Bird community patterns in sub–Mediterranean pastures: the effects of shrub cover and grazing intensity

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Nikolov, S. C., Demerdzhiev, D. A., Popgeorgiev, G. S. & Plachiyski, D. G., 2011. Bird community patterns in sub–Mediterranean pastures: the effects of shrub cover and grazing intensity. *Animal Biodiversity and Conservation*, 34.1: 11–21.

Abstract
Bird community patterns in sub–Mediterranean pastures: the effects of shrub cover and grazing intensity.— Shrubs are widely considered a threat to grassland biodiversity. We investigated the effects of shrub cover and grazing intensity on bird communities in sub–Mediterranean pastures in Bulgaria. The point–count method was used on 80 plots in open (< 10% shrub cover) and shrubby (approx. 20% cover) pastures under either intensive or extensive management (grazing intensity) from 2008 to 2009. We recorded a total of 1,956 observations of birds from 53 species. Main environmental gradients accounting for the bird community pattern were related to vegetation succession and land productivity. Bird species richness was higher in shrubby pastures than in open sites, while no effect was found in respect to total bird abundance. Bird species diversity (*i.e. H'* index) was highest in extensive shrubby pastures. Shrubland specialists were positively affected by shrub cover and extensive management of pastures while grassland and woodland specialists showed no significant response to these factors. We conclude that a small proportion of shrubs within pastures may be beneficial for farmland birds and sustainable management of pastures could be achieved by greater flexibility of national agri–environmental schemes.

Key words: Agri–environmental scheme, Farmland birds, Grassland management, Semi–natural habitats, Shrubby vegetation.

Resumen
Patrones de las comunidades de aves en los pastos submediterráneos: el efecto de la cubierta arbustiva y la intensidad de pastoreo.— Se suele considerar a los arbustos como una amenaza a la biodiversidad de los pastos. Investigamos los efectos de la cubierta arbustiva y la intensidad del pastoreo sobre las comunidades de aves en los pastos submediterráneos de Bulgaria. Se utilizó el método de estaciones de escucha en 80 puntos de registro en pastos abiertos (cubierta arbustiva < 10%) y arbustivos (aproximadamente un 20% de la superficie cubierta), con una gestión de pastoreo tanto intensiva como extensiva desde 2008 a 2009. Registramos un total de 1.956 observaciones de aves pertenecientes a 53 especies distintas. Los gradientes ambientales principales responsables de los patrones de las comunidades de aves se relacionaron con la sucesión de la vegetación y la productividad de la tierra. La riqueza de especies de aves era mayor en los pastos arbustivos que en los lugares abiertos, aunque no se observó efecto alguno con respecto a la abundancia total de aves. La mayor diversidad de especies de aves (índice *H'*) se daba en los pastos arbustivos con gestión extensiva. Los especialistas en zonas arbustivas se veían afectados positivamente por la cubierta arbustiva y la gestión extensiva de los pastos, mientras que los especialistas de praderas y bosques no presentaron ninguna respuesta positiva a dichos factores. Nuestra conclusión es que una pequeña proporción de arbustos dentro de los pastos puede ser beneficiosa para las aves de tierras de labrantío, y la gestión sostenible de los pastos podría alcanzarse mediante una mayor flexibilidad de los esquemas agroambientales nacionales.

Palabras clave: Esquema agroambiental, Aves de labrantío, Gestión de prados, Hábitats seminaturales, Vegetación arbustiva.

(Received: 14 VI 10; Conditional acceptance: 6 IX 10; Final acceptance: 10 II 11)

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ISSN: 1578–665X

Introduction

Semi–natural grasslands are among the high nature value farming systems of conservation concern as they are biodiversity–rich and provide agricultural benefits through stock grazing and haymaking (Henle et al., 2008). These habitats were created under traditional agricultural practices but currently, due to agricultural intensification or land abandonment, they have now become significantly reduced in area in northern European (Pärt & Söderström, 1999), western European (Tucker & Heath, 1994; Fuller et al., 1995) and eastern European countries (Meshinev et al., 2005).

