

MS Thesis
Department of Environmental Science and Policy
George Mason University

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Title: Assessing the Thermal Performance of Green Roofs and the Influence of Solar Panels

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ABSTRACT

Approximately 25% of city area is roof, traditionally made up of darker materials with low albedos. Cool roofs are designed to have higher albedos and range from white membranes to green roofs. Green roofs have the added benefit of mitigating stormwater, improving air quality, and insulating the building envelope. Since green roofs cost a premium over other materials, it is important to assess which type will meet the desired performance goals. Dark asphalt shingles, black and white membranes, and three depths of green roof soils were assessed for their thermal performance in terms of surface temperatures and the temperature underneath the roofing materials from March 2018-March 2019. A research green roof was installed on a parking garage at the George Mason University Fairfax, VA campus and included replicate trials that were also outfitted with solar panels above the green roof. Temperature data revealed that green roofs (1) reduced surface temperature and below material temperatures compared to the darker roofing materials; (2) performed similarly to a white PVC membrane cool roof; (3) did not perform different thermally when depth was increased; and (4) found that vegetation presence reduces surface temperatures of green roofs but does not notably impact temperatures beneath the growing media. Regular observations and photo records revealed that solar panels promote vegetation growth for longer throughout the year in addition to increased surface coverage and vegetation density which has the potential increase the performance benefits of green roofs. Due to limitations of small-scale testing and the influence of ambient air temperatures below the tested trials, future full-scale observations are recommended.