



Climate limits across space and time on European forest structural attributes

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The impact climate has on forests has been extensively studied. However, the large scale effect climate has on forest structures, such as average diameters, heights and basal area are understudied in a spatially explicit manner. The limits that climate places on forest structures dictate the resources a forest may provide and the potential value of the timber there within. The majority of current research either investigates climate impacts on forest pools and fluxes, or on case studies that are used to extrapolate results. A spatially explicit study on how climate affects forest structure over a large region would give valuable information to stakeholders who are more concerned with ecosystem services that cannot be described by pools and fluxes - such as biodiversity, habitat suitability, and market values. In this study we quantified the limits that climate (maximum, minimum temperature and precipitation) places on 3 forest structures: diameter at breast height, height, and basal area. Our results show clear climatic zones of high and low upper limits for each forest structure variable studied. We also spatially analyzed how climate restricts the potential upper limits of each forest structure variable and which climate factors are most limiting. We find that diameter, height and basal area are limited by climate in different ways and that areas may have high upper limits in one structure and low upper limits in another. We also found that even though individual forests may have increased in their potential upper limit forest structure values, European forests as a whole have lost, on average, 5.0%, 1.7% and 6.5% in potential mean forest diameter, height and basal area, respectively. This decrease in potential limits forest managers ability to reproduce forests that they have managed historically.