In the European Union, semi–natural grasslands are under the regulation of the Common Agricultural Policy (CAP) which was adopted in 1957 to increase agricultural production by ensuring sufficient food for all inhabitants and a fair standard of living for farmers (Verhulst et al., 2004). Implementation of the CAP resulted in a polarization of production areas by stimulating land use intensification in some areas (Donald et al., 2002) and leading to abandonment of other, marginally profitable areas (Bignal, 1998). It was found that intensification or abandonment of land management can greatly reduce biodiversity by threatening the survival of many species adapted to the diversity of structures and resources of high nature value farmlands (Sirami et al., 2007; Kleijn et al., 2009; Nikolov, 2010). Grassland bird populations for instance, declined sharply due to agricultural intensification in Europe over the past half century (Gregory et al., 2004; Donald et al., 2006). On the other hand, abandonment of land management benefits vegetation succession through the development of woody vegetation, providing benefits to shrubland and woodland birds whilst negatively affecting open–habitat specialists (Preiss et al., 1997; Suárez–Seoane et al., 2002; Pons et al., 2003; Verhulst et al., 2004). As a result, the development of shrubby and woody vegetation was considered a potential threat to grassland biodiversity, and the CAP strongly advised removal of these habitat features as a management recommendation (Boccaccio et al., 2009). In many countries (*e.g.* France, Sweden, Greece and Bulgaria), this measure was not tested but applied directly in the national agri–environmental schemes (Lefranc, 1997; Pärt & Söderström, 1999; Söderström et al., 2001; Kati & Sekercioglu, 2006; Nikolov, 2010). Indeed, in northern and southeastern Europe small covers of woody vegetation (≤ 20%) were found to increase avian species richness and diversity by favouring some threatened species (Pärt & Söderström, 1999; Söderström et al., 2001; Nikolov, 2010).

The main objective of this study was to test the effects of shrub cover and grazing intensity on farmland birds in sub–Mediterranean pastures. The obtained results may serve as a basis for more sustainable and regionally–oriented pasture management aiming to maintain species rich, diverse bird communities.

Methods

Study area

The study area covers the territory of the Special Protected Area (SPA) Besaparski Hills (147.7 km^2) in southern Bulgaria (42° 7' N–24° 23' E; fig. 1). The landscape represents sub–Mediterranean limestone hills with an average altitude of 350 m a.s.l. (ranging from 184 m a.s.l. to 536 m a.s.l.) (Demerdzhiev, 2007). Most of the area is covered by arable land (about 50% of the territory) and by dry grasslands with some shrub heath (about 33% of the territory) and the rest of the territory is covered by vineyards and orchards (6%), wetlands (3%), stone pits (3%), urban areas and roads (3%) and small forests (1%). Grasslands are not fertilized and most of them are used for pastures (mainly for sheep and cattle).

Study design

Based on a digital map of the area (Bulgarian Society for the Protection of Birds, unpublished data), a total of 80 point–count stations were equally distributed and located randomly within two categories of pastures (open pastures with up to 10% shrub cover and shrubby pastures with more than 10% shrub cover) with the restriction that any two adjacent point–count stations should be a minimum of 250 m apart (Ralph et al., 1995). All study plots with difficult accessibility to the field were replaced using a second random selection. As a result, an aggregation of study plots in the eastern part of the study area appeared, but as the study plots were equally distributed between the studied pastureland categories (25 *vs.* 25 study plots in shrubby and open pastures, respectively) within the area of aggregation, we assumed that our data were not biased by spatial autocorrelation effects. After a pilot visit to the study area, we found that 41 point–count stations were located within open pastures and 39 in shrubby pastures. Supplementary data on grazing intensity within the studied areas was collected from the local agricultural authorities and studied plots were classified according to their grazing regime as intensively grazed (0.8 AU ha^{-1}; n = 30 study plots) and extensively grazed pastures (0.2 AU ha^{-1}; n = 50 study plots). Finally, we used 31 study plots in open and extensive pastures, 10 in open and intensive pastures, 19 in shrubby and extensive pastures and 20 in shrubby and intensive pastures.

Fieldwork was carried out during the breeding seasons of 2008 and 2009. Birds were sampled twice per year (in May and June), in the mornings (6:00–10:00 a.m.), under appropriate weather conditions and by the same observer (D. D.). The point count method (Gibbons & Gregory, 2006) was applied, with a counting period of 5 min and a radial distance of 100 m. All birds seen or heard were recorded. Individuals simply flying over the point–count stations and not foraging in flight were excluded from the analysis (Batáry et al., 2007). To investigate how different ecological groups of birds respond to vegetation composition within pastures in respect to their habitat specialization we

