

Value-Oriented Spatial Design of Nature Based Solutions for Resilience and Sustainability in Climate-Water Nexus

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Abstract

Climate change is intensifying urban flooding, droughts, and heat stress, posing significant challenges for water management and urban resilience. At the same time, the projected expansion of urban infrastructure presents an opportunity to integrate sustainability into future development. In this study, we introduce a value-oriented spatial design framework to support climate-resilient and water-sensitive planning from urban to basin scales. The approach emphasizes strategic integration of nature based solutions (NBS), such as wetlands and floodplains, into spatial planning, moving beyond fragmented and ad hoc implementations. Our framework links spatial design decisions (e.g., location, size, and configuration of interventions) to ecosystem services and socio-economic benefits. It adopts a multi-scale perspective, extending NBS planning from site-level interventions to basin-wide coordination. By explicitly connecting interventions to performance outcomes and value generation, it enables evidence-based, spatially explicit planning that accounts for hydrological, biophysical, and socio-ecological dynamics. A structured five-step procedure is proposed to deliver the planning framework, guiding decision-making, including performance evaluation in terms of services, resilience, and social equity. Our integrated approach enhances water security, resilience and sustainability while promoting equitable distribution of benefits. This study contributes a systematic methodology for operationalizing value oriented, ecosystem-based water management in the climate-water nexus.

Keywords

Spatial Planning, Valuation, Resilience, Water Management, Ecosystem Services, Climate Change.