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Green Panel performance testing – Analysis from one season of monitoring data and implications for urban scale applications

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Most cities have climate goals such as lowering the Urban Heat Island (UHI) effect and reducing flood damages. Green infrastructure (GI) can help mitigate the UHI effects and has the potential to locally delay flood peaks. However, in dense urban infrastructure there is often little space for ground based vegetation. Green roofs are therefore a feasible implementation option even within city centres. While there is a myriad of types of green roofs available for flat roofs, and their performance is tested in various environments, sloped roofs as of yet have few design options available. To this end, Green Panels were developed as a novel type of GI for sloped roofs. As it is a novel design, its performance can be estimated only by literature results of GI applying different designs and materials. To overcome this research gap, in this case study a Green Panel prototype was constructed and its performance was monitored over a period of 3-4 months at the University of Twente, the Netherlands.

The experimental setup consisted of 1 m2 of Green Panels, and 1 m2 of regular roof tiles as control area, both at a slope of 45 degrees. The materials of the Green Panels, mounted on the same railing as solar panels, is High Density Polyethylene, while different substrates were tested: soil, rock wool, recycled fabric, and combinations thereof. Applied sensors were a soil moisture and temperature sensor (Truebner SMT50) and an environmental sensor (BME680), including a thermal sensor, both connected to Sensebox Mini dataloggers. The soil moisture sensors were placed in each of 6 Green Panel trays. The environmental sensors were placed above and below the roof tiles in both control and Green Panel locations, as well as above and below the Green Panels themselves. The measured parameters were air temperature, humidity, atmospheric pressure, VOC, soil temperature, and soil moisture. These values were compared to meteorological data from a local weather station at 5km distance. Other benefits such as increased biodiversity were not monitored, though species such as ladybug (family Coccinellidae) and fly (family Muscidae) were observed.

Analysis of the results shows that there is a small effect of Green Panels on reducing extreme temperatures, and errors in measurement setup and gaps in data continuity did not affect validity. The implications of this analysis were extrapolated to the urban scale for the city of Enschede to help answer what an appropriate performance monitoring scheme is for cities intending to implement GI and still uncertain about when their climate goals are being met.