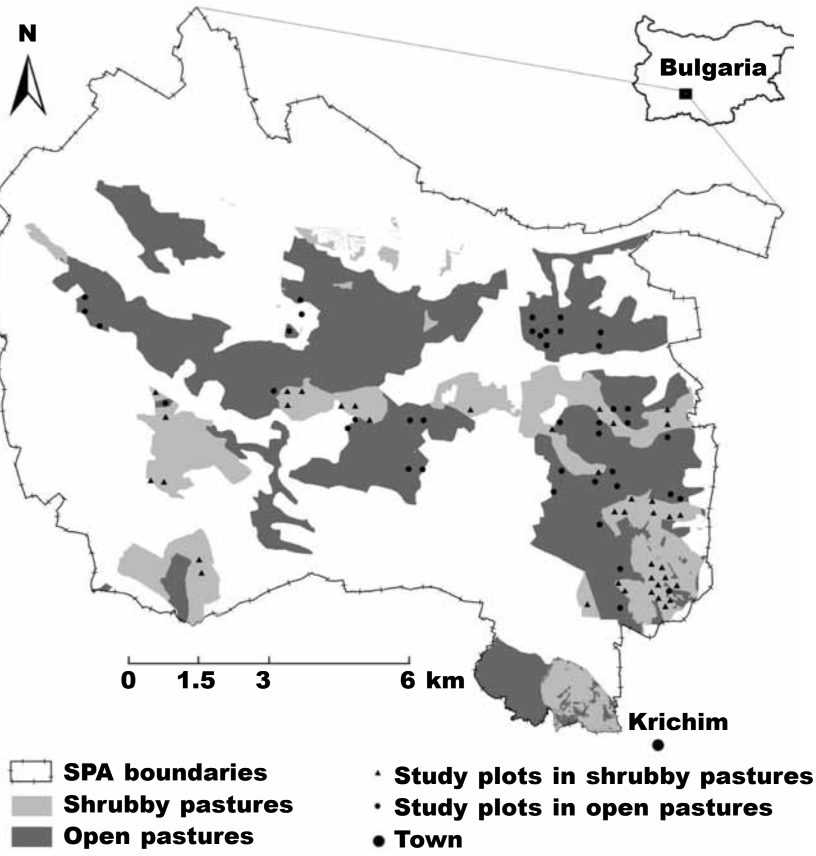

Fig. 1. Location of the study area (SPA Besaparski Hills) in Bulgaria and distribution of point–count stations within the semi–natural grasslands.

Fig. 1. Localización del area de estudio (área protegida especial de las colinas de Besaparski) en Bulgaria y distribución de las estaciones de escucha en el interior de los prados seminaturales.

classified birds as grassland, shrubland or woodland specialists, following Iankov (2007). The conservation status of birds at the European and national levels was described following BirdLife International (2004) and Spassov (2007), respectively (appendix).

Data on habitat composition were collected within a radius of 50 m centred on each point–count station. The relative cover of rocks and stones, arable land and vegetation layers was estimated visually and recorded in percentages (%). The following vegetation layers were recognized in the field: (1) grass, consisted mainly of *Medicago* spp., *Trifolium* spp., *Sideritis montana*, *Chrysopogon gryllus, Dichnthium ischaemum, Eryngium campestre* and *Stipa capillata*; (2) shrubs, consisted of woody vegetation up to 2 m height and dominated mainly by *Paliurus spina–christi, Rubus* sp.*, Jasminum fruticans, Juniperus oxycedrus*; and (3) trees, consisted of woody vegetation above 2 m height and dominated mainly by *Quercus pubescens*. Elevation was recorded using a Global Positioning Systems unit (Etrex Summit). Studied pasture categories differed significantly only in their grass cover and shrub cover (table 1).

Data analyses

Bird data were square root transformed and habitat variables were arcsine transformed to approach normal distributions. For comparisons of environmental variables between open and shrubby pastures, *t*–test for unpaired samples was performed using STATISTICA version 7.0 software package (StatSoft, 2004). To analyze bird species richness and overall bird abundance we used the mean values of the maximum numbers of species and individuals recorded at each point–count station during both visits in both years. Bird species diversity was calculated using the Shannon–Wiener diversity index *H'*.

Relationships between bird species and habitat characteristics were determined by Canonical Correspondence Analysis (CCA) computed in CANOCO 4.5 software (Ter Braak & Smilauer, 2002). Length of

Table 1. Habitat characteristics (mean ± SE) and their comparisons (*t*–test for independent samples; StatSoft, 2004) in shrubby and open pastures in SPA Besaparski Hills, S Bulgaria: N. Sample size; * Significant *P*–values are in bold.

Table 1. Características del hábitat (media ± EE) y sus comparaciones (test t *para muestras independientes; StatSoft, 2004) en pastos arbustivos y abiertos del área protegida especial de las colinas de Besaparski, S de Bulgaria: N. Tamaño de la muestra; * Los valores significativos de* P *se dan en negrita.*

Environmental variables	Shrubby pastures (N = 39)	Open pastures (N = 41)	t_{78}	*P* *
Altitude	326.49 ± 12.00	300.15 ± 10.57	1.65	0.103
Cover of grass	64.10 ± 2.82	85.82 ± 3.09	–6.35	**< 0.001**
Cover of shrubs	21.09 ± 1.75	2.12 ± 0.40	10.60	**< 0.001**
Cover of trees	1.92 ± 1.31	0.57 ± 0.30	1.03	0.305
Cover of rocks	8.72 ± 2.54	8.41 ± 2.66	0.09	0.931
Cover of arable land	2.76 ± 1.41	3.07 ± 1.75	–0.17	0.868

bird data gradient was checked by preliminary detrended correspondence analysis (DCA) and unimodal ordination was applied even though the gradient was relatively short (*i.e.* 2.82 for the first canonical axis), because this model better explained data variability and because the length of the gradient was close to the range for which both linear and unimodal methods work well (Lepš & Šmilauer, 2003). The Monte–Carlo permutation test was used to assess the statistical significance of canonical axes (Lepš & Šmilauer, 2003).

