Biological Conservation 194 (2016) 150–157

Contents lists available at ScienceDirect

Biological Conservation

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

Evaluating conservation tools in Polish grasslands: The occurrence of birds in relation to agri-environment schemes and Natura 2000 areas

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ARTICLE INFO

Article history:
Received 14 August 2015
Received in revised form 5 December 2015
Accepted 9 December 2015
Available online 29 December 2015

Keywords:
AES
CAP
Farmland birds
Grazing
Mowing
Special Protection Areas

ABSTRACT

To halt the decline of biodiversity in European farmland, two major tools are available: the Natura 2000 network and agri-environment schemes (AES). We investigated the effect of these two measures on local species richness, single species occurrence and beta diversity of grassland birds in Poland. We counted birds on AES parcels (with less intensive grassland management) and control parcels, both within and outside Special Protection Areas (SPAs, part of Natura 2000), during 2013–2014. Local species richness of AES-target birds was not associated with AES. Similarly, the turnover of AES-target species among sites was comparable at AES and control parcels. Furthermore, no positive interaction between AES and SPAs was observed, indicating a general lack of effect of AES. Local species richness of SPA-target birds was not higher within than outside SPAs, but two SPA-target species were more common and the beta diversity of SPA-target species was higher within than outside SPAs. Thus, our study showed no positive effects of AES on the occurrence of their target species, but confirmed some positive effects of SPAs on their target species. The decision to restrict AES to Special Protection Areas in 2015–2020 has no justification in our analyses. Actually, many AES-target species will be protected within SPAs irrespective of whether the area is an AES or not, but future AES should also include parcels outside SPAs, as many target species occur there. However, to improve the effectiveness of AES management prescriptions should be diversified and customized to meet the largely different habitat preferences of present target species (such as, for instance, the lapwing and corncrake).

1. Introduction

As a result of the intensified agricultural practices taking place during the last 50–60 years, the biodiversity of modern farmland has declined extensively and halting the rate of this decline remains a challenging task. The spatio-temporal patterns of biodiversity loss differ among regions and countries. Population declines have usually been more marked in western and northern Europe than in central and eastern Europe (Chamberlain et al. 2000; Guerrero et al. 2012), where farmland biodiversity is still relatively well preserved as a result of economic and political history (Tryjanowski et al. 2011; Baldi et al. 2013). Thus, at present, the central-eastern part of the continent is an important region for the pan-European populations of several species of farmland birds (BirdLife International 2004). However, this stronghold of farmland bird populations could rapidly change due to changes in the agricultural landscape caused by the political and economic transformations in central and east Europe of the past few decades. Consequently, biodiversity in eastern Europe is strongly decreasing (Baldi and Farago 2007) and several previously common species are undergoing rapid declines, resembling the scenario from western Europe of a few decades ago (Donald et al. 2002).

To reverse this overall biodiversity decline, two major tools are now available: (i) the European network of nature protection areas (Natura 2000 network) and (ii) agri-environment schemes (AES) aimed at biodiversity conservation in the agricultural landscape. Natura 2000 is a network of protection areas established under Habitats and Birds Directives (92/43/EEC, 2009/147/EC) to protect the most threatened species and habitats. Special Protection Areas (SPAs), being part of this network, are designed to protect the most suitable areas for birds in order to reach a favourable conservation status for all bird species listed in Annex 1 of the Birds Directive. There are more than 5400 SPAs in Europe, covering 12.5% of the land area of EU member states. Most SPAs are several km^2 in size and usually cover species-rich landscapes, mainly in forest complexes and river valleys (Natura 2000 Barometer 2013, Wilk et al. 2010). Agri-environment schemes, on the other hand, are part of the EU Common Agricultural Policy (CAP) and provide payments to farmers for protecting the environment on their farmland by adopting environment-friendly farming practices or for maintaining habitats and species with certain management practices. Total financial expenditure on agri-environment payments in EU during 2007–2013

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http://dx.doi.org/10.1016/j.biocon.2015.12.007
0006-3207/

was over 33,000,000,000 EUR (ENRD 2014). Some of the AES measures are focused on the protection of farmland birds. Although some short-term studies have shown that AES are linked to species-rich habitats (e.g. Hiron et al. 2013; Marja et al. 2014), many other studies suggest that at this time, agri-environment schemes frequently fail to protect or increase biodiversity (Kleijn et al. 2001; Kleijn and Sutherland 2003; Konvicka et al. 2008; Breeuwer et al. 2009; Batary et al. 2015). However, a majority of these assessments have been performed in western Europe and almost none in eastern Europe (but see Konvicka et al. 2008), where agricultural intensity is low, landscape complexity high and populations of agricultural species are generally large (BirdLife International 2004). It has been suggested that the effectiveness of AES may depend on landscape type (Tscharntke et al. 2005) and the effect of AES on farmland biodiversity in eastern Europe might therefore differ from those reported from western Europe. Furthermore, very few studies have assessed the effects of the Natura 2000 areas on biodiversity in farmland, and especially in eastern Europe (but see Krenova and Kindlmann 2015). Moreover, Natura 2000 areas frequently overlap geographically with the sites of agri-environment measures. Thus, it is important to secure more empirical data on the effects of these two policy tools (and possible interactions between them) to identify measures that can reverse the negative trends of farmland biodiversity.

