Stormwater drainage is reducing stream biodiversity

Australia's sensitive and rare endemic water bugs are in decline around our urban fringes because streams and waterways are receiving unnatural runoff from the impervious surfaces laid in developed areas. New research published in the journal *Marine and Freshwater Research* suggests that it's actually the drainage pipes that carry urban runoff to waterways that are exacerbating the biodiversity loss, and that better drainage planning will help.

Impervious surfaces in urban areas, such as roads, pavements and roofs are thought to be the main cause of water quality degradation and biodiversity loss because they negate the soil and vegetation that would normally soak up rainwater. Take-up is reduced even more by conventional stormwater drainage, which transports runoff directly to receiving waters. All this results in 'flashes' of flow during storms, and bypasses the natural terrestrial and waterside pathways that normally process pollution.

It has been argued that in order to conserve aquatic ecosystems, it's the level of imperviousness in a catchment that must be kept as low as possible. However, research by Dr Chris Walsh of the Cooperative Research Centre for Freshwater Ecology at Monash University shows that water sensitive urban design approaches that reduce the connection between impervious surfaces and drainage systems could be the most effective way of protecting urban stream biota.

Walsh's study looked at 'effective imperviousness' – the area of impervious surfaces directly connected to streams via stormwater pipes (as a proportion of the whole catchment area) – and its effect on stream macroinvertebrate (waterbug) populations in catchments straddling urban and rural areas. Other potential factors that may affect bug diversity, such as sewage, catchment area, elevation, and geography, were also considered.

'A large proportion of sensitive species were absent from streams in catchments with greater than 20 per cent of impervious areas directly connected to streams by stormwater pipes,' he says.

'Those species positively correlated with connection, on the other hand, tended to be associated with disturbed environments, and they all increased in relative abundance with increasing connection.'

The loss of rare, sensitive taxa on urban fringes in Australia, such as the Dandenong Ranges, is of concern, because of the high level of endemism in Australian freshwater macroinvertebrates. Critically, Walsh's study suggests that poor urban design is likely to impact on aquatic systems even in sparsely populated catchments where there is less than 10 per cent imperviousness. However, Walsh says these effects are likely to be avoidable through the minimisation of drainage connection.

The Waterbug Book/ Ed Tysfin & John Gooderham

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Two orders of sensitive stream insects. Left: A caddisfly, *Agapetus* (Trichoptera). Right: A stonefly, *Reikoperla* (Plecoptera).

CRC for Catchment Hydrology

Sensitive urban water design (centralised flow through water-loving plants) at Lynbrook Estate in Melbourne's south-east.

Results showed that streams in catchment areas with few impervious surfaces supported a diversity of macroinvertebrates, many of which were sensitive to disturbance.

'This study suggests that conservation and restoration of streams in urban catchments should start with attention to the catchment drainage system, rather than in-stream habitat or riparian quality,' he says.

'The study also suggests that minimising drainage connections in streams with imperviousness at greater that 12 percent, will result in greater protection of macroinvertebrate life.'

To confirm the relationship between drainage connection and stream biodiversity, Walsh proposes further 'before' and 'after' experiments that look at urban developments with and without water sensitive design. These studies could examine undeveloped catchments that are then developed, or poorly designed catchments whose drainage systems are retrofitted to reduce drainage connection.

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More information:
Walsh, CJ. (2004). Protection of in-stream biota from urban impacts: minimise catchment imperviousness or improve drainage design? *Marine and Freshwater Research*, 55: 317–326.

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