DIFFERENCES IN TOPSOIL CONDITIONS UNDER DIFFERENT TYPES OF FOREST STRUCTURE

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INTRODUCTION Soil plays a key role in the sustainability of forest ecosystems. In turn, the forest plant community comprises many organisms and biochemical processes that influence the soil (Grayston and Prescott, 2005; Lucas-Borja et al., 2010). Plant diversity and forest type can affect soil physical and chemical properties and substrate quality, and, more directly, the soil microbial community (Ushio et al., 2008), primarily through the influence of species differences on litter quality, root exudates and nutrient uptake (Grayston and Prescott, 2005). The relationship between woody plant composition and soil biochemical properties in pure or mixed forests is still not fully understood (Grayston and Prescott, 2005). Ushio et al. (2008), however, have shown that tropical forest soil microbial processes have some specificity (especially when comparing conifer and broadleaved species), and that soil total carbon can be an important factor affecting the soil microbial community. Additionally, tree species in northern hardwood forests are known to influence microbial biomass (Lovett et al., 2004). Nevertheless, such soil studies are rare for European temperate forests.

MATERIAL AND METHODS In the Czech Republic, seven sets of three different stand structures (A, B, C) have been established at low, mid- and high altitudes (for further information on triplet design, see Kománek et al., 2022). Each set is composed of four forest stands with varying structures:

A1 – mono-specific, even-aged stand with deciduous species (oak or beech monoculture)
A2 – mono-specific, even-aged stand with conifer species (pine or spruce monoculture)
B – even-aged mixed stand (comprising two tree species: oak x pine or beech x spruce)
C – uneven-aged mixed stand with rich structure (i. e. DBH, tree height, spatial differentiation and species richness).

At each stand, nine disturbed soil samples were taken from the organic humus layer (OH; 5 cm) according to a uniform sampling protocol. These were combined in the laboratory into three mixed samples representing site-specific conditions and forest structure type. A range of biological and chemical analyses were then performed (e. g. microbial carbon, nitrogen forms, enzymatic activity, total soil carbon and nitrogen).

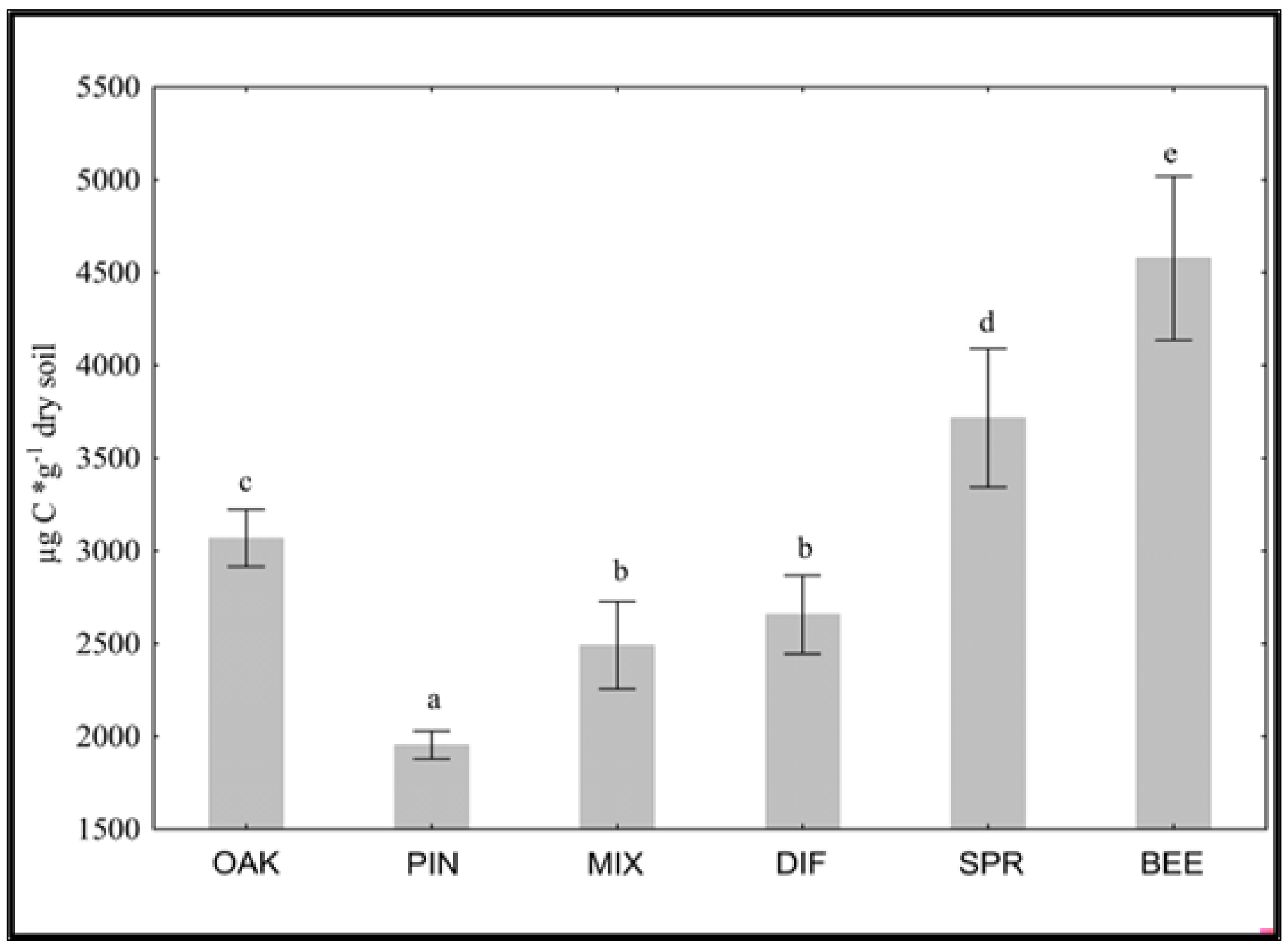

Fig. 1: Mean differences in OH layer microbial carbon under different stand types. OAK = oak monocultures, PIN = pine monocultures, MIX = even-aged mixed stands, DIF = uneven-aged mixed stands, SPR = spruce monocultures, BEE = beech monocultures.

