

植物群落结构和绿地类型对城市公园生态系统服务的影响 及其耦合协调机制

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摘要: 城市绿地的生态功能多样化, 因此科学设计和管理它们以最大化生态效益是必要的。在本研究中, 我们评估了不同类型城市绿地及其植物群落结构之间的生态系统服务差异, 以提供更好的公园设计参考。我们在中国成都天府新区的 13 个公园进行了实地实验, 选取了代表五种群落结构的 28 个植被样本点, 并分别测量了它们的降温、加湿、颗粒物吸附、负离子供应和降噪功能。我们使用了多种机器学习算法进行加权特征筛选, 并开发了一个线性混合效应模型, 该模型将群落结构和绿地类型视为随机效应, 以识别关键因素。此外, 我们还开发了一个耦合协调度模型来分析群落结构、绿地类型与生态系统服务之间的关系。结果显示, 靠近水体、大树冠、高植被覆盖和高草本植物的地方空气湿度增加, 周围温度降低。密植低冠树和灌木有效降低噪音和颗粒物。起伏的坡度极大地影响了负氧离子的分布。耦合协调显示, 树木组成通常与生态系统服务密切匹配, 而灌木和草本植物的协调性较低。线性混合效应模型准确识别了影响因素, 并解释了特定指标如何调控生态系统服务。结果表明, 优化植物群落结构和蓝绿比率可以增强城市绿地的生态功能。

Effects of surface drip irrigation and fertigation managements on biomass production and carbon storage in a poplar plantation on sandy soil in northern China

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Abstract: The ecological functions of urban green spaces are diverse, so it is necessary to design and manage them scientifically to maximize ecological benefits. In this study, we assessed the differences in ecosystem services among various types of urban green spaces and their plant community structures to provide a reference for better park design. We conducted field experiments in 13 parks in Tianfu New District, Chengdu, China, and selected 28 vegetation sample sites representing five types of community structures and measured their cooling, humidification, particulate matter adsorption, negative ion supply, and noise reduction functions, respectively. We used multiple

machine learning algorithms for weighted feature screening and developed a linear mixed-effects model, which considered community structure and green space type as random effects, to identify key factors. In addition, we developed a coupled coordination degree model to analyze the relationship between community structure, green space type, and ecosystem services. The results showed that proximity to water bodies, large tree canopies, high vegetation cover and high grass plants increased air humidity and decreased ambient temperature. Dense planting of low canopy trees and shrubs effectively reduced noise and particulate matter. Undulating slopes greatly influenced the distribution of negative oxygen ions. The coupled coordination showed that the composition of trees usually closely matched ecosystem services, while shrubs and herbs were less coordinated. Linear mixed effects modeling accurately identified influencing factors and explained how specific metrics regulate ecosystem services. The results suggest that optimizing plant community structure and blue-green ratio can enhance the ecological functions of urban green spaces.