The effects of shrub cover, grazing intensity and their interaction on birds at community and ecological group levels were analysed by General Linear Models (GLM) in STATISTICA version 7.0 software package (StatSoft, 2004). For each of the studied dependent variables (*i.e.* bird species richness, *H'* diversity index and abundance) separate GLM was conducted, where pasture categories (in respect of shrub cover and grazing intensity) were categorical factors and studied habitat characteristics (see table 1) were continuous predictors. In the GLM, a Tukey HSD post–hoc test was used to determine significant differences between groups ($\alpha = 0.05$).

Results

Habitat composition and bird community pattern

A total of 1,956 individuals from 53 species were recorded in the semi–natural grasslands of Besaparski Hills SPA (appendix). The main environmental gradient in the studied habitat was related to vegetation succession (representing the transition of open to shrubby pastures, fig. 2) and was represented by the first CCA axis accounting for 15.6% of bird data variability (species–environment correlation = 0.743). All grassland specialists, excluding the woodlark *Lullula arborea*, showed a positive association with the open semi–natural grasslands (fig. 2). Shrubland and woodland species displayed the opposite pattern, being associated with semi–natural grasslands with an increased cover of shrubs and trees. However, these species were more widely spread along the gradient. Apart from grassland species, the open pastures also sheltered aerial feeders (*e.g.* European bee–eater *Merops apiaster* and barn swallow *Hirundo rustica*) or birds that forage in open landscapes (*e.g.* Spanish sparrows *Passer hispaniolensis*).

The second environmental gradient was related to land productivity, (represented by land conversion: higher cover of arable lands at the one extremity of the gradient and the less productive rocky fields at the other extremity, fig. 2) and was represented by the second CCA axis accounting for 8.1% of bird data variability (species–environment correlation = 0.736). Most birds associated with this gradient were shrubland and woodland species: some of them benefited from arable mosaics (*e.g.* common cuckoo *Cuculus canorus*, common starling *Sturnus vulgaris* and European roller *Coracias garrulus*), while others were associated mainly with the less productive grasslands (*e.g.* ortolan bunting *Emberiza hortulana*, blackcap *Sylvia atricapilla* and European greenfinch *Carduelis chloris*).

Effects of shrubby vegetation

Species richness was positively affected by the cover of shrubby vegetation while the effect of grazing intensity was not significant (table 2). Number of species ranged from 3–33 species/point–count station (mean ± SE = 7.56 ± 0.89, n = 39 point–count stations) in shrubby pastures and 1–15 species/point–count station (mean ± SE = 4.95 ± 0.43, n = 41 point–count stations) in open pastures. Bird species diversity (*i.e. H'* index) was influenced

