



Effects of forest management and structural heterogeneity on microclimate in Central European forests

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Several ecosystem processes and functions are affected by variations in forest microclimate. Current forest management practices in Central Europe aim at increasing forest structural heterogeneity, which is likely to impact microclimatic conditions on stand level. Against this background, we investigated relationships between forest structure and the diurnal range of air temperature and vapor pressure deficit in 128 forest stands along a gradient of stand structural heterogeneity in three climatically different locations (Swabian Alb, Hainich-Dün and Schorfheide-Chorin) in Germany. Structurally heterogeneous forest stands with a high diversity of tree sizes and a pronounced vertical stratification showed an impaired diurnal temperature range during the vegetation period compared to stands with low tree size diversity and a homogeneous stand structure. We observed no effects of structural heterogeneity on the diurnal range of vapor pressure deficit. Linear regression models with geographic location, elevation above sea level, canopy openness and measures of structural heterogeneity as explanatory variables explained 79.4 – 80.9 % of variance in the diurnal temperature range. Even though the overall effect of structural heterogeneity on the diurnal temperature range was small, effects were more pronounced in regions with low precipitation and could not be observed in regions with high precipitation. Furthermore, unmanaged forests were characterized by a significantly lower diurnal temperature range than managed, even-aged forests. Managed, but uneven-aged were characterized by a diurnal temperature range comparable to unmanaged forests. We conclude that structural characteristics other than canopy openness contribute marginally to variations in forest microclimate in areas with high precipitation, but have a significant effect on forest microclimate in areas with low precipitation or during dry periods.