Assembling high resolution spatial datasets for robust effective imperviousness modelling

Dr Joshphar Kunapo[1], Dr Christopher Walsh[2]
[1]Grace Detailed-GIS Services, [2]School of Ecosystem and Forest Sciences, The University of Melbourne

Biography:
Dr. Kunapo is the Entrepreneur & Director of Grace Detailed-GIS Services, Australia. He is also a researcher at University of Melbourne. He has a PhD from Monash University with a thesis related to Water Sensitive Urban Design (WSUD). He has more than 20 years of research and industry experience in developing large scale applications that involve spatial information technology.

The degrading effects of urbanization on stream ecosystems are well documented. A dominant hypothesis is that urban stormwater runoff is the primary mechanism for that degradation. However, few studies have developed and tested landscape-scale metrics that quantify the impact of urban stormwater in a way that adequately separates it from other potential mechanisms of degradation, such as land clearance or direct impacts of humans or their constructions on streams. Effective imperviousness (EI) has long been proposed as a more direct measure of urban stormwater impacts. The underlying concept of EI assumes that runoff from impervious surfaces will have a much larger and more direct impact on stream ecosystems if that runoff is routed to the stream through drainage pipes and sealed drains than if it is permitted to flow to pervious land, where greater infiltration and loss is likely. This paper describes a method for mapping impervious surfaces and other land cover features and estimating their flow distances to streams via pipes and overland, to permit realistic estimation of effective imperviousness. A combination of LiDAR and infra-red aerial photography are used to classify land cover into impervious and pervious classes that are likely to exhibit different hydrologic responses. LiDAR ground data and drainage network lines are used to develop an engineered elevation model, routing flows through pipes and sealed drains. This engineered elevation model is then used to measure flow distances from each impervious polygon to its nearest pipe and stream. An example is presented to illustrate the derivation of an estimate of effective imperviousness, but derivation of more complex weighted measures of land cover are also possible.