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Regular patterns and context-dependent deviations in successional trajectories of spontaneously developed semi-natural forests on abandoned farmland in Hungary

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Spontaneously developed forests (SDFs) dominated by native tree species have expanded across vast areas of abandoned farmland in Central and Eastern Europe in the last decades. These forests hold considerable potential for contributing to the semi-natural forest restoration objectives of the European Union's Nature Restoration Regulation. However, their effective management requires robust, comparative, and evidence-based research, while SDFs remain insufficiently studied in the Carpathian Basin. We aimed to assess how site locality, historical land use, and time since abandonment shape the species composition of spontaneously developed semi-natural forests across three forest landscape types in Hungary (riverine oak–ash–elm forests, mesic hornbeam–sessile oak forests, and thermophilous turkey oak–sessile oak forests). We surveyed the species composition of the canopy, shrub, and herb layers at 358 sampling points. Ordination analyses based on species cover data revealed that site locality, land-use history, and time since abandonment each contribute to deviations from general species-compositional patterns within forest layers and across landscape types. We found that the number of forest-generalist herbaceous species increased markedly following abandonment, reaching levels comparable to reference ancient forests already in 25–50-year-old stands across all habitat and land-use categories. In contrast, the number of forest-specialist species exhibited habitat-specific successional trajectories. These findings highlight the importance of management approaches that maintain the distinct species-compositional patterns of spontaneously developed forests on former farmland, thereby favouring close-to-nature and low-intensity forestry practices.