average of 62% of total winter rainfall and 53% of total summer rainfall was collected in the drains. The rest of the water falling on the asphalt would have evaporated or remained in small puddles, instead of flowing to the drains. More water would have evaporated in the summer months than in the winter, as the asphalt surface would be hotter.

Rainwater collected from the tree plots averaged 26% of the total winter rainfall and 20% of the total summer rainfall, suggesting that these plots reduced surface runoff by 58% and 62% respectively during winter and summer periods when compared with the plots completely sealed with asphalt.

As the trees in this study were relatively small, with the tree canopies only covering about 35% of the plot, most of the reduction would have come from water infiltrating the tree pit rather than from interception by the tree canopy. Designing urban surfaces that slope towards tree pits, without the risk of waterlogging the trees, would further enhance the ability of trees to reduce surface runoff.

The grass plots absorbed most of the rainfall, with the average runoff measuring less than 1% of the total rainfall. Having more grass cover in urban areas would reduce the risk of flooding, provided that the underlying soil has not been compacted (for example, by being trampled on), which makes it more impermeable to the surface water.