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Abstract

Old-growth forests: An ecosystem approach

Structural characteristics and aboveground biomass of old-growth spruce-fir stands in the eastern Carpathian mountains, Ukraine

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Abstract:

Temperate old-growth forests are known to have ecological characteristics distinct from younger forests, but these have been poorly described for the remaining old-growth *Picea abies*-*Abies alba* forests in the eastern Carpathian mountains. In addition, recent studies suggest that old-growth forests may be more significant carbon sinks than previously recognized. This has stimulated interest in quantifying aboveground carbon stocks in primary forest systems. We investigated the structural attributes and aboveground biomass in two remnant old-growth spruce-fir stands and compared these against a primary (never logged) mature reference stand. Our sites were located in the Gorgany Nature Reserve in western Ukraine. Overstory data were collected using variable radius plots; coarse woody debris was sampled along line intercept transects. Differences among sites were assessed using non-parametric statistical analyses. Goodness-of-fit tests were used to evaluate the form of diameter distributions.

The results strongly supported the hypothesis that old-growth temperate spruce-fir forests have greater structural complexity compared to mature forests, including higher densities of large trees, more complex horizontal structure, and elevated aboveground biomass. The late-successional sites we sampled exhibited rotated sigmoid diameter distributions; these may reflect natural disturbance dynamics. Old-growth Carpathian spruce-fir forests store on average approximately 155-165 Mg ha⁻¹ of carbon in aboveground tree parts alone. This is approximately 50% higher than mature stands. Given the scarcity of primary spruce-fir forests in the Carpathian region, remaining stands have high conservation value, both as habitat for late-successional species and as carbon storage reservoirs.

[forest structure: stand](#)
[deadwood](#)

Notes

Old-growth, temperate spruce-fir, forest carbon, stand structure, forest development, ecosystem services

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