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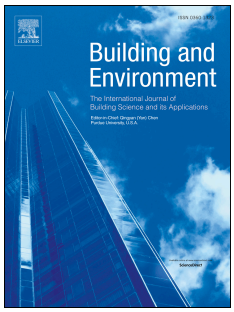

More than just a Green Facade: The sound absorption properties of a vertical garden with and without plants

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More than just a Green Facade: the sound absorption properties of a vertical garden with and without plants

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Abstract

Up to 44% of EU residents are exposed to noise levels that are detrimental to health. In this context, vertical gardens could play an important role in architectural acoustics, where the main absorber material is the substrate soil. Plants have a beneficial effect for higher frequencies when planted in a large density. In this paper a vertical garden design developed at the Pontificia Universidad Católica of Ecuador (PUCE) was tested for interior acoustic design. The modules solely with substrate and planted with ferns were tested. The objective was to ascertain and explain the random incidence sound absorption coefficient of vertical garden modules. 50 modules making up a total floor area of 10.125 m^2 were used for the measurements. Six different configurations were measured: connected versus dispersed and directly on the floor versus with an air cavity of 5 and 10 cm. Furthermore, each configuration was tested with modules solely filled with substrate and with substrate filled modules with densely planted ferns. The weighted random incidence sound absorption coefficient of the modules densely planted with ferns equals 1.00. This applied to all different configurations tested. The sound absorption coefficient in the lower frequencies (100-315 Hz), mid frequencies (400-1250 Hz) and high frequencies (1600-5000 Hz) was 0.59-0.80, 1.00 and 1.00 respectively. This makes this type of building technology highly suitable for applications where sound needs to be attenuated, paving the way for applying vertical garden systems as a design tool for improving the acoustics of indoor spaces or urban squares.

1. Intro

The aim of this research is to show how vertical gardens can be a useful tool for mitigating noise pollution in urban environments.

The Paris Accord recognizes the need to restore natural habitats and prevent deforestation: “Parties are encouraged to take action to implement and support…enhancement of forest carbon stocks” [1]. Urbanisation in the world is also on the increase, where Latin America in particular almost doubled its percentage of urbanization from 41.4% to 75.3% between 1950 and 2000 [2]. Coupled with this, the growth of cities tends to go hand in hand with a decrease in vegetation, which then in turn leads to temperature increases related to the urban heat island effect [3].

Many spaces inside buildings, or urban environments like public squares, are noisy or reverberant. In order to maintain stable and comfortable indoor air temperatures, generally thermal mass is used. In order to be effective, this thermal mass needs to be exposed to the air. As a result, concrete or