Integrated climate response and biomass modeling of the endemic conifer *Picea omorika*

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The Balkan Peninsula – where Mediterranean, alpine, and continental climates converge – hosts diverse ecosystems and relict species. *Picea omorika,* endemic to the Drina Gorge, faces increasing heat and drought stress. This study presents the first integrated dendroclimatic-biomass analysis of *P. omorika* at the Govza site in Southeastern Europe, assessing its climate sensitivity and carbon sequestration potential by linking temperature and precipitation to tree-ring width (TRW), biomass increment, and aboveground carbon stock.

Fifty increment cores from Govza, Bosnia and Herzegovina, were analyzed using CooRecorder and CDendro, retaining 37 series after COFECHA verification. TRW series were standardized in R with a cubic spline to remove long-term biological trends while preserving interannual variability. The analysis identified the previous summer (June–August) as the critical climatic window, with precipitation enhancing *P. omorika* growth and high temperatures suppressing it due to drought stress. Growth declines in the late 1950s, early 1990s, and early 2000s coincide with documented Balkan droughts and reflect reduced vitality under prolonged moisture deficits (Klippel et al. 2018). Meanwhile, biomass modeling revealed that TRW is an effective proxy for biomass accumulation and associated carbon storage, with reduced growth corresponding to climate-induced stress events, highlighting the role of *P. omorika* in climate regulation and its vulnerability under projected warming scenarios in Southeastern Europe.

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References

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