LIFE13 ENV/SI/000148

LIFEGENMON Final Conference. Ljubljana, Slovenia, 21-25 September 2020

Microclimate in Dinaric fir-beech forests is controlled by the interaction effect between management intensity and topography

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INTRODUCTION

Forests are often referred to as specific abiotic environments where microclimatic conditions can significantly deviate from the regional macroclimate. Forest management interventions alter canopy cover and related light regime. Apart from these direct effects of managment on microclimate, local topographic factors have been proven to be very important for fine-scale variation in microclimate, particularly in areas with heterogeneous topographical setups. However, it remains unclear whether topography-induced spatial variability of forest microclimate increases after management disturbance.

MATERIALS AND METHODS

Our study was conducted in managed fir-beech forests in the Dinaric Mountains, Slovenia. These forest ecosystems are characterized by very diverse karst terrain with numerous sinkholes. Sinkholes are bowl-shaped karst depressions and a dominant landform in studied forests.

The study was experimentally designed. In 2012, three different cutting treatments were implemented: uncut controls (CON), 50% cut of stand growing stock (intermediate management intensity – IMI) and 100% cut (high management intensity – HMI) (Fig. 1). Fine-scale variation in aspect and slope and its effects on microclimate was assessed by comparing central, south-facing and north-facing within-sinkhole positions (Fig. 2). We measured air temperature (T) and relative humidity (RH) over three post-treatment growing seasons.

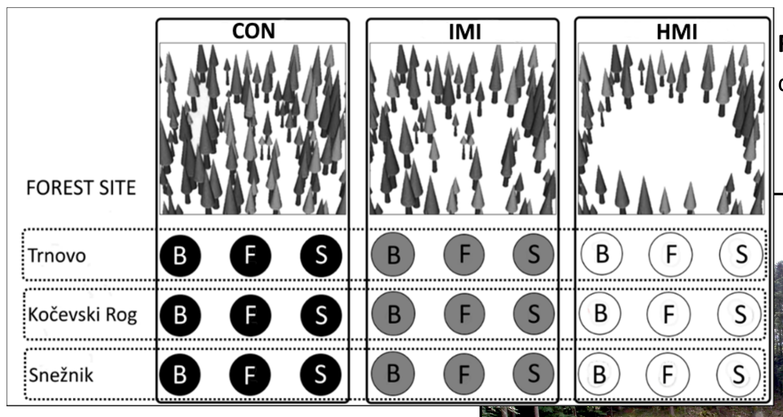

FIGURE 1: Study design showing three different management intensities.

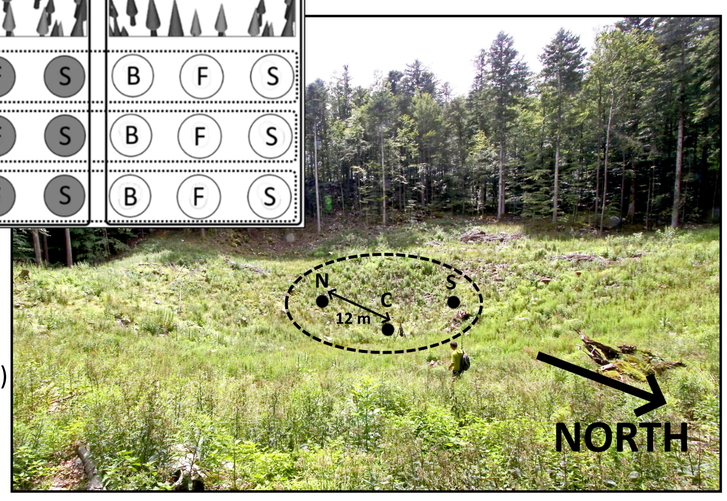

FIGURE 2: Three sampling plots (C, S, N) were established within each sinkhole.

RESULTS

-> Daily Tmax in canopy gaps were up to 5.9°C higher compared to closed stands. Daily RHmin was up to 22.7 percentage points lower (Fig. 3).

-> Overall, south-facing plots in canopy gaps exhibited the most extreme conditions, i.e. highest Tmax and lowest RHmin (Fig. 3).

-> Differences in microclimate between treatments were strongly modulated by canopy cover.

-> Overstory removal increased the dependence of microclimate upon local topographic factors (Fig. 4).

