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The effects of different silvicultural treatments on microclimate in oak-dominated forests: results of a 4-year experiment

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Stable below-canopy microclimate of forests is essential for the biodiversity and ecosystem functionality. Forest management necessarily modifies the buffering capacity of woodlands, while rotation forestry often decreases that. However, the specific effects of different silvicultural treatments on microclimate, the temporal recovery after the interventions are still poorly understood.
The effects of four different forestry treatments (clear-cutting, retention tree group, preparation cutting and gap-cutting) on microclimatic variables were studied within a field experiment in a managed oakdominated stand in Hungary, before (2014) and after (2015–2017) the interventions by complete block design with six replicates.
From the first post-treatment year, clear-cuts differed the most from the uncut control due to the increased irradiance and heat load. Means and variability of air and soil temperature increased, airbecame dryer along with higher soil moisture levels. Retention tree groups could effectively ameliorate the extreme temperatures but not the mean values. Preparation cutting induced slight changes from the original buffered and humid forest microclimate. Despite the substantially more incoming light, gapcutting could keep the cool and humid air conditions and showed the highest increase in soil moisture after the interventions. For most microclimate variables, we could not observe any obvious trend within three years. Though soil temperature variability decreased with time in clear-cuts, while soil moisture difference continuously increased in gap- and clear-cuts. Based on multivariate analyses, the treatments separated significantly based mainly on the temperature maxima and variability.
We found that (1) microclimate changes immediately after the harvests; (2) the effect sizes among treatment types were consistent throughout the years; (3) the climatic recovery time for variables appears to be far more than three years and (4) the applied silvicultural methods diverged mainly among the temperature maxima.
Based on this study, the spatially heterogeneous and fine-scaled treatments of continuous cover forestry (gap-cutting, selection systems) are recommended. By applying these practices, the essential structural elements creating buffered microclimate could be more successfully maintained. Thus, forestry interventions could induce less pronounced alterations in environmental conditions for forest-dwelling organism groups.
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https://www.piliskiserlet.okologia.mta.hu/en.