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## **Substantial but unequal effects of global blue and green spaces on human wellbeing**

Urban blue and green spaces, integrating vegetated areas and surface water features, are pivotal nature-based solutions for sustainable urban development. Yet, the global impacts of accessibility (geospatial proximity) and equality (distributional equity) of these natural spaces on human wellbeing remain poorly understood. Here, we evaluate the spatiotemporal evolution of natural-space accessibility and equality across 105 countries from 2000 to 2100, and examine their nexus effects on human wellbeing. Over the past two decades, both global accessibility and equality of urban natural spaces declined by 23.8% and 2.7%, respectively. Econometric analyses reveal that accessibility exerts a modest but significant positive effect on wellbeing ( $\beta = 0.85$ ,  $p < 0.001$ ), while inequality has a stronger negative influence ( $\beta = -0.41$ ,  $p = 0.003$ ). Notably, the positive influence of accessibility is more pronounced in countries with lower levels of human wellbeing, whereas the effect of equality in enhancing wellbeing becomes stronger as overall wellbeing increases. Country classification further shows that the effects of accessibility and equality on wellbeing are context-dependent, being more pronounced in socioeconomically advantaged and environmentally favorable contexts. We also project future potential impacts of urban natural-space accessibility and equality on wellbeing based on four Shared Socioeconomic Pathways-Representative Concentration Pathways (SSP-RCP) scenarios. The projections reveal divergent trajectories: while accessibility is likely to recover in the latter half of the century, equality is expected to continue deteriorating. The sustainable development pathway (SSP1-2.6) emerges as the only scenario likely to deliver major improvements in wellbeing by century's end. Our findings call for adaptive, context-sensitive governance of accessibility and equality in natural spaces to promote inclusive wellbeing, and highlight the importance of integrated urban planning strategies that foster ecosystem justice and urban sustainability.

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