THESIS

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Environmental Engineering Course

Gödöllő

2024

Summary

Rapid urbanization and economic expansion have reduced green spaces in cities and increased pollution, contributing to global warming. Green roofs are widely recognized as a highly effective solution for enhancing the indoor and outdoor environment in both buildings and metropolitan areas. Green roofs offer numerous advantages when compared to traditional roofs. These include lowering the temperature of the roof and surrounding air, reducing air pollution, improving water runoff management, enhancing urban biodiversity, minimizing noise, and decreasing energy consumption in buildings, particularly for cooling.

In this thesis, I explored how green roofs can contribute to urban development by mitigating solar radiation towards buildings. By comparing temperatures between green roofs and traditional shingle roofs, I aimed to uncover their effectiveness in reducing heat, focusing on both the east and west orientation of the roofs as well as interior and exterior temperatures. The study took place at the campus of the Hungarian University of Agriculture and Life Science in Gödöllő, Hungary.

Between June 1st and August 31st, 2023, temperature data was collected at 5-minute intervals from both green roof and traditional shingle roof model houses. The roof type of the model houses was gable roof which has two sloping sides. For each model house, two temperature data loggers were installed on the east and west sides of a roof. Additionally, a single temperature data logger was used to measure both the interior and exterior temperatures of the model houses using an EBI 300 data logger. Microsoft Excel software program was used for advanced data analysis.

The study's findings emphasize the significant effect of roof orientation on thermal performance, as the west sides of the roofs frequently demonstrate higher temperatures due to greater solar radiation exposure. With the exception of the exterior temperature on the east sides of the green roof (GEE), all other temperature readings of green roof functioned as heat sinks between the peak sunlight hours of 10 AM and 5 PM. GEE sustained higher temperatures, potentially as a result of shading in its surroundings. A detailed analysis conducted on the day of August 25th, selected randomly, confirmed the constant trend of elevated temperatures on the western side. Moreover, during this peak heat period, both the east and west sides of the green roof demonstrated notably lower temperatures compared to the shingle roof.

The analysis of randomly selected weeks highlighted the positive impact of green roofs in minimizing temperature fluctuations and maintaining consistent temperatures. Overall, green roofs emerged as natural regulators, enhancing insulation and cooling effects to create a more comfortable and sustainable urban environment. This discovery exposes the importance of green roofs in mitigating extreme weather effects and improving the quality of urban living spaces.