Agriculture, Ecosystems and Environment 138 (2010) 27–34

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee

Effects of changed grazing regimes and habitat fragmentation on Mediterranean grassland birds

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ARTICLE INFO

Article history:
Received 15 October 2009
Received in revised form 17 March 2010
Accepted 18 March 2010
Available online 18 April 2010

Keywords:
Agri-environment schemes
CAP reform
Cereal-steppe
Conservation
Decoupling
Farmland birds

ABSTRACT

In Iberian cereal-steppes, decoupling of payments from current production levels through the Single Farm Payment raised concerns regarding the potential for land abandonment and replacement of sheep by cattle, with eventual negative consequences for declining grassland birds. This study addressed this issue by analysing the responses of five grassland bird species of conservation concern to spatial land use gradients, which are expected to reflect changes potentially associated with the CAP reform. Our results show that both habitat fragmentation and grazing regimes were major drivers of breeding bird densities, though responses to these factors were species-specific. Thekla larks were most abundant in landscapes with small grassland patches and high edge density, whereas calandra larks were abundant only in large expanses of continuous open farmland habitat. Little bustard and short-toed lark densities declined in highly fragmented landscapes, but they appeared to tolerate or even benefit from low to moderate levels of open habitat fragmentation. Corn buntings were little affected by landscape patterns. At the field scale, little bustard and corn bunting densities were highest in fields grazed by cattle, whereas short-toed larks were mostly associated with sheep pastures. Short-toed larks and Thekla larks were most abundant in old fallow fields where cattle was largely absent, whereas corn buntings showed the inverse pattern. These results confirm the view that the same agricultural policies may be favourable for some species of conservation concern but detrimental to others, and so they cannot be assumed to bring uniform conservation benefits.

1. Introduction

The introduction of the Single Farm Payment, and the associated decoupling of payments from current production levels, is one aspect of CAP (Common Agricultural Policy) reform with the potential for determining major land use changes in marginal farming areas (Oñate et al., 2007; Tranter et al., 2007; Stoate et al., 2009). There is a risk that decoupling of crop payments may promote abandonment of low-income farming systems (Oñate et al., 2007; Tranter et al., 2007), particularly where the added costs of cross-compliance requirements cannot be met by production increases (de Graaff et al., 2010). This might contribute to further losses and fragmentation of farmland habitats, thereby maintaining the tendencies encouraged by past financial incentives such as European regulation 2080/92, which supported the afforestation of marginal agricultural land (Robson, 1997). Decoupling may also spread idling into areas of extensive production systems that were formerly carried out in order to receive livestock payments (Tranter et al., 2007). Further land use changes are expected from the possibility given to Member States for maintaining variable levels of coupled support to suckler cow, goat and sheep, which is likely to favour particular herbivore species depending on the level of coupled support retained in each country, as well as promoting shifts from crop to livestock production (Röder et al., 2008).

Iberian cereal-steppes cover over 4.5 million ha and are among the European farmland landscapes with the highest value for biodiversity conservation, mainly due to their importance for grassland birds (EEA, 2004; Bota et al., 2005). These are extensively farmed, mixed rotational systems of winter cereals, fodder crops and grazed fallow land and pastures, which are under increasing pressure from

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doi:10.1016/j.agee.2010.03.013

abandonment and intensification (Bota et al., 2005; Oñate et al., 2007). Fears have been expressed that the CAP reform will exacerbate these trends, due to a potential reduction of gross profit margins under the new CAP mechanisms and a derived risk of activity cessation (Oñate et al., 2007; Tranter et al., 2007). It is also possible that changes in livestock headage payments will affect pastoral regimes, fostering the decline of traditional systems of extensive sheep grazing and their eventual replacement by more rewarding cattle production systems (Serrão and Coelho, 2005; Tranter et al., 2007). There is thus an urgent need for understanding in detail the responses of cereal-steppe birds to these land use changes, in order to prevent undesired effects of the CAP reform.

In this study we examined variation in grassland bird breeding densities in relation to grazing regimes and the fragmentation of open agricultural land, across a spatial gradient ranging from intensive dry cereal cultivation to land abandonment, in cereal-steppes of Southern Portugal. The study focused on fallow land habitats because they tend to occupy a large proportion of the traditional cereal-steppe landscape, they are highly vulnerable to changing farming practices, and they are particularly important for grassland bird conservation (Delgado and Moreira, 2000; Moreira et al., 2005). Results were used to discuss the likely impact of land use changes resulting from CAP reform and to formulate recommendations for agri-environment schemes targeted at Mediterranean grassland birds.