Semi-natural grasslands are one of the most species rich habitats of European farmland (Dengler et al. 2014), hosting many rare and declining species (Pe'er et al. 2014). One of the best known and carefully monitored faunal groups are birds and many species of grassland birds have been declining rapidly during the last decades in central and eastern Europe, probably because of habitat loss and the degradation caused by, for example, drainage, fertilization, earlier mowing, increased grazing intensity or, in some regions, the cessation of grassland management (Ławicki et al. 2011). As a consequence, several AES measures and Natura 2000 areas are devoted to the conservation and management of grassland birds (Wilk et al. 2010).

In this study we investigated the relationships between the two above-mentioned conservation initiatives and Polish grassland bird fauna, since much effort has been placed on measures to conserve Polish grassland ecosystems. For example, in Poland nearly 450,000,000 EUR was spent on the AES in grasslands during the period of 2007–2014, of which more than 280,000,000 EUR was spent on the breeding habitats of grassland birds (Anonymous 2015). Furthermore, the implementation of AES aimed at protecting birds in the new Polish Rural Development Programme for 2015–2020 has been restricted to parcels within SPAs, as it is assumed to give the highest pay-off in terms of the diversity of grassland birds. An assessment of the importance of AES and SPAs on grassland birds is therefore urgently needed.

We compared the occurrence of selected grassland birds that are the targets of agri-environment schemes (eight target species, as decided by the Polish Rural Development Programme, Anonymous 2007) and Special Protection Areas (11 target species that are grassland birds listed in Annex 1 of the Birds Directive recorded in our study) at 585 grassland sites across Poland (see Table 2 for the list of target species). We included AES established to protect birds (i.e. sites with less intensive grassland management) and control sites without AES both within and outside SPAs. More specifically, we investigated whether local species richness (alpha diversity), single species occurrence and beta diversity (i.e. species turnover among sites) in the two target groups of birds differed between grassland parcels (i) with or without AES and (ii) within or outside SPAs. Moreover, we investigated whether the importance of AES for birds was different within and outside SPAs, i.e. (iii) we tested whether these two conservation measures had any complementary or additive effects on the two target groups. (See Table 1.)

Table 1
Number of point count sites and 10-min visits performed at these sites in 2013–2014.

Management	Protection	Number of	
		Point count sites	Visits
AES	Within SPA	129	516
	Outside SPA	206	824
Control	Within SPA	92	368
	Outside SPA	158	632
Total		585	2340

2. Methods

2.1. Agri-environment schemes in Poland

Agri-environment schemes were implemented in Poland in 2004 as part of the Rural Development Programme (RDP, Anonymous 2007). The first RDP was applied in 2004–2006, the second RDP was designed for 2007–2013, but was extended to 2014, and the third RDP started in the spring of 2015 and will end in 2020. In this study, we investigated the effects of the second RDP, which has just finished.

The main aim of the AES in Poland is "to promote rural production based on methods meeting the requirements for the protection of the environment and nature" (Anonymous 2007). In 2007–2014, AES were divided into 49 variants, among which only two were dedicated to the protection of birds (4.1 "Protection of bird breeding habitats outside Natura 2000 areas" and 5.1 "Protection of bird breeding habitats in Natura 2000 areas"). We evaluated both these bird-related conservation initiatives by collecting data on the abundance of the target species in grasslands. The other variants of AES were linked to the protection of rare habitats, soil and water quality, genetic resources of domestic animals, etc. (Anonymous 2007).

AES dedicated to protection of birds (hereafter we refer to these AES variants only) were implemented in the whole country and payments were available for parcels registered as permanent grasslands. To receive AES payments for a parcel, a farmer had to show (by a field inventory conducted by qualified ornithologist) that at least one of 10 target bird species was breeding in that field. The payment amount depended on parcel size and was provided over five years.

During the five years of participation in the AES, the farmer was required to apply a less intensive grassland management regime. The management rules did not reflect the bird species composition of a given parcel (i.e. the same rules for all AES-target species) and, in short, were as follows: (1) no tilling, sowing, fertilization or chemical plant protection was allowed during spring and summer, (2) existing drainage systems should not be improved and the construction of new drainage elements was not allowed, (3) mowing was allowed only once a year during August and September, and 5–10% of each parcel should be left unmowed. Mowed biomass should be removed or placed in a pile in the parcel. (4) Grazing instead of mowing was allowed, but with animal densities below 0.5 LU ha^{-1} (1 LU = 1 livestock unit, equivalent to one cow) until 20 July, and between 0.5–1.0 LU ha^{-1} after this date. Mixed management of mowing and grazing could also be applied.

Financial support for AES parcels was 350.9 Euro ha^{-1} $year^{-1}$ and 307.4 Euro ha^{-1} $year^{-1}$ for areas within and outside Natura 2000, respectively (Anonymous 2007). At the end of 2014, the total area included in the AES was 313,738 ha and a total sum of c. 287,000,000 EUR was paid to farmers (Anonymous 2015).

2.2. Site selection

We randomly selected 30 counties in Poland. The selection was weighted by the area of AES parcels, so the probability of being selected was proportional to the pooled area of AES in a given county. We randomly selected about 10 AES parcels per county, however, fewer AES parcels were available in some counties and all AES parcels were chosen in these cases. We included an average of 10.6 AES parcel per county. A similar number of control grassland parcels were randomly selected in