Species-area relationships in European dry grasslands A comparative analysis across regions, taxa, and scales

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The increase of species richness (S) with the enlargement of the size of the analysed area (A) is one of the most fundamental 'laws' in ecology (species-area relationship, SAR). However, little is known about the variability of SAR function types, their parameters, and how they depend on scale, taxon, vegetation structure, and environmental factors. We studied different dry grassland types (*Koelerio-Corynephorenea*, *Sedo-Scleranthenea*, *Festuco-Brometea*) in various regions of central and northern Europe (Germany, Switzerland, Sweden, Russia, Estonia), analysing altogether ca. 160 series of nested plots. All vascular plants, bryophytes, and lichens (mostly also including non-terricolous taxa) were recorded on different plot sizes, mostly covering a range from 1 cm² to 100 m² (partly also beyond). We tested the suitability of five different SAR function types fitted both for S and log S using various criteria ($R^2_{adj.}$, AICc, mean relative deviation, log error of extrapolation, etc.). Power functions [$S = c\ A^{\ z}$], quadratic power functions [$S = 10^{(b0 + b1 \log A + b2 (\log A)^2)}$], and Lomolino functions [$S = b_0 / (1 + (b_1^{\ \log(b2/A)}))$] generally fitted the relationships well whereas logarithmic functions [$S = b_0 + b1 \log A$] and Michaelis-Menten functions [$S = b_0\ A\ /\ (b_1 + A)$] proved to be unsuitable. Quadratic power functions fitted for log S resulted in the lowest mean relative deviation and 'normal' power functions fitted for S produced the most accurate extrapolations of species richness values for plots of ten-fold size. The increments (z) of the power functions fitted for S averaged 0.217 (SD = 0.031) and showed only little scale-dependency within individual curves. In contrast to other studies, we found no negative correlation between z and c. Whereas c showed typical values for different dry grassland syntaxa, a wide range of z values could be found within most of these (Fig. 1). Further, we will present analyses of the dependency of SAR parameters on taxon (vascular plants, bryophytes, lichens), geographic position, environmental conditions, and land-use history.

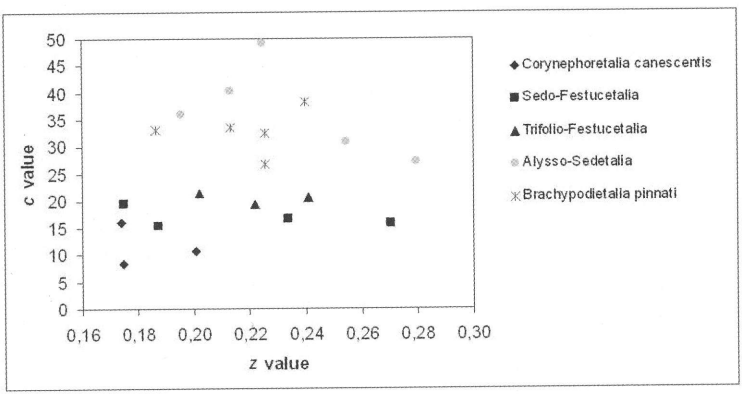

Fig. 1: Combinations of z values (fitted for S) and c values (= species densities on 1 m²) for different syntaxa of dry grasslands (black: *Koelerio-Corynephorenea*; grey: *Sedo-Scleranthenea*; asterisks: *Festuco-Brometea*).

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