2. Methods

The study was conducted in Southern Portugal, mostly within the Special Protection Area (SPA) of Castro Verde (85,000 ha). Climate is Mediterranean, with hot summers (averaging 24.2 °C in July), mild winters (averaging 9.3 °C in January), and more than 75% of annual rainfall (500–600 mm) concentrated in October–March. The landscape is flat or gently undulating (100–300 m a.s.l.) and is dominated by an open agricultural mosaic of cereal, fallow and ploughed fields, created by rotational dry cereal cultivation. From north to south there is a gradient of intensification-abandonment, associated with spatial variation in soil productivity. The northern part is flatter and soils more productive, and so the proportion of land cultivated each year is high and fallow fields are short-term (<3 years). In the south there is a mosaic of shrubland interspersed with old fallow fields (up to 10 years), as a result of agricultural abandonment and shrub encroachment. Finally, in the central part of the study area the cultivation of cereals is associated with medium to long rotations (2–5 years), and so grazed fallow fields predominantly occupy the arable land. Throughout the region there are holm oak (*Quercus rotundifolia*) pastoral woodlands of variable tree cover (*montados*). Forest plantations are increasing due to afforestation of abandoned arable land with umbrella pine (*Pinus pinea*) and holm and cork oaks (*Q. suber*). In part of the area there is an agri-environment subsidy scheme, whereby farmers are compensated for maintaining agricultural practices favouring bird conservation. Details of the study area are provided elsewhere (Moreira et al., 2007).

The study focused on the most abundant grassland bird species breeding in fallow fields of Castro Verde SPA (Moreira et al., 2007), all of which are species of European conservation concern (BirdLife International, 2004): little bustard *Tetrax tetrax*, calandra lark *Melanocorypha calandra*, short-toed lark *Calandrella brachydactyla*, Thekla lark *Galerida theklae*, and corn bunting *Emberiza calandra*. The distribution and abundance of these species at Castro Verde were recently described by Moreira et al. (2007): corn bunting was the most abundant species (*ca.* 16,000 pairs), showing the highest breeding densities in cereal fields; little bustards (*ca.* 4200 displaying males) and calandra larks (*ca.* 6200 pairs) were also abundant, and they were strongly associated with fallow fields; short-toed larks (*ca.* 1500 pairs) were common in ploughed land and, to a lesser extent, in fallow fields, whereas Thekla larks (*ca.* 3700 pairs) occurred most often in grasslands interspersed with shrubs and trees.

2.1. Sampling design

Sampling was carried out on fallow fields selected within a 20 km × 30 km rectangle following the stratified random procedure described by Moreira et al. (2005), in order to cover the north–south spatial gradient of agricultural intensification-abandonment. A total of 49 fallow fields of approximately 10 ha each (mean = 9.4 ha ± 1.6 S.D., range: 5.5–13.6) were selected in 2000, with the constraints of just one field per farm and a minimum distance of 500 m between fields, to reduce eventual non-independence due to similarities in farm management and spatial autocorrelation. Long-abandoned fields (>20% cover by shrubs) and open oak woodlands (>5% cover by trees) were dropped from selection because they tend to be less used by steppe birds of conservation concern than open fields (Delgado and Moreira, 2000; Moreira et al., 2005). Due to logistical constraints, 36 fields were sampled in spring 2000 and another 13 in spring 2001. Sampling was repeated in 2004, using the same set of fields selected in 2000/01. However, part of these (19) had been ploughed or sown with cereals due to the normal rotation cycle, and so a new fallow field that met the initial criteria was selected at <500 m of each transformed field. In nine cases there were no fields meeting the selection criteria, and so sampling in 2004 was reduced to 40 sites and the remaining nine sites were discarded from further analysis.

2.2. Bird sampling

Bird sampling was based on the territory mapping technique (Bibby et al., 2000). Each field was counted six times, at about 2-w. intervals, from mid-March to mid-June. In each visit, the entire field was walked so that the observer approached to within 50 m or less of every point. All individuals were identified and recorded on detailed field maps (1:2000), where the position of marking poles and noteworthy topographical features (e.g., dirt tracks, stone piles and shrub patches) was depicted. Counts were always carried out within 4 h after sunrise and 2 h before sunset, with none in rainy or windy conditions. The number of breeding territories was estimated by compiling the information obtained in the six counts. Little bustard estimates refer to territorial males, because this species has a polygynous mating system (Traba et al., 2008). Sampling was carried out by five experienced ornithologists (AD, FM, LG, LR, RM) in 2000/01 and by a single one (LR) in 2004, but the estimate of breeding territories from field sketches of bird observations was always carried out by the same person (RM). This was considered adequate to enhance comparability across sites and over time, because the territory mapping technique is rather robust to variation in observer efficiency (Bibby et al., 2000), and because only five easily identified species were studied in an open landscape with unobstructed views.

2.3. Explanatory variables

Factors influencing bird densities were analyzed using two sets of explanatory variables, reflecting field management and landscape context. Variables were selected based on consideration of the existing literature on habitat associations of Mediterranean grassland birds (e.g., Bota et al., 2005; Serrano and Astrain, 2005; Reino et al., 2009; Morgado et al., 2010). Fields were characterized from six variables expressing the age and height of the herbaceous sward, the type and intensity of use by livestock, and the presence