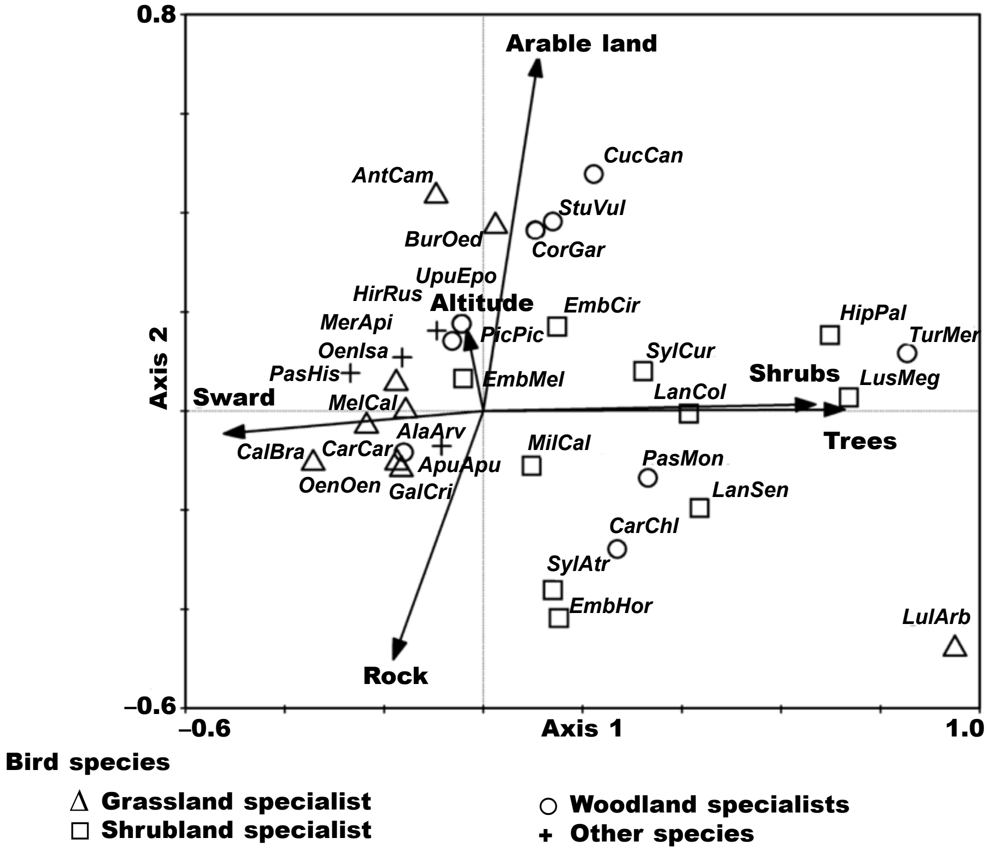

Fig. 2. Two–dimensional ordination by CCA relating bird abundances to habitat characteristics in the sub–Mediterranean lowland pastures in southern Bulgaria. The first two canonical axes account for 23.9% of bird data variability and all axes are statistically significant (Monte–Carlo test based on 499 random permutations, $F = 2.06$, $p = 0.02$). Environmental variables are indicated by arrows. (Only brid species with fit > 5% in the model are shown; for bird species acronyms see the appendix.)

Fig. 2. Ordenación bidimensional por análisis canónico de correspondencias (CCA) que relaciona las abudancias de aves con las características del hábitat en los pastos submediterráneos de tierras bajas del sur de Bulgaria. Los dos primeros ejes canónicos responden del 23,9% de la variabilidad de los datos de las aves, y todos los ejes son estadísticamente significativos (test de Monte–Carlo, basado en 499 permutaciones al azar, F *= 2,06,* p *= 0,02). Las variables ambientales se indican por medio de flechas. (Sólo se muestran las especies de aves que se ajustan > 5% al modelo; para los acrónimos de las especies de aves, ver el apéndice.)*

by the interaction between the effects of shrubby vegetation cover and grazing intensity (table 2), and *H'* index had the highest values in extensive shrubby pastures (extensive shrubby pastures: mean *H'* ± SE = 1.58 ± 0.005, n = 19; extensive open pastures: mean *H'* ± SE = 1.55 ± 0.004, n = 31; intensive shrubby pastures: mean *H'* ± SE = 1.56 ± 0.006, n = 20; intensive open pastures: mean *H'* ± SE = 1.56 ± 0.009, n = 10). Total bird abundance showed no significant response to shrub cover or grazing intensity (table 2).

Grassland and woodland birds did not show significant response to the cover of shrubs within pastures or grazing intensity, while the low proportion of shrub cover and extensive grazing of pastures were found to increase the species richness and abundance of shrubland birds (table 3).

Regarding conservation status, open and shrubby pastures sheltered similar numbers but different species from conservation priority. Of the 15 species associated with open pastures (left sector of the biplot in fig. 2), three are included in Annex 1 of the Directive on the conservation of wild birds (Directive 2009/147/EC), 10 have an unfavourable status in Europe and three are known to be decreasing in Bulgaria. Of the 17 species associated with shrubby pastures (right sector of the biplot in fig. 2), five are included in Annex 1 of the Directive 2009/147/EC, nine have an unfavourable status in Europe and three are known to be decreasing in Bulgaria.

Table 2. The effects of grazing intensity (GI), shrubby cover (SC) and their interaction (INT) on bird community parameters in semi–natural grasslands of SPA Besaparski Hills (GLM, StatSoft, 2004): * Significant *P*–values are in bold; ** Between–group comparisons were determined by applying Tukey HSD post–hoc test, only significant differences (P < 0.05) are shown.

