Green roofs effective for adapting to climate change

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Benaguasil green roof. Credit: Asociación RUVID

A study headed by researchers of the Water and Environment Engineering Institute of Valencia's Polytechnic University (IIAMA-

UPV) shows that green roofs are an effective measure to adapt to climate change in the Mediterranean, as they offer positive hydrological performance and reduce the creation of surface water runoff.

This is the main conclusion of the article "Hydrological Performance of Green Roofs at Building and City Scales under Mediterranean Conditions," published in *Sustainability*.

The research compared the hydrological performance of a green roof and a traditional roof under Mediterranean weather conditions at two different scales: at the building level and at the city level.

"Different studies show that the performance of green infrastructure varies depending on its hydro-climatic exposure, specially regarding rain patterns (frequency, amount of rain) and the ground's humidity conditions, which made it necessary to quantify its performance in an area with a dry climate, such as the Mediterranean," explains Ignacio Andrés.

In fact, the IIAMA researcher recalls that the European Commission acknowledges the management of rainwater in cities as one of the most important challenges in the fight against climate change, "where green roof are a type of green infrastructure that can help improve mitigation and adaptation to global change."

Case study

The study was conducted in the city of Benaguasil (Valencia) where, in 2014, a traditional 315 m^2 roof was turned into a green roof.

A pluviograph was installed to analyse the rain data during the period monitored – from June 2014 to June 2015. Furthermore, the flows generated by the adjacent 240 m^2 traditional roof were also monitored.

To analyse the efficiency of the green roof in the long term, the response of both roofs to the rains between 1990 and 2006 was analysed with a mathematical model, as Ignacio Andrés Doménech explains.

"To conduct this investigation, we developed a hydrological model using the SWMM (Storm Water Management Model) software from the EPA (United States Environmental Protection Agency). Calibration and validation of the model at the building scale was carried out with data registered on both roofs, while the long-term hydrological performance was calculated by simulating the historical rain patterns during 17 prior years. Lastly, the effect of the green roof regarding hydrological response on the city scale was analysed by way of an urban area which is representative of the region's cities," explains the UPV professor.

Main results

The results obtained in the research show that in the long term, the hydrological efficiency of the green roof is high, and the amount of surface runoff is reduced significantly compared to those produced by a traditional roof.

Specifically, on the city scale, the results show that the effective range of rain that can be controlled by the green roof is between 15 and 20 mm, which corresponds to the most common bouts of rain. Ignacio Andrés believes that the average runoff coefficients in Mediterranean conditions can be reduced by as much as 75 percent in a scenario where half of the roofs were turned into green roofs.

Furthermore, the IIAMA researcher stresses that these hydrological benefits are added to other environmental and landscape benefits that made this type of sustainable drainage systems (SUDS) "a promising solution to face the urban challenges caused by climatic threats."

Green roofs are a specific type of SUDS that consist on areas of live vegetation that are installed on top of buildings, which promotes a reduction in pollution and runoff generated on these surfaces, and which also provide ecosystem services such as aesthetic benefits, ecological added value and an improvement of the building's thermal performance.

Provided by Asociacion RUVID