

Resource utilisation by wild bees (Hymenoptera, Apoidea) in grazed and ungrazed sand-ecosystems

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In a sand-ecosystem (*Allio-Stipetum* complex) situated in the nature reserve 'Griesheimer Düne und Eichwäldchen' (Darmstadt, Germany), influences of sheep grazing on wild-bee coenoses and their food resources were studied. A three-years study (following initial grazing) comparing vegetation on grazed and ungrazed areas showed a significant increase of some plant species used by wild bees (e.g. *Helichrysum arenarium*), as well as an increase of *Calamagrostis epigejos* in ungrazed areas [1]. Even after three years, grazed and ungrazed areas hardly showed any differences concerning their flowering phenology. Concerning their wild-bee species and abundance, there were also no significant differences between grazed and ungrazed areas (ANOVA; $F_{1,16} = 2.44$; $p = n.s.$, $F_{1,16} = 1.45$; $p = n.s.$). However, according to a more detailed analysis, grazed old sand dune complexes showed significantly higher numbers of wild-bee species than younger ones ($F_{2,9} = 12.8$; $0.01 \geq p > 0.001$), the latter having previously been exposed to severe anthropogenic impact. According to a Canonical Correspondence Analysis (Fig. 1), the species composition of wild bees on the specific grid areas depended on the available pollen and nectar resources, whereas in the present vegetation stage, grazing and non-grazing factors do not play any role. Some species (e.g. *Centaurea stoebe*) are characterised by a correlation between increasing resources and increasing numbers of wild-bee species. Patchy sheep grazing on small areas for a limited time starting at the beginning of July has not caused any impact on the wild-bee community. On the contrary, grazing produces bare ground nesting sites for endogeic wild-bee species. Moreover, it promotes important pollen and nectar resources on the one hand and prevents further succession of mono-dominant grass species on the other.

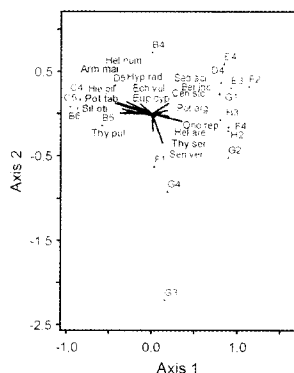


Fig. 1: CCA of the wild bee species. Environmental factor "pollen/nectar resource": maximum number of flowers/inflorescences of plant species per grid plot (log [x+1]-transformed). Sites grazed: B4, B5, B6, C4, D5, G1, G2, H2, H3; sites ungrazed: D4, C5, F1, F2, F4, G3, G4, E3, E4. Eigenvalues and significance level (Monte Carlo test): $\lambda_1 = 0.36$, $p_1 = 0.01$; $\lambda_2 = 0.26$, $p_2 = 0.01$; $\lambda_3 = 0.19$, $p_3 = 0.02$. Plant species: *Armeria maritima*, *Berteroa incana*, *Centaurea stoebe*, *Echium vulgare*, *Euphorbia cyparissias*, *Helianthemum nummularium*, *Helichrysum arenarium*, *Hieracium pilosella*, *Hypochaeris radicata*, *Ononis repens*, *Potentilla argentea*, *P. tabernaemontani*, *Sedum acre*, *Senecio vernalis*, *Silene otites*, *Thymus pulegioides*, *T. serpyllum*.

Reference

- [1] Schwabe A, Zehm A, Nobis M, Storm C, Süß K (2004) Auswirkungen von Schaf-Erstbeweidung auf die Vegetation primär basenreicher Sand-Ökosysteme. NNA-Ber. 17, H.1.

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