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Green roof impact on the hydrological cycle components

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In the last decades the importance of storm water management in urban areas has increased considerably, due to both urbanization extension and to a greater concern for environment pollution. Traditional storm water control practices, based on the “all to the sewer” attitude, rely on conveyance to route storm water runoff from urban impervious surfaces towards the nearby natural water bodies. In recent years, infiltration facilities are receiving an increasing attention, due to their particular efficiency in restoring a balance in hydrological cycle quite equal to quite pre-urbanization condition. In particular, such techniques are designed to capture, temporarily retain and infiltrate storm water, promote evapotranspiration and harvest water at the source, encouraging in general evaporation, evapotranspiration, groundwater recharge and the re-use of storm water.

Green roofs are emerging as an increasingly popular Sustainable Urban Drainage Systems (SUDS) technique for urban storm water management. Indeed, they are able to operate hydrologic control over storm water runoff: they allow a significant reduction of peak flows and runoff volumes collected by drainage system, with a consequent reduction of flooding events and pollution masses discharges by CSO. Furthermore green roofs have a positive influence on the microclimate in urban areas by helping in lower urban air temperatures and mitigate the heat island effect. Last but not least, they have the advantage of improving the thermal insulation of buildings, with significant energy savings.

A detailed analysis of the hydrological dynamics, connected both with the characteristics of the climatic context and with the green roof technical design, is essential in order to obtain a full characterization of the hydrologic behavior of a green roof system and its effects on the urban water cycle components.

The purpose of this paper is to analysis the hydrological effects and urban benefits of the vegetation cover of a building by installing green roofs and, thus, providing a conversion of rooftops in pervious areas; the objective is modeling hydrological fluxes (interception, evapotranspiration, soil water fluxes in the surface and hypodermic components) in relation to climate forcing, basic technology components and geometric characteristics of green roof systems (thickness of the stratigraphy, soil layers and materials, vegetation typology and density).

The sensitivity analysis of hydrological processes at different hydrological, climatic and geometric parameters has allowed to draw some general guidelines useful in the design and construction of this type of drainage systems.