*Table 2. Los efectos de la intensidad de pastoreo (GI), la cubierta arbustiva (SC) y su interacción (INT) con los parámetros de las comunidades de aves en las praderas seminaturales del área protegida especial de las colinas de Besaparski (modelos lineales generales, GLM, StatSoft, 2004): * Los valores de* P *significativos están en negrita; ** Las comparaciones entre grupos se determinaron aplicando el test HSD de Tukey post–hoc, sólo se muestran las diferencias significativas (*P *< 0,05).*

Parameter	R^2	Effect	$F_{1, 76}$	*P* *	Interpretation**
Species richness	0.13	GI	0.91	0.342	
		CS	5.68	**0.019**	Shrubby pastures > open pastures
		INT	0.98	0.326	
Species diversity	0.11	GI	< 0.01	0.703	
		CS	2.0	0.167	
		INT	5.0	**0.031**	Extensive shrubby pastures > extensive open pastures
Total abundance	0.05	GI	2.76	0.101	
		CS	0.13	0.721	
		INT	0.21	0.885	

Discussion

Birds and shrubby vegetation cover

Our results demonstrate that a small proportion of shrubby vegetation (*ca*. 20%) within semi–natural grasslands may increase the species richness of bird communities in the sub–Mediterranean pastures of southern Bulgaria. This finding is consistent with the results from dry pastures in northern Europe (Pärt & Söderström, 1999) and upland pastures in south–eastern Europe (Nikolov, 2010) where retention of 10–15% shrub cover within pastures is advised as beneficial for farmland birds dependent on shrubs. This phenomenon could be explained by the increased habitat complexity within shrubby pastures, which provides more varied resources to bird species for nesting, searching for food, displaying (Verhulst et al., 2004) or escaping from predators (Shaefer & Vogel, 2000). This finding contributes to the concept that habitat heterogeneity is a key predictor for species richness within farmlands (Benton et al., 2003; Kati et al., 2009).

Most of the positive effects of shrubby vegetation upon the structure of bird communities could be attributed to shrubland birds. Often this is a *post–factum* effect observed after land abandonment and the resulting secondary succession of the vegetation (Preiss et al., 1997; Suárez–Seoane et al., 2002; Verhulst et al., 2004; but see Batáry et al., 2007). However, a limited presence of shrubby vegetation (ca. 20% cover) had no significant effects on grassland specialists. This was not expected as the presence of shrubs and trees within pastures reduces the overall area of the prime habitat for this group of birds. In western and central Europe, grassland bird abundance was observed to decrease as a consequence of the reduction of open grassland habitats (Preiss et al., 1997; Brotons et al., 2005) and it has also been found that increase in habitat heterogeneity may suppress the abundance of grassland specialists (Batáry et al., 2007). Possible ecological mechanisms explaining this pattern include an increasing predation risk for some grassland specialists due to the high vegetation cover in the surroundings (Shaefer & Vogel, 2000) or increased nest predation (Suárez & Manrique, 1992). In our study, the lack of negative effects of shrubby vegetation cover on grassland specialists may be explained by the relatively low cover of this habitat feature within studied pastures (about 20% mean cover for shrubby pastures; see table 1).

Conversion of pastures into arable land

Although several species (*e.g.* common cuckoo, common starling and European roller) were positively affected by the presence of arable lands, this should not be misinterpreted as a good reason for the conversion of grassland habitats into arable lands. In our study, the only threatened species associated with

Table 3. The effects of grazing intensity (GI), shrub cover (SC) and their interaction (INT) on species richness and abundance of ecological groups of birds in respect of their habitat specialization in pastures of Besaparski Hills, Bulgaria (GLM, StatSoft, 2004): * Significant *P*–values are in bold; ** Between–group comparisons were determined by applying Tukey HSD post–hoc test; only significant differences ($P < 0.05$) are shown.

*Tabla 3. Efectos de la intensidad de pastoreo (GI), la cubierta arbustiva (SC) y su interacción (INT) con la riqueza de especies y la abundancia de grupos ecológicos de aves respecto a su especialización en cuanto al hábitat en los pastos de las colinas de Besaparski, Bulgaria (modelos lineales generales–GLM, StatSoft, 2004): * Los valores significativos de* P *se dan en negrita; ** Las comparaciones entre grupos se determinan por medio del test HSD de Tukey post–hoc; sólo se muestran las diferencias significativas (*P *< 0,05).*

Bird group / Parameter	R^2	Effect	$F_{1,76}$	*P* *	Interpretation **
Grassland birds					
Species richness	0.03	GI	0.79	0.377	
		SC	0.33	0.565	
		INT	0.66	0.420	
Abundance	0.08	GI	2.41	0.125	
		SC	1.73	0.192	
		INT	0.10	0.748	
Shrubland birds					
Species richness	0.22	GI	4.3	**0.041**	Extensive pastures > intensive pastures
		SC	9.26	**0.003**	Shrubby pastures > open pastures
		INT	0.68	0.412	
Abundance	0.23	GI	11.14	**0.001**	Extensive pastures > intensive pastures
		SC	4.17	**0.045**	Shrubby pastures > open pastures
		INT	0.66	0.418	
Woodland birds					
Species richness		GI	0.99	0.321	
		SC	2.19	0.143	
		INT	< 0.01	0.965	
Abundance		GI	1.91	0.171	
		SC	0.37	0.544	
		INT	0.18	0.676	

