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Special Issue Reprint

Adaptive Physiology of Forest Plants

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This Reprint presents recent advances in tree physiology, emphasizing the integration of photosynthesis, water use, secondary metabolism, and structural organization as interconnected components of plant adaptation. The collected studies show that tree responses to environmental variability depend on interactions among species identity, organ function, canopy structure, and environmental conditions rather than on isolated physiological traits. Contributions examine seasonal photosynthetic dynamics, canopy heterogeneity, drought and salinity responses, species-specific stress tolerance, and the role of rhizosphere microorganisms in improving nutrient acquisition and resilience. The Reprint also highlights the importance of secondary metabolism in coordinating acclimation, defense, and seasonal transitions, while showing that adaptive responses are often organ-specific. Across natural forests, managed ecosystems, and urban environments, the studies indicate that structural and morphological traits can provide more reliable indicators of long-term adaptation than instantaneous physiological measurements alone. A unifying theme is the growing use of integrative approaches combining physiological measurements with remote sensing, transcriptomics, metabolomics, structural trait analysis, and ecological modeling to link processes from individual organs to whole ecosystems. Together, these contributions provide an overview of current research directions and show how multiscale integration is advancing our understanding of tree resilience, productivity, and adaptation under changing environmental conditions across natural systems.



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