The age of managed deciduous forest stands shapes opposing trends in biodiversity: lichens gain, plants lose

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Temperate deciduous forests are characterised by a wide variety of forest types. However, in most natural forest communities, oaks (*Quercus robur* and *Q. petraea*) play a key role. At the same time, oak stands have significant economic importance, so a major proportion of oak forests is shaped by regular management practices. Human intervention affects the age structure of trees, the species composition of communities, and the availability of dead wood resources. Consequently, the diversity of individual groups of organisms may change as the tree stand grows and develops, depending on various factors.

The aim of this study was to assess the effect of stand age on the species richness of vascular plants, bryophytes, and lichens occurring on the substrates available in oak-dominated managed forests.

The study was conducted in a lowland area of south-western Poland, within the Bory Stobrawskie Mesoregion, across four forest types: *Agrostio-Quercion*, *Quercion roboris*, *Carpinion betuli*, and *Alnion incanae*. On 100 circular study plots (300 m²; proportion of native oak species in the stand ≥ 50%; stand age 41–180 years), vascular plant species were recorded in the forest layers, as well as bryophyte and lichen species occurring on the trunks of living trees (up to 130 cm in height), on decaying wood (logs, stumps, and fine woody debris), and on the forest floor. Total species richness and the richness of particular groups – vascular plants, bryophytes, and lichens in forest layers or on available substrates – were compared using the Friedman test and the Wilcoxon test. Subsequently, the effect of stand age on species richness was assessed in two ways: using Spearman's rank correlation coefficient and multivariate Generalized Linear Models (GLMs) that included habitat and landscape variables.

The species richness of vascular plants, all bryophytes, and epiphytic bryophytes was negatively correlated with stand age. In the multivariate models, the negative effect persisted only for total bryophyte richness, while it disappeared for epiphytic bryophytes and vascular plants. Additionally, epixylic bryophytes and epixylic lichens showed a positive response to stand age.

The results indicate that biodiversity development in managed forests is a complex process, as different organism groups respond differently to environmental factors. Stand age is one of several factors shaping biodiversity in managed oak forests.