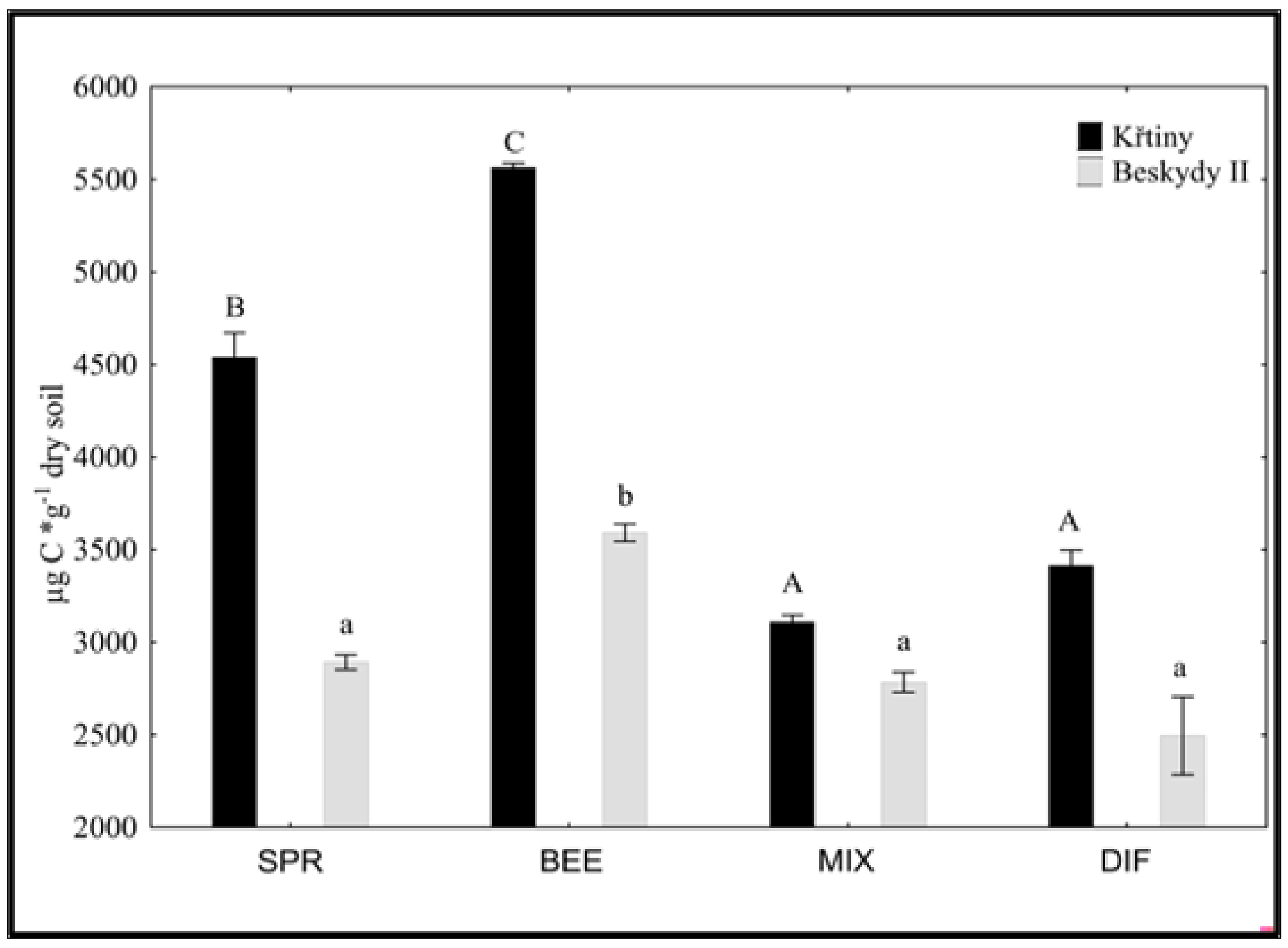

Fig. 2: Mean differences in OH layer microbial carbon at mid- (Křtiny) and high (Beskydy II) altitudes. SPR = spruce monocultures, BEE = beech monocultures, MIX = even-aged mixed stands, DIF = uneven-aged mixed stands..

RESULTS AND DISCUSSION While there were significant differences in OH layer microbial carbon between beech, spruce, oak and pine monocultures, there were no significant differences between MIX and DIF stands (Figs. 1 and 2). Differences in ammoniacal nitrogen between stand types were less evident, with significant differences found between pine monoculture and MIX stands only. A similar pattern was observed for amount of soil labile carbon, with significant differences observed between spruce monoculture, oak monoculture and MIX stands only. This variability is most likely due to site-specific conditions (e. g. annual precipitation, specific hydrology and geology), supported in part by differences in microbial carbon abundance between sites of the same forest structure type at different elevations (Fig. 2).

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