The Impact of Vegetation Structure and Spatial Heterogeneity on Invertebrate Biodiversity Within Upland Landscapes

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Introduction Livestock grazing influences vegetation structure and composition at both the patch and wider landscape scale (Milne *et al.,* 1998), and this may have effects on upland invertebrate communities, which in turn influence bird abundance and distribution (Fuller & Gough, 1999; Cole *et al*., 2002). Of particular importance are open grasslands and wet flushes where invertebrates are abundant and more accessible to birds. However, there have been few studies of invertebrates associated with upland habitats, and most of these have focused on heather moorland, blanket bog, or very fine-scaled structure within grasslands (Dennis *et al.* 1997; 1998; 2001). This study addresses the relationship between upland invertebrate biodiversity and the spatial and structural diversity of vegetation.

Materials and methods Four large (>40 ha) plots were established at two sites: Kirkton in Perthshire, Scotland and Sourhope, The Borders, Scotland. At each site, two grazing treatments (light summer-only grazing and moderate year-round grazing) were applied as part of a larger research project. Forty areas of vegetation (i.e. 10 within each plot) were chosen to represent the range of vegetation types and structures within each plot, with emphasis on areas containing *Nardus stricta*. Surface-active invertebrates were sampled within each area using a line of nine pitfall traps. Vegetation height and species composition data were collected from a transect around the pitfall traps. The vegetation patches within a 30 m diameter circle (centred on the line of traps) was mapped, and sward heights measured within the patches.

Results Two-way ANOVA indicated that neither site nor grazing treatment influenced the number of ground beetle species recorded in the pitfall traps (Site: $F=0.02$, $P>0.1$, df = 1,39; Treatment: $F=1.98$, $P>0.1$, df = 1,39). Differences in ground beetle assemblage structure were evident between sites, with altitude (and hence potentially exposure) appearing to have greater influence on invertebrates at Kirkton, while at Sourhope there was a relationship between dominant vegetation type and invertebrates. Across both sites, there was no relationship between invertebrate occurrence and vegetation height or the number of different vegetation patches within the 30 m circle. Further analyses will, however, consider the potential influence of spatial location of these different vegetation types on ground beetles.

Conclusions The results of this study demonstrate that livestock management, in the short term, has less impact on ground beetle assemblages than site factors such as geographical location, climate, altitude and vegetation type. The influence of different variables was site-specific thus indicating that management prescriptions should be tailored to particular sites rather than the adoption of a prescription of one-fits-all.

References

Cole, L.J., D.I McCracken, S. Blake, I.S Downie, G.N Foster, A. Waterhouse, P. Dennis, J.A Milne, K.J. Murphy, M.P. Kennedy, R.W. Furness & A. Milligan (2002). The influence of grassland management and vegetation structure on invertebrates and birds. In: I. Hulbert & E. McEwan (eds). Biodiversity, plant structure and vegetation heterogeneity: interactions with the grazing herbivore, Proceedings of Meeting 9-10 October 2001,. SAC Hill & Mountain Research Centre, Crianlarich, UK, pp 6-10. (CD-Rom)

Dennis, P., M.R. Young & C. Bentley (2001). The effects of varied grazing management on epigeal spiders, harvestmen and pseudoscorpions of *Nardus stricta* grasslands in upland Scotland. *Agriculture, Ecosystems & Environment*, 86, 39-57

Dennis, P., M.R Young & I.J. Gordon (1998). Distribution and abundance of small insects and arachnids in relation to structural heterogeneity of grazed, indigenous grasslands. *Ecological Entomology*, 22, 253-264.

Dennis, P., M.R. Young, C.L. Howard & I.J. Gordon (1997). The response of epigeal beetles (Col: Carabidae, Staphylinidae) to varied grazing regimes on upland *Nardus stricta* grasslands. *Journal of Applied Ecology*, 34, 433-443.

Fuller, R.J. & S. J. Gough (1999). Changes in sheep numbers in Britain: implications for bird populations. *Biological Conservation*, 91, 73-89.

Milne, J. A., C. P. D. Birch., A. J. Hester, H. M. Armstrong & A. Robertson (1998). The impact of vertebrate herbivores on the natural heritage of the Scottish uplands – a review. Scottish Natural Heritage Review No 95. Scottish Natural Heritage, Edinburgh.