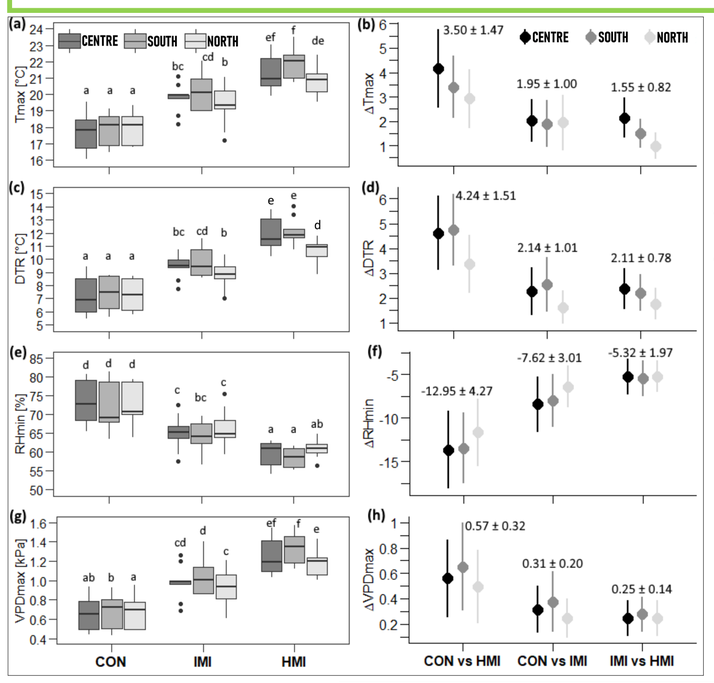

FIGURE 3: Differences in microclimatic variables between management intensities and within-sinkhole positions.

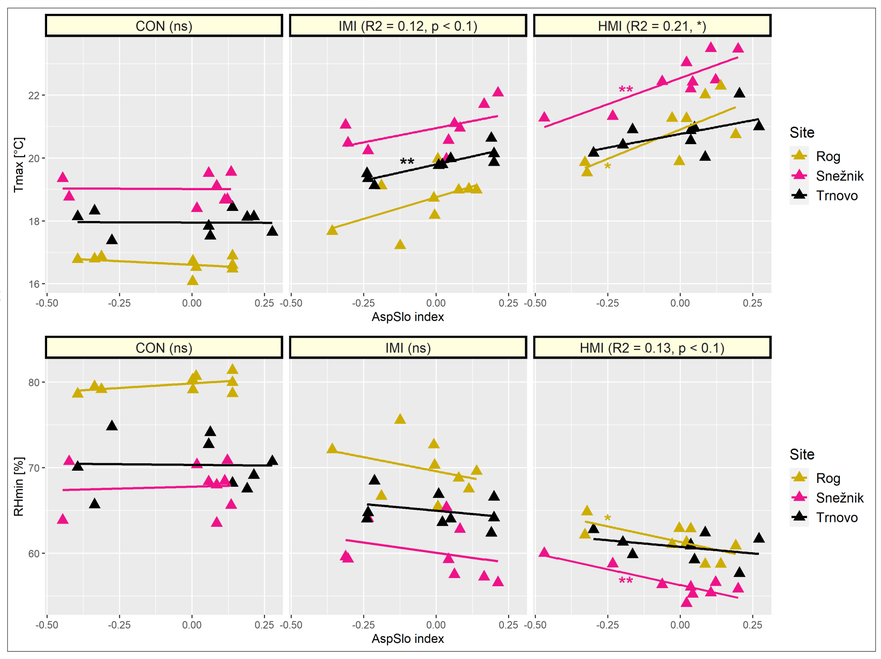

FIGURE 4: Relationship between AspSlo index, which combines aspect and slope, and microclimatic variables.

CONCLUSIONS

Spatio-temporal variations in T and RH were jointly driven by canopy cover and topographic factors. Topographically induced variation of microclimate has important implications for post-disturbance regeneration of two main tree species, i.e. European beech (*Fagus sylvatica*) and silver fir (*Abies alba*). Microsites within canopy gaps with extreme microclimatic conditions are likely less favourable for typical forest plant species.

Acknowledgments

The research was funded by the European LIFE ManFor C.BD Project (LIFE09 ENV/IT/000078) and the Slovenian Research Agency core funding for the Programme Groups P4-0107 and P4-0085. J. K. received funding from the Slovenian Research Agency as part of the Young Researcher Programme (Contract no. 1000-18-0404).

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