arable lands was the European roller, but it is known that highly intensified agricultural practices could have deleterious effects on its populations (Avilés & Parejo, 2004). Furthermore, some grassland specialists, including calandra lark *Melanocorypha calandra* and short–toed lark *Calandrella brachydactyla*, which are from high conservation priority within Natura 2000 network, are negatively affected by the presence of arable lands in grassland–dominated landscapes (Brotons et al., 2005). Therefore, our results suggest that it may be possible to support small parcels of arable land as a part of the rural mosaic within SPAs, but this practice should be adopted with caution and strictly controlled, as it is recognized as a major cause of the loss of the semi–natural grassland habitats (Robertson et al., 1990) and one of the main threats to the local avifauna (Demerdzhiev, 2007).

Bird conservation in sub–Mediterranean pastures

The CAP was implemented rapidly in many countries of the European Union, and most agri–environment schemes were applied without sufficient testing at national scales (Wrbka et al., 2008; Stoate et al., 2009;

Nikolov, 2010). It was expected that the fast process of CAP implementation and the resulting changes in agricultural land use (*i.e*. agricultural intensification and abandonment) would cause alterations to traditional extensive exploitation systems and structure of grassland habitats (Tucker & Evans, 1997). Some of these effects on birds have been investigated (*e.g.* Batáry et al., 2007; Herzon et al., 2008; Nagy et al., 2009), but they are regionally dependent and should not be directly extrapolated to represent other locations with different cultural, economical and landscape characteristics (Nikolov, 2010). For instance, in many countries the removal of shrubby vegetation from pastures was promoted as an agricultural practice by CAP (Boccaccio et al., 2009), being considered as a threat to grassland biodiversity (Preiss et al., 1997; Stefanović et al., 2008). However, several studies from northern and south–eastern Europe have provided sound evidence that the availability of shrubby vegetation within semi–natural grasslands may be beneficial for the local avifauna (Pärt & Söderström, 1999; Söderström et al., 2001; Kati & Sekercioglu, 2006; Nikolov, 2010). Our results support this statement, demonstrating that from a conservation viewpoint open and shrubby pastures benefit a similar number of species of high conservation priority. We found that the small proportion of shrubby vegetation within pastures should not be considered as a threat, but as a potential factor increasing the conservation value of the protected area through the addition of some non–grassland threatened species to the existing typical grassland avifauna. Therefore, a possible way to counteract the negative effects of CAP on avian diversity in sub–Mediterranean areas could be at the level of national agri–environmental schemes (Verhulst et al., 2004) by providing higher flexibility of national standards at the regional scale (Wrbka et al., 2008). Particularly, regarding protected areas in the ecological networks this could be done by elaboration of management plans and zoning of agricultural activities at local scale. Finally, to ensure the effective long–term conservation of birds that are dependent on pastoral landscapes, it is crucial to assess the potential for resulting conflicts between intended outcomes for farmers and biodiversity (Henle et al., 2008). Therefore, we strongly advise further investigation into the stock holder's production losses in relation to the availability of shrubs within pastures, and the potential opportunities for the compensation of these losses.

Acknowledgements

The study was funded by the project 'Conservation of globally important biodiversity in high nature value semi–natural grasslands through support for the traditional local economy' supported by the UNDP (Project No. 43595) and GEF (Project ID 2730) and executed by the Bulgarian Society for the Protection of Birds / BirdLife Bulgaria. The authors are grateful to Kiril Metodiev for providing the floristic data and to Hristo Ivanov for assistance with bird counts. The paper improved greatly with the comments from three anonymous referees and the editor, and English language editing by Jamie Carr.

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Appendix. List of bird species found in pastures of SPA Besaparski Hills. Ecological groups (EG) of birds according to their habitat specialization (Iankov, 2007): G. Grassland birds; S. Shrubland birds; W. Woodland birds; O. Other birds. The status in Europe and Bulgaria follow BirdLife International (2004) and Spassov (2007), respectively.

Apéndice. Lista de especies de aves encontradas en los pastos del área de protección especial (SPA) de las colinas de Besaparski. Grupos ecológicos (EG) de aves en función de su especialización en cuanto al hábitat (Iankov, 2007): G. Aves de prados; S. Aves de zonas arbustivas; W. Aves de zonas arboladas; O. Otras aves. El estatus en Europa y en Bulgaria según BirdLife International (2004) y Spassov (2007), respectivamente.

