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Effects of agricultural management on the use of lowland grassland by foraging birds

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Abstract

A field-scale correlative study was used to identify which factors had the greatest influence on the usage of agricultural grassland by foraging birds in the English West Midlands. The study extended previous work by directly comparing a more complete range of lowland grassland management practises, bird species and seasons. Sward structure had more influence on bird usage than botanical composition. Bird species fell into two groups based on their sward structure preferences, which closely reflected where they obtained their food. Species that feed on soil-dwelling invertebrates selected short swards, while species that feed on sward-dwelling invertebrates or seeds selected taller swards with greater spatial heterogeneity. Grazing had a greater influence on grassland usage than sward age and other management practices. Birds mainly responded positively to grazing, especially by cattle. Weed control reduced the usage of grass fields by granivorous birds during summer and winter. Intensive grazing systems create and maintain short, uniform swards that favour bird species foraging for soil-dwelling invertebrates, but not those reliant on seeds or sward-dwelling invertebrates. It is proposed that excessive defoliation of agricultural grasslands (associated with intensive grazing and mowing regimes) impacts granivorous birds by reducing prey abundance. Reductions in grazing intensity and the avoidance of weed control should increase food availability for granivorous and insectivorous birds on grass fields.

Keywords: Farmland birds; Grassland management; Sward structure; Grazing; Mixed models

1. Introduction

Permanent grassland accounts for a large proportion of all agricultural land in Britain (66% in 2001) and Europe (40% in the EU15 countries in 2001) (UN Food and Agriculture Organisation FAOSTAT data, updated February 2004, www.apps.fao.org/default.asp). Since the mid-twentieth century, grassland management has intensified to increase livestock forage and fodder production. The resulting habitat changes have been widespread and pervasive. Grasslands of nature conservation value, mainly defined by botanical communities, now comprise less than 2% of the area of lowland grassland in England and Wales (Blackstock et al., 1999). Farms have also specialised into either arable or livestock production, abandoning mixed farming systems. Pastoral farming has increased in western Britain, which now holds over 60% of the area of grassland in Britain, compared to just 12% in eastern arable areas (MAFF, 1997).

Farmland bird populations have declined in the UK since the 1970s (Siriwardena et al., 1998). Most research into bird declines has focussed on arable systems, where there is increasing evidence of links to intensification (e.g. Brickle et al., 2000). A general intensification of pastoral farming practice coincided with relatively severe declines in the abundance and range of farmland birds, particularly seed-eating species, in western pastoral regions of Britain (Chamberlain and Fuller, 2000). The presence of arable crops in pastoral areas is associated with increased densities of granivorous farmland birds (Robinson et al., 2001), so the loss of arable cropping from many livestock farms may account in part for the declines in western Britain. The intensification of grassland management has probably

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caused a reduction in seed and invertebrate densities and possibly their availability to foraging birds (Vickery et al., 2001). However, the key management practices and the mechanisms involved are poorly understood.

The UK government has committed to reversing the long-term decline in the numbers of farmland birds by 2020 (Defra, 2002). Meeting this Public Service Agreement will require a better understanding of avian ecology on grasslands, both to establish the mechanisms involved and to design remedial measures. The development of potential conservation measures on arable farmland is much further advanced (e.g. Boatman et al., 2000).

The intensification of grassland management has involved several interrelated changes in farming practice. The principal changes that may have impacted bird populations are increased use of fertilisers (especially inorganic nitrogen), the switch from hay to silage, increased stocking densities, reseeding of grasslands and drainage (Vickery et al., 2001). All of these actions promote structurally uniform, dense swards dominated by competitive ryegrasses *Lolium* spp. and such swards now dominate agricultural landscapes. Grassland management has developed along the same lines throughout the parts of western Europe where farmland birds have declined (Lazenby, 1988; Donald et al., 2001b).

Behavioural studies have described foraging site selection by birds as a trade-off between energy intake rates and perceived predation risk. Vegetation structure influences this trade-off via three main factors: food abundance, predation risk and food accessibility. Food intake rates are higher where food is more abundant (e.g. Brodman et al., 1997). But food intake rates are lower where visibility is impaired: for instance, deeper swards force birds to spend a greater proportion of their time watching for predators, rather than feeding (Devereux et al., 2004; Whittingham and Evans, 2004). Deeper swards also obstruct access to the bird and conceal food items, further reducing intake rates (Whittingham and Evans, 2004). Numerous studies have demonstrated the importance of minimising the predation risk, but risk avoidance strategies and consequently selection responses to sward structure vary substantially between species (Watts, 1991; Devereux et al., 2004). No behavioural studies have explicitly considered situations where the effects of vegetation structure on predation risk conflicted with those on food abundance. Grasslands are one such habitat as certain key prey items (e.g. herbivorous invertebrates, Morris, 2000) are more abundant in taller swards, where predation risk is relatively high and accessibility relatively poor. This behavioural framework needs to be applied to explaining the effects of grassland management on foraging site selection in order to identify the limiting factors before practical solutions can be developed.

The aim of this study was to identify the key components of lowland grassland management that influence the suitability of grass fields as feeding habitats. A correlative approach was used to generate hypotheses for more focussed future work. A large sample of fields was employed to assess the generality of foraging responses across the full suite of management practises, bird species and seasons. Previous studies have been restricted to winter and have considered narrower ranges of management practices or bird groups (Tucker, 1992; Perkins et al., 2000; Barnett et al., 2004). It is particularly important to understand factors affecting the utility of grasslands for birds during summer because the abundance and quality of grassland can be a key factor influencing the breeding performance of farmland birds (e.g. Evans et al., 1997).

2. Methods

2.1. Study areas

A sample of 23 farms representing a wide range of pastoral businesses was selected for study in a mixed farming region in the English West Midlands (Shropshire, Staffordshire and Cheshire). The farms comprised approximately 70–90% grassland, with the remaining area in arable crops. Farms were selected to stratify the sample of fields across the farming practices and management gradients (such as fertiliser inputs, Fig. 1) occurring in the region. Thus, the sample maximised sensitivity to management effects but did not sample each management type in proportion to its area in the region. The same fields were surveyed in both summer and winter, though some fields were lost or subdivided between seasons (1392 ha of grass fields, $n = 388$ in winter and $n = 373$ in summer).

Thirteen farms had dairy herds and ten raised beef cattle. Sheep grazed nine farms during summer and 15 during winter. In summer, almost all grazed fields were grazed by cattle and one-third by sheep. In winter, about three quarters of grazed fields were sheep grazed and half cattle grazed. Horses were kept on five farms, including two large livery stables and a racehorse stud, totalling 40 fields. Six farms were managed as organic dairies. Agri-environment management agreements were in place on 15 farms (Countryside Stewardship Scheme, CSS): 12 farms with whole-field management options and five with grass margin options. During the 5 years prior to fieldwork, hay was harvested on 17 of the farms and silage on 18. Zero-grazing (involving daily mowing of grass for consumption by cattle housed elsewhere on the farm) was practised on two conventional dairies. Sward ages ranged from newly established leys to permanent pastures over 160 years old (25% fields $\leq$5 years old, 25% fields $\geq$50 years old). Sward types ranged from high-input ryegrass *Lolium* monocultures to low-input species-rich meadows. The predominant NVC communities were MG6 (*L. perenne-Cynosurus cristatus* grassland) and MG7 (*L. perenne* leys), with a smaller sample of MG4 (*Alopecurus pratensis-Sanguisorba officinalis* grassland) and MG5 (*C. cristatus-Centaurea nigra* unimproved grassland) (Rodwell, 1992).