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Restoring pre-development conditions in a urban environment using green roofs

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As development progresses in a urban environment, the impervious areas that rapidly contribute runoff to the receiving water bodies increase while the pervious areas that store and deliver subsurface flow over periods of hours, days or weeks diminish, with the direct consequence of higher runoff rates and volumes and shorter times of concentration. The construction of impervious surfaces modifies the surrounding soils through engineered compaction and eliminates superficial soil and its role as a significant pervious storage interface between the subsurface and the atmosphere.

There are documented case studies that conclusively link urbanization and increased watershed imperviousness to hydrologic impacts on streams. The Effective Impervious Area (EIA) in a watershed is the impervious area directly connected to the storm drainage system that contributes to increased storm water volumes and runoff rates. It is shown in the literature that a reduction of EIA could compensate the adverse impact of possible global warming scenarios on urban hydrology and in particular on the efficiency of a combined sewer system.

In this paper, the implementation of green roofs is analyzed as a technique able to reduce the amount of EIA in order to mitigate the impact of urbanization on the hydrologic response of the urban catchment of Colle Ometti in the town of Genoa (Italy). Although no green roof installations are now present in the area, this study modelled – using extensive green roof details – the hydrologic effects of hypothetical roof greening scenarios.

The modelling of green roof systems was undertaken using the EPA SWMM and was calibrated and validated on a small size green roof test bed completed in September 2007 in the laboratory of the Department of Civil, Environmental and Architectural Engineering (DICAT – University of Genova).