Universitatea
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HABILITATION THESIS

SUMMARY

Title: Diversity aspects of Romanian forest vegetation

Domain: Silviculture

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SUMMARY

The habilitation thesis shows the evolution of research activities devoted by the author in the field of forest vegetation biodiversity. After finishing the PhD thesis in 2008 (Floristic and phytosociological researches on sessile oak forests in the upper basin of Olt river), a post-doc project was accessed in order to construct a phytosociological database covering the oak forests over whole country of Romania (Quercion petraeae, Quercion roboris, Quercion pubescenti-petraeae, Lathyro-Carpinion, Quercion frainetto, Syringo-Carpinion). During this project, financed by the national authority for scientific research, both field and literature data was collected, standardized, stored and analyzed. A one month stage at Department of Botany and Zoology of Masaryk University in Brno, Czech Republic offered a specialization in using specific software for storing and analyzing vegetation databases. The database was further completed, with the help of other four specialists, with releves from other vegetation alliances and deposited in the European vegetation archive (code EU-RO-007, Indreica et al. 2017) in order to be accessible for further studies at supra-national level. The suitability of such databases to describe the habitats diversity or species ecology have to be tested previously, looking for the coverage of plots both in geographic and ecological space. For this purpose, Sporbert et al. (2019) developed a methodology based on the dynamic match coefficient (DMC) that measures the fit of the available sampling over species range and climatic niche at various resolutions.

The Romanian forest database was used to validate statistically and ecologically some forest types, like Potentillo albae-Quercetum petraeae association (Indreica 2011), or to review and complete the syntaxonomical description of some alliances of Romanian forest vegetation (Indreica 2012, 2015). Such reviews applied methods of multivariate statistics, like ordination (NMDS, DCA), classification (divisive and clustering techniques), indicator species analysis, validation of optimal partitioning, creation of formal (expert system) definitions of vegetation types. Specific software were learned and applied – Juice, Turboveg, PC-ORD, Hyper-Niche, in conjunction with principles of the code of phytosociological nomenclature. In order to map the vegetation types, the skills in GIS software were acquired (DMAP, QGIS SAGA-GIS). The syntaxonomical experience gained at national level and plot-data contribution to European databases facilitated cooperation in international-level studies, like revision and mapping of European habitat types and phytosociological alliances (Chytry et al. 2020).

Beside identification and description of vegetation types, a more practical studies were those investigating the determinants of forest biodiversity. In this regard, a project requested by the administration of the Natural Park Măcin Mountains aimed to quantify the naturalness and diversity of submediteranean forests in SE Romania where pure stands of silver lime are regarded as results of inapropriate forests' use in the past or inefficient forest management in the present. Using indicator species and correlations between tree species and site factors was demonstrated that natural competition, not forest management, is the main driver of stand composition (Lavro și Indreica 2013). Another challenge was to identify the environmental tipping points between vegetation types in order to predict changes in vegetation composition or to assess the suitability of expanding the range of some tree species better adapted to warmer and drier conditions. Three studies were dedicated to this topic. First, there were developed methods to assess the climate favourability of vegetation types based on existing databases (EVA, World Clim), species distribution models (Generalized Linear Models, Classification Trees, Random Forests, Multivariate Adaptive Regression Spline, Non-parametric Permutation Procedure and Maximum Entropy) and co-occurrences of characteristic species (Baatar et al. 2019, Indreica et al. 2019). Then, in cooperation with scientists from two universities of Göttingen, field investigations were conducted along three transects in western Romania following vegetation-temperature gradients from pure oak to mountain beech forests. The results revealed micro-climatic peculiarities that may favor competition or resistance of tree species (Hohnwald et al. 2020), and the influence of *Tilia tomentosa* on plant species gama-diversity and resilience of forested landscape (Heinrichs et al. 2021).

The ability to investigate the drivers of forest biodiversity was developed through cooperation in several international teams. In a study of Vecera et al. (2019) the alpha diversity of European forest classes was analyzed in relation with nineteen environmental variables, then it was mapped by Random Forest algorithm and diversity hot spots were emphasized. The combined influence of environmental and historical variables upon life-forms, taxonomic and phylogenetic beta-diversity of temperate deciduous forests of western Eurasia was explored through structural equation (Padules Cubino et al. 2021) and generalized linear mixed models (Loidi et al. 2021).

The assessment of conservation status of protected plant species required field investigations upon population distribution, size, vitality, followed by analysis of species's habitat suitability, genetic diversity and populations connectivity. The skills in conducting or supporting such analysis were demonstrated for the species *Adenophora liliifolia* (Indreica

2011, Manole et al. 2015, Prausova et al. 2016), *Betula nana* (Borbely & Indreica 2019), *Saussurea discolor* (Baroga & Indreica 2021).

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