Species		Acronym	EG	Europe	Bulgaria
Eurasian Hobby	*Falco subbuteo*	*FalSub*	O	Secure	
Common Kestrel	*F. tinnunculus*	*FalTin*	O	Declining	Uncertain
Common Quail	*Coturnix coturnix*	CotCot	G	Depleted	Decreasing
Stone–curlew	*Burhinus oedicnemus*	*BurOed*	G	Vulnerable	
Common Cuckoo	*Cuculus canorus*	*CucCan*	W	Secure	Uncertain
Common Swift	*Apus apus*	*ApuApu*	O	Secure	Uncertain
Eurasian Hoopoe	*Upupa epops*	*UpuEpo*	W	Declining	Decreasing
European Bee–eater	*Merops apiaster*	*MerApi*	O	Depleted	
European Roller	*Coracias garrulus*	*CorGar*	W	Vulnerable	
Green Woodpecker	*Picus viridis*	*PicVir*	W	Depleted	
Great Spotted Woodpecker	*Dendrocopos major*	*DenMaj*	W	Secure	Uncertain
Common Skylark	*Alauda arvensis*	*AlaArv*	G	Depleted	Decreasing
Crested Lark	*Galerida cristata*	*GalCri*	G	Depleted	Decreasing
Woodlark	*Lullua arborea*	*LulArb*	G	Depleted	
Greater Short–toed Lark	*Calandrella brachydactyla*	*CalBra*	G	Declining	
Calandra Lark	*Melanocorypha calandra*	*MelCal*	G	Declining	
Barn Swallow	*Hirundo rustica*	*HirRus*	O	Depleted	Uncertain
Red–rumped Swallow	*H. daurica*	*HirDau*	O	Secure	
Common House Martin	*Delichon urbica*	*DelUrb*	O	Declining	Uncertain
Tawny Pipit	*Anthus campestris*	*AntCam*	G	Declining	
Common Nightingale	*Luscinia megarhynchos*	*LusMeg*	W	Secure	Uncertain
Northern Wheatear	*Oenanthe oenanthe*	*OenOen*	G	Declining	
Isabelline Wheatear	*O. isabellina*	*OenIsa*	G	Secure	
Black–eared Wheatear	*O. hispanica*	*OenHis*	O	Depleted	
Song Thrush	*Turdus philomelos*	*TurPhi*	W	Secure	Uncertain
Common Blackbird	*T. merula*	*TurMer*	W	Secure	
Blackcap	*Sylvia atricapilla*	*SylAtr*	W	Secure	Uncertain
Lesser Whitethroat	*S. curruca*	*SylCur*	S	Secure	
Common Whitethroat	*S. communis*	*SylCom*	S	Secure	Increasing
Olivaceous Warbler	*Hippolais pallida*	*HipPal*	S	Secure	
Chiffchaff	*Phylloscopus collybita*	*PhyCol*	W	Secure	
Great Tit	*Parus major*	*ParMaj*	W	Secure	Uncertain
Long–tailed Tit	*Aegithalos caudatus*	*AegCau*	W	Secure	
Red–backed Shrike	*Lanius collurio*	*LanCol*	S	Depleted	Decreasing

Appendix. (Cont.)

Species		Acronym	EG	Europe	Bulgaria
Woodchat Shrike	*L. senator*	*LanSen*	S	Declining	
Lesser Grey Shrike	*L. minor*	*LanMin*	S	Declining	
Common Magpie	*Pica pica*	*PicPic*	W	Secure	Uncertain
Eurasian Jay	*Garrulus glandarius*	*GarGla*	W	Secure	Decreasing
Common Raven	*Corvus corax*	*CorCor*	O	Secure	
Common Starling	*Sturnus vulgaris*	*StuVul*	W	Declining	Decreasing
Rose–coloured Starling	*S. roseus*	*StuRos*	O	Secure	
Eurasian Golden Oriole	*Oriolus oriolus*	*OriOri*	W	Secure	Uncertain
House Sparrow	*Passer domesticus*	*PasDom*	O	Declining	Uncertain
Spanish Sparrow	*Passer hispaniolensis*	*PasHis*	O	Secure	
Eurasian Tree Sparrow	*P. montanus*	*PasMon*	W	Declining	Uncertain
Common Linnet	*Carduelis cannabina*	*CarCan*	G	Declining	
European Goldfinch	*C. carduelis*	*CarCar*	W	Secure	Uncertain
European Greenfinch	*C. chloris*	*CarChl*	W	Secure	Uncertain
Ortolan Bunting	*Emberiza hortulana*	*EmbHor*	S	Depleted	Uncertain
Yellowhammer	*E. citrinella*	*EmbCit*	S	Secure	
Cirl Bunting	*E. cirlus*	*EmbCir*	S	Secure	
Black–headed Bunting	*E. melanocephala*	*EmbMel*	S	Depleted	Uncertain
Corn Bunting	*Miliaria calandra*	*MilCal*	S	Declining	Decreasing