Frontiers of Vegetation Science—An Evolutionary Angle

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Evolution and adaptations of the 'matorral costero suculento' (coastal succulent scrub) in Baja California, Mexico

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The vegetation in the mediterranean-climate regions of the world is characterised by evergreen sclerophyllous trees and shrubs. In the mediterranean region of North America—California (USA) and Baja California (Mexico) —the chaparral and the coastal sage scrub form are the most abundant and dominant vegetation. However, in the northwest of the Peninsula Baja California, at latitudes spanning 30°00' and 32°30' N, unique and endemic community, so called 'matorral costero suculento' (coastal succulent scrub) occurs. The characteristic of this matorral is the abundance of succulent plants of the families (Cactaceae, Agavaceae, Crassulaceae and Euphorbiaceae) typically occurring in arid and semiarid regions.

We ask several questions about this matorral vegetation and its flora, in particular: (1) What is the origin of this flora? (2) Why do succulent plants occur in this Mediterranean region? and (3) Which climatic conditions control the establishment of this plant community?

We used bioclimatic data as well as floristic and biogeographic analyses to answer these questions.

Varying diversity patterns of different plant groups at different spatial scales in central European landscapes

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'Biodiversity' has been an important catchphrase both in science and in politics for some 15 years now. Well-funded research programs, countless publications, and even complete new journals have been devoted to the study of biodiversity, its patterns and causations as well as its decline and how this can be halted. Beside this enormous effort, some very basic pieces of knowledge are still missing, even in such well-studied regions as central Europe.

The question how species rich the central European landscape is on average can well be answered for scales from quadrants of topographic map sheets onwards (> 25 km^2) but not for scales below that. However, square metres or some dozens or hundreds of square metres are the scales at which different plant species directly interact with each other and at which studies on conservation or restoration of biodiversity are usually focussing. Yet, these studies are still lacking a well-founded benchmark to evaluate their results. Moreover, the few available studies/reviews with data of species densities on small scales usually provide only values for preconceived plant community types without actually knowing *(i)* how representative the used relevés are for the respective community and *(ii)* what proportions of a landscape are covered by the different types. Finally, most studies on plant diversity so far only deal with vascular plants and exclude bryophytes and lichens. Our aim therefore was to measure the average plant species richness for all plant groups and to characterise plant diversity pattern different spatial scales, using a new standardised approach.

For this purpose we selected two contrasting landscapes in the North German Lowlands, namely the area (126 km^2) of the topographic map sheet 2728 (Lüneburg) in Lower Saxony, NW Germany (ca. 35% forest, 10% grassland, 30% arable land, 25% settlement), and a sector of 6 km^2 of the topographic map sheet 3049 (Brodowin), Brandenburg, NE Germany (ca. 50% forest, 25% grassland, 20% arable land, 5% settlement). Within both investigation areas, we placed series of nested plots randomly and irrespectively of homogeneity with the help of a GPS (50 in Lower Saxony, 16 in Brandenburg). In each of these series, we recorded all species (shoot presence) of vascular plants, bryophytes, and lichens on plots of 0.0001 m^2, 0.0009 m^2, 0.01 m^2, 0.09 m^2, 1 m^2, 9 m^2, and 100 m^2 size. In each series, all plot sizes smaller than 100 m^2 were replicated four times in the four corners of the 100 m^2 plot.

In Lower Saxony, we found an average of 1–2 species on 1 cm^2, 8–9 species on 1 m^2, and 38–39 species on 100 m^2 (range: 2–137). The values for Brandenburg were consistently higher for all spatial scales (by 4%–29%). Non-vascular plants contributed a significant share to the overall plant diversity in both regions and at all spatial scales. On 100 m^2, for example, bryophytes constituted 15% and lichens 11% of average plant species richness. The most frequent plant species in both study areas and at all spatial scales besides the

smallest was the moss *Brachythecium rutabulum*, which occurred in more than 80% of all 100 m^2 plots. Also, the other most frequent species highly coincided between both regions, with the grasses *Lolium perenne* and *Elymus repens*, the forbs *Taraxacum* spp. and *Stellaria media*, the moss *Hypnum cupressiforme*, as well as the lichen *Lepraria incana* being present in more than 1/3 of randomly chosen 100 m^2 plots, each.

The species-area relationship was best described by a power law with a mean z value (increment) of 0.22 (fitted for log-transformed species richness). Beside substantial differences in the z values between individual plot series (range: 0.15–0.41), z values showed a general pattern of scale-dependency with a minimum between 0.0009 and 0.01 m^2. The observed increase towards larger plot sizes differs from published findings within homogeneous vegetation stands, where z values generally remain constant or even decrease with increasing plot size. We further analysed the species-area relationship separately for taxonomic groups and species of different floristic status (native, archaeophyte, neophyte, ornamental plant), and correlated diversity parameters to stand structure, landscape type, and site conditions.

We conclude that our flexible approach allows for objective comparison between differently structured landscapes and between various geographic regions. The approach is particularly promising in analysing biodiversity patterns simultaneously on multiple spatial scales and thus being capable of detecting relationships of diversity parameters to predictor variables that change direction with spatial scale.

The basiphilous semi-dry grasslands (Festuco–Brometea) in N and NE Europe: gradient analysis and large-scale classification

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The aim of our study was to develop a comprehensive and consistent classification of the basiphilous semi-dry grasslands (Festuco–Brometea) in the Nordic (Scandinavian) and