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**Optimizing residential vegetation to address heat mitigation and water irrigation trade-offs in Metropolitan Phoenix, Arizona**

In the arid southwestern U.S., climate change has exacerbated the extreme heat stress in urban environments. Urban greening programs that aim to increase vegetation cover are widely recognized as effective cooling strategies. However, these programs also increase the water demand in cities that are already water stressed. Despite their importance, the optimal distribution of different vegetation types (e.g., grass and trees) to maximize heat mitigation while minimizing water usage remains underexplored. To address the research gap, this study aims to develop spatial models to evaluate and redesign residential vegetation patterns, with the goal of maximizing cooling benefits while minimizing water irrigation. In particular, the study considers reclaimed wastewater as a renewable water resource for outdoor irrigation. In the models, we also consider different vegetation types (i.e., grass, trees, and a combination of trees and grass) to account for their varying cooling effects and emphasize equity in tree coverage, particularly in low socio-economic neighborhoods. The models will be applied to the city of Phoenix to assess current vegetation coverage in the city and identify the optimal strategies for grass removals and tree plantation to achieve the maximum benefits. This study will provide practical and sustainability-oriented urban vegetation management for landscape designers and urban planners.

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