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Editorial

Editorial Note on Global Forest Simulations and Climate Controls

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EDITORIAL

The sophistication of forest structures plays a key role in controlling the roles of forest ecosystems and has a strong impact on biodiversity. Yet, knowledge of global forest structural complexity dynamics and determinants remains scarce. We measure the structural complexity of boreal complexity using a structural complexity index based on terrestrial laser scanning, temperate, subtropical and tropical primary forests. We find that annual precipitation and precipitation seasonality (R2 = 0.89) is primarily explained by the global heterogeneity in forest structural complexity. We model the potential structural complexity across biomes using the structural complexity of primary forests as a benchmark and present a global map of the potential structural complexity of the Eco regions of the Earth's forest. Our studies show distinct latitudinal trends of forest structure and illustrate that high structural complexity hotspots correlate with plant diversity hotspots. Our findings propose spatially comparing shifts in forest structure with climate change within and through biomes, taking into account the mechanistic underpinnings of forest structural complexity.

The composition and functionality of boreal, temperate and tropical forest ecosystems will be changed by climate change, with opposing, yet undefined, impacts on habitats and ecosystem functions across biomes. Land biodiversity responses and ecological roles to climate change are closely related to changes in the systemic complexity of forests. As a result, recognizing the impacts of climate change on forest habitats and habitat functions requires a detailed understanding of the systemic complexity of forests through climate controls. Climate forms forest compositional and functional variability, which are important determinants of the complexity of forest structure. It remains uncertain, however, how environment and compositional and functional diversity interactions transform into global forest structural complexity trends. To help forecast how biodiversity And ecosystem functions will respond to climate change, understanding the climatic determinants and global dynamics of forest structural complexity could provide the desperately needed basis.

The goal of forest structural complexity is to measure the distribution of trees and their canopies in three-dimensional space, thereby extending structural characteristics such as biomass, leaf area or canopy height beyond summarizing forest structure. At the stand level, a larger range of tree sizes and crown morphologies represents greater structural sophistication, this result in multi-layered and more densely-packed canopies and a higher relation between individual canopies of the tree. The degree of heterogeneity in biomass distribution in three-dimensional space may thus be described by forest structural complexity and depends on the spatial trends and efficiency of canopy space occupation. Tests of forest structural complexity, first used to answer core ecological questions such as the relationship between habitat heterogeneity and biodiversity, have recently proven useful for explaining relationships between three-dimensional forest structure, biodiversity, and ecosystem functions. The enhanced availability of LiDAR airborne and terrestrial (Light Detection and Ranging) Technologies for the implementation of forest ecology, which offer an ability to measure the three-dimensional existence of forest systems, have contributed to the creation of new methodologies and measurements to quantify the complexity of forest structures. Structural complexity tests have proved to be effective predictors of net primary efficiency; important factors of forest growth are accounted for in structural complexity metrics, such as filled canopy area connectivity of tree canopies, and therefore light absorption.

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