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Thermal performance of extensive green roofs in a subtropical metropolitan area

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Highlights

1. Extensive green roofs are suitable for reducing the temperature and heat amplitude of a bare rooftop in subtropical climates.
2. In the relative term, perennial herb green roofs have the most significant rooftop temperature reduction.
3. Air temperature and solar radiation exert positive effects on the temperature reduction of the bare rooftop caused by the extensive green roofs, whereas relative humidity has a negative effect.

ABSTRACT

Extreme weather events caused by climate change intensify the heat island effect, and a lack of greenery in urban areas increases the psychological stress and anxiety of city dwellers. This study compared the temperature reductions and heat amplitude reductions provided by four types of green roofing that can cover bare rooftops. The four types of plants grown on extensive green roofs in this study were: shrubs, perennial herbs, vines, and groundcover; these are potentially healing plants. Furthermore, this study investigated the effects of air temperature, relative humidity, and solar radiation on temperature reduction of the rooftop. Four-stage field experiments under various ambient temperatures were conducted on the roof of a typical residential townhouse in the Taichung metropolitan area, in central Taiwan, which has a warm oceanic climate/humid subtropical climate (Cfa). The results indicated that the bottom temperature of the perennial herb, shrub, vine, and groundcover green roofs were lower than the bare rooftop temperature by 17.75°, 12.57°, 11.55°, and 9.31°, respectively. The heat amplitude reductions of the bare rooftop were defined as 1 minus the result of

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