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Quantification of Spatial Variability and Seasonality of Microbial Processes in the Upper Layers of Hardwood Forest Soil

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Extracellular lignocellulose-degrading enzymes are responsible for the transformation of organic matter in hardwood forest soils. The spatial variability and vertical distribution of the extracellular enzymes laccase, Mn-peroxidase, endoglucanase, endoxylanase, cellobiohydrolase, 1,4-β-glucosidase, 1,4-β-xylosidase, chitinase and acid phosphatase and the content of soil mirobial biomass were studied in a *Quercus petraea* forest soil profile. The seasonality of the above variables was followed monthly over 3 years. Activities of all tested enzymes exhibited high spatial variability in the L and H horizons. Acid phosphatase and chitinase exhibited low variability in both horizons, while the variability of Mn-peroxidase activity in the L horizon, and endoxylanase and cellobiohydrolase activities in the H horizon were high. The L horizon contained 4 $\times$ more total microbial biomass and 7 $\times$ more fungal biomass than the H horizon. The L horizon also contained relatively more fungi-specific and less actinomycete-specific PLFA markers. There were no significant correlations between enzyme activities and total microbial biomass. In the L horizon polysaccharide hydrolases correlated with each other and also with chitinase and acid phosphatase activities. Laccase, Mn-peroxidase and acid phosphatase activities correlated in the H horizon. The soil profile showed a decreasing gradient of pH, organic carbon and humic compounds content, microbial biomass and enzyme activities. Ligninolytic enzymes showed preferential localization in the upper part of the H horizon. The production of enzymes was highly variable in time but no significant seasonality was detected. However, when taking into acount the ambient temperature, highest activity

of most enzymes was proposed for a summer season except for Mn-peroxidase that culminated in Autumn. This work was supported by the Ministry of Education, Youth and Sports of the Czech Republic (LC06066), Ministry of Agriculture of the Czech Republic (QH72216) and the Grant Agency of the ASCR (B600200516).