Predicting channel physical form disturbance and geomorphic response to urbanisation

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# ABSTRACT

In urban areas, stormwater drainage serves as the primary pathway through which urbanisation degrades the physical form and ecological functioning of streams. In-channel features such as bars, large woody debris, pools, and riffles are important geomorphic attributes that capture ecological relevance but are rarely studied in relation to urbanisation. The main goal of this study is to predict channel enlargement and the associated geomorphic response to urbanisation. To achieve our aim, this study employed a combination of field observations and GIS techniques to assess morphological changes occurring within an urban channel (Toomuc Creek, Melbourne, Australia). Field surveys involving cross-sectional channel geometry in pools and riffles, large woody debris counts, and qualitative assessments of channel characteristics both upstream and downstream of stormwater runoff. Using GIS, the effective catchments of the stream were delineated, and impervious cover was extracted for each survey location. Furthermore, we hypothesised that (i) the channel capacity increases with catchment urbanisation, with detectable increases at major stormwater outfalls, and (ii) in-channel features (such as woody debris) and longitudinal pool-riffle spacing decrease with urban intensity. We found that the overall channel capacity increased with the urbanisation gradient, with some evidence that cross-sections downstream of stormwater outfalls actively adjusted to urbanisation. Large woody debris abundance and pool and riffle spacing were negatively correlated with the downstream urbanisation gradient. Pool and riffle bankfull depths were positively correlated with the downstream urbanisation gradient. Consequently, the reduction in woody debris along the longitudinal channel profile indicated that the urban channel may have experienced a decrease in ecological functions (such as aquatic heterogeneity). Shorter pool and riffle spacing with increasing downstream deepening of pools and riffles also indicate degrading streams which have been linked to poor stream health. Generally, this study contributes to the understanding of the interplay between in-channel features, longitudinal adjustments, and urbanisation.