DESIGN AND EVALUATION OF MICROCLIMATE PERFORMANCE OF A FOOD FOREST THEMED GREEN ROOF IN AN URBAN AREA

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Rapid urbanization in Sri Lanka is contributing to the Urban Heat Island (UHI) effect, elevated rooftop temperatures, and declining urban thermal comfort. Green roofs have emerged as an effective nature based solution for improving urban microclimates. This study aimed to design and evaluate the microclimate performance of a food forest themed green roof system for improving rooftop environmental conditions. The study was conducted on the rooftop of a commercial building in Maharagama, Sri Lanka (6°50'50.04"N, 79°55'42.20"E). A food forest inspired green roof system was designed and implemented using 13 selected fruit, medicinal, and herbal plant species identified through a literature survey. Environmental parameters of air temperature and relative humidity were measured using DHT22 sensors, while light intensity (lux) was recorded using a BH1750 light sensor while soil moisture and soil temperature were measured using a fertility meter. Measurements were taken at five time intervals throughout the day (6:00 AM, 9:00 AM, 12:00 PM, 3:00 PM, and 6:00 PM) and were monitored and compared between the green roof and an adjacent bare roof from January to April 2026. Geographic Information System (GIS) techniques and Inverse Distance Weighting (IDW) interpolation were employed. Statistical analysis revealed that the mean temperature of the green roof (27.0 °C) was significantly lower than that of the bare roof (33.1 °C), resulting in an average reduction of 6.1 °C ($T = 8.57$, $p < 0.05$). Similarly, the mean relative humidity of the green roof (70.20%) was significantly higher than that of the bare roof (51.75%), with an increase of 18.45% ($T = -12.71$, $p < 0.05$). GIS-based spatial analysis further highlighted improved moisture retention and microclimatic conditions associated with vegetation cover. The findings confirm that food forest-based green roofs can significantly improve rooftop thermal performance and contribute to UHI mitigation in tropical urban environments.

Keywords: inverse distance weighting (IDW), Geographic Information System (GIS), green roof, thermal regulation, urban microclimate