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Climatic Sensitive Landscape Design: Towards a Better Microclimate through Plantation in Public Schools, Cairo, Egypt.

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Abstract

In recent years, the accelerated rate of urban growth in hot climate cities highlights the critical necessity of creating more outdoor spaces for different activities of citizens from leisure or recreation. Thermal sensation of users have not been fully explored in outdoor environments of hot and humid climate specially in early stages of design which affects thermal comfort in negative ways. This fact elucidates the need for considering human thermal comfort in outdoor spaces design with such climates. Recently, Egyptian climatic quality of space has received attention among climatologist and urban designers. In most cases, the climatic sensitive landscape design is absent on planning and site design levels.

This paper discusses the climatic sensitive landscape design in public schools courtyards using ENVI-met simulation tool. A case study: EL-Sherouk school is selected and numerically simulated in elevated temperature during school time. The simulation results revealed high thermal discomfort after setting boundary conditions for the climate and the possible vegetation patterns.

Finally, the paper concludes that specific patterns and types of trees among other landscape elements strongly ameliorate the microclimate within such schools courtyard size. They significantly attenuate the direct radiation modify the wind speed and direction; and fairly reduce temperature and change humidity. Design implications were proposed for a better microclimate in school courtyards.

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Keywords: Microclimate; ENVI-met; Plantation; Schools; thermal comfort.

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1. Introduction

The climatic quality of the space, recently, has received attention among climatologist and urban designers worldwide, especially after the global climatic change and Urban Heat Island (UHI) occurrence phenomena,(Jentsch et al. 2008; Abdel-aleem 2012). The absence of an efficient landscape pattern, on the planning levels and the rapid urbanization, originally are the contributing factors for creating thermally uncomfortable spaces,(Helmut & Ali-Toudert 2005). This alerts urban planners and designers to urgently consider the landscape design, in particular, plantation, as an integral part in a comprehensive planning system. This integrates urban and natural environments altogether, respectively. The consequences of this integration, not only attain, not only attain thermally comfortable spaces, but also authentically pleasing space with an excessive noise and glare reduction for those who wish to use the outdoor space(Shashua-Bar et al. 2011; Georgi & Dimitriou 2010).

1.1. Landscape Design in Egypt.

In Egypt, nearly the climatic landscape dimension is absent on the planning and the site design level,(Fahmy, Mohamad; Sharples 2008).Over the last 50 years, most of the Egyptian cities lost its gardens, open spaces and public squares. Also, pedestrian pathways disappeared, and the historical gardens dramatically deteriorated such as the fish garden in Cairo and the Zoo in El-Giza. The absence of the landscape profession and conspicuous lack the awareness, in the importance of landscape as an infrastructure tool to enhance the climate, originally are the reason for this disappearance,(El-Masry 2014). Also, the common belief, among the community that the landscape is only a makeup tool for an aesthetic urban context, regardless its climatic functioning dimension. Thus, it is essential to revive the importance of the landscape elements among the society in particular students and children in schools, the coming future generation. And highlight the importance of creating thermally outdoor comfortable space among researchers, landscapers and planners.

1.2. Microclimate and its Variables.

Given the aim to promote welfare conditions, particularly in school' courtyard, it is fundamental to understand the immense complexity of the microclimate and its mechanism that significantly influences human outdoor comfort. (Oke 1987), in his book, illustrated the horizontal urban climatic scale in accordance with the climatic interactions within the urban boundary layer. These scales respectively are microclimate scale, local climatic scale, mesoscale, shown in figure1. The microclimate scale falls beyond the Urban Canopy Layer (UCL) with height up to 1000m i.e. climatic interactions occurs between street level and surfaces above expressed by Zh that include buildings, plantation, etc.

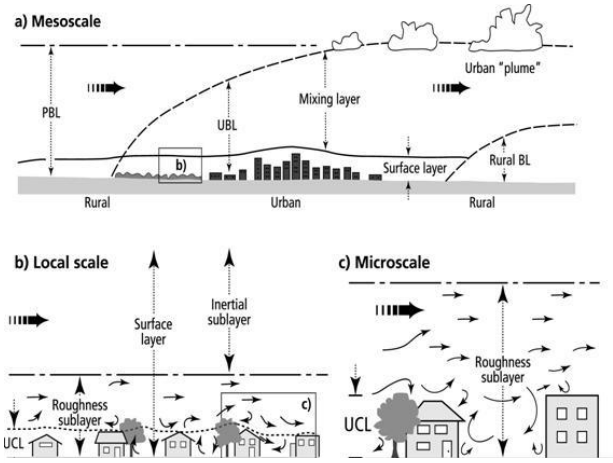

Figure 1: Horizontal climatic urban scales and its climatic interactions within the urban boundary layer, adapted from Oke 1987

Maintaining decent comfort level in the outdoor spaces is complex relative to indoor spaces in terms of temporal and spatial variability(Nikolopoulou et al. 2003). Human, in the outdoor spaces, is affected by the environmental factors, built environment such as building morphology, topology, vegetation, water, surface albedos. As well as his personal and behavioral factors such as clothing CLO and activity factor MET,(Erell et al. 2011; Shashua-Bar et al. 2011).