Agriculture, Ecosystems and Environment 168 (2013) 16–24

Contents lists available at SciVerse ScienceDirect

Agriculture, Ecosystems and Environment

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

Impacts of agricultural intensification and abandonment on farmland birds in Poland following EU accession

Fiona J. Sanderson[a,*], Marta Kucharz[b], Marek Jobda[b], Paul F. Donald[a]

[a] RSPB, The Lodge, Sandy, Bedfordshire SG19 2DL, UK
[b] Polish Society for the Protection of Birds (OTOP), ul. Odrowaza 24, 05-270 Marki k, Warszawy, Poland

ARTICLE INFO

Article history:
Received 8 August 2012
Received in revised form 29 January 2013
Accepted 31 January 2013
Available online 21 March 2013

Keywords:
CAP
Agricultural management
Farmland biodiversity
Agri-environment schemes

ABSTRACT

Intensification and abandonment of European farmland and consequent changes, usually declines, in farmland bird populations are strongly linked to the European Union's (EU) Common Agricultural Policy. The 12 Central and Eastern European countries which joined the EU in 2004 and 2007 support higher densities of farmland birds overall than the first 15 member states, and are therefore disproportionately important for farmland bird conservation in Europe, but are vulnerable to changes in farmland avifauna as a result of accession to the EU. Changes in farmland bird abundance and species richness on 71 1-km squares in Poland from shortly before (2002) to five years after (2009) EU accession were examined in relation to changes in agricultural management. There was a decline in the cover of low-intensity farmland between these years, partly as a result of previously abandoned or fallow land returning to production, but there was also a loss of farmland to woodland or scrubby woodland, indicative of agricultural abandonment. The loss of low-intensity farmland was associated with decreases in the abundance of nine of 28 bird species examined, five of them already declining in the EU as a whole, although these effects were sometimes region-specific. The increase in woodland edge habitat had species-specific effects. There were detectable changes in agricultural management and associated bird populations in Poland five years after EU accession. If such trends continue, they are likely to lead to substantial long-term changes in Poland's internationally important populations of farmland bird species.

1. Introduction

There have been considerable changes in agricultural management in the European Union (EU) in the past 60 years, including both intensification and abandonment of farmland (MacDonald et al., 2000; Robinson and Sutherland, 2002; Sanderson et al., 2005; Stoate et al., 2009). These have been driven partly by economic growth, but have been accelerated and exacerbated by policy, in particular agricultural subsidies provided under the European Union's Common Agricultural Policy (CAP) (MacDonald et al., 2000; Robinson and Sutherland, 2002; Sanderson et al., 2005). These changes have driven major declines in farmland biodiversity over huge areas of Europe (Benton et al., 2002; Donald et al., 2001, 2006). In 2004 and 2007, 12 new Central and Eastern European countries (CEECs) acceded to the European Union. These countries contain less than 30% of the newly expanded EU's farmland, but support 41% of its farmland bird populations (BirdLife International, 2004). Poland, 70% of which is farmland, supports more than 11% of the EU's farmland birds (BirdLife International, 2004). Changes in Polish farmland are therefore predicted to have a disproportionately large impact on the European farmland bird index (Butler et al., 2010). Although CAP reforms in the past decade have removed the direct link between subsidy and production and redirected some of the resulting finance into environmental improvement and protection measures (Directorate-General for Agriculture and Rural Development, 2005), concern remains that access to new markets and subsidies will lead to major changes in the agriculture of the New Member States (NMS); changes which, if they mirror those in the original 15 Member States of the EU, are likely to be detrimental to biodiversity. Proposed changes to the CAP in 2013 include allowing transfer of payments from Rural Development, which includes agri-environment measures, to direct support for farmers for countries whose direct payment level is below 90% of the EU average, which includes most NMS (Anon., 2012). This would reduce the availability of funding for agri-environment measures, which is the primary policy instrument for biodiversity conservation on farmland (Farmer et al., 2008), although a number of other initiatives also exist (Kleijn et al., 2011). In order to enable agri-environment schemes to protect biodiversity and reverse farmland bird declines effectively when funds to do so are increasingly limited, the causes of changes in farmland bird populations across

* Corresponding author. Tel.: +44 1767 693263.
E-mail addresses: Fiona.Sanderson@rspb.org.uk (F.J. Sanderson), Paul.Donald@rspb.org.uk (P.F. Donald).

0167-8809/$ – see front matter
http://dx.doi.org/10.1016/j.agee.2013.01.015

the EU need to be fully understood. The effectiveness of measures to protect farmland birds is vital to meet the 2020 target for reversing the loss of EU biodiversity (Anon., 2011).

Declines in farmland bird populations in the NMS have been ongoing since the mid-1990s and appear to be continuing at a similar or faster rate since accession to the EU (Voříšek et al., 2010). Although a considerable body of research exists on the impact of changes in agricultural management on the abundance and species richness of farmland birds and other biodiversity (Batáry et al., 2010; Chamberlain et al., 2000; Donald et al., 2001; Gillings et al., 2005; Kleijn and Sutherland, 2003; Wretenberg et al., 2010), most has been carried out in the more intensive agricultural habitats of Western Europe (Báldi and Batáry, 2011). Such results may not readily extrapolate to the extensively farmed habitats of Eastern Europe (Báldi and Batáry, 2011), for example because bird–habitat relationships are non-linear (Sanderson et al., 2009; Schaub et al., 2011), because of differences in the habitat matrix in which the farmland is embedded (Tryjanowski et al., 2011), or both (Concepción et al., 2012). Furthermore, agricultural abandonment is likely to be a major trend in agriculture in less economically viable farmland in the NMS (EEA, 2004), as it has been in economically marginal regions of Iberia following EU accession (Reino et al., 2010; Sirami et al., 2007). There has been less research on the impact of agricultural abandonment on farmland bird populations and most has been carried out in the EU15 (Berg and Gustafson, 2007; Brambilla et al., 2007; Laiolo et al., 2004; Sirami et al., 2007; