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Implementation of an urban irrigation and a biofiltration system in the urban canopy model CLM-U

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A recent review by Coutts et al. (2012) points out that to date the role of water in influencing urban climates through both irrigation and the support of urban vegetation receives less attention. Impervious urban surfaces prevent infiltration, and runoff is rapidly exported away from urban environments via the stormwater network. This produces a deficit of water in urban areas, and reduces soil moisture levels – a deficit that is often balanced by imported potable water to maintain a healthy vegetation via irrigation.

Because of long-term dry spells over large areas of Australia in the last decades, State Governments introduced compulsory and voluntary strategies to encourage water saving across the community – including outdoor water restrictions. In this respect, residents have adapted gardening approaches by planting more drought-tolerant species. Each of these factors of drought, water restrictions and xeric gardens, along with the reduced health of urban vegetation, may further exacerbate urban warming and energy demands.

In this respect, this study explores possible pathways towards a more Water Sensitive Urban Design (WSUD), implementing a decentralisation of water supply via residential rainwater tanks that collect run-off water from the roofs, an urban irrigation system connected to these rainwater tanks and bio-infiltration systems in which the impervious road fraction drains. All changes are implemented in the Community Land Model – Urban (CLM-U) and several sensitivity tests are performed for the residential area of Preston (Melbourne, Australia) in order to answer the question on how much water is actually needed to maintain healthy vegetation and where this water should come from. Can rainwater tanks provide a sufficient capacity to irrigate bio-infiltration systems or will it be necessary to apply high-quality potable water? In addition, this research can also be used to quantify the role of WSUD with respect to thermal comfort.