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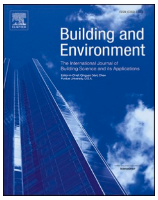

Monitorization and statistical analysis of south and west green walls in a retrofitted building in Madrid

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ABSTRACT

Green walls can act as natural thermal regulators, reducing solar radiation on surfaces and providing cooling due to shading and evapotranspiration. Several studies have investigated the cooling effects of a bare wall, in contrast to a vegetated wall, as well as the correlation between temperature reduction and system characteristics. In the present work, we analyze the influence of the orientation of a green wall on its ability to reduce surface temperatures in a Mediterranean climate. Environmental variables such as irradiation and air temperature have been considered. A real-time monitoring system has been used, with a database of three years of measurements. Results show that on average, the control temperature is greater than the green wall temperature with maximum differences of 20 °C in summer and 8 °C in winter in the south wall surface. During the summer, the temperature reduction in the south façade occurs mainly in the central hours of the day, while in the west façade it occurs mainly in the afternoon. Being the summer the most relevant season for the use of green walls, this information is very valuable as it allows the designers to know at what time of day the façade provides a temperature reduction, depending on the orientation.

1. Introduction

The impacts of urbanization and climate change are driving a transformation towards complex scenarios that threaten the sustainability of the planet [1]. The world population is constantly growing, using unrenewable natural resources in a continuous and unbalanced way. The consequences of climate change are becoming increasingly visible alongside this scenario: rising temperatures, floods, droughts, air pollution, noise, etc. These effects, in addition to harming life inside cities, diminish the development of new plant species, degrade habitats, alter the development of species adapted to a particular type of climate and reduce drinking water reserves, among others [2]. Currently cities are at the centre of political, social and environmental decision-making.

Mitigating and adapting cities to the effects of climate change means coping with the expected and widespread effects. It is estimated that more than half of the world population will live in cities by 2050, equivalent to 90% development of urban contexts [1]. In other words, urban growth will be approximately one million people per week. Nowadays, cities represent 3% of the earth's surface, and paradoxically are responsible for 80% of the energy consumption and about 75% of CO_2 emissions into the atmosphere. This is a reflection on the fact that population growth will not only be synonymous of urbanization but also of high consumption and pollution ratios [3,4].

This scenario has been the starting point for global initiatives such as Agenda 2030 and the Sustainable Development Goals (SDGs) [5]. 193 member states of the United Nations unanimously adopted a route composed of 17 SDGs based on three main dimensions: society, environment, and economy. This new approach has changed how human development problems are addressed. It will require tackling challenges on a global scale and in an increasingly complex and interdependent world that requires significant resource management. To achieve these challenges in a stable and long-term scenario, transformations and incentives are needed to promote resilient technologies that stimulate current governance mechanisms.

Considering the challenges of climate change as opportunities for innovation, nature-based solutions can be part of new technologies aimed at preserving biodiversity and solving economic, social and environmental problems. The nature-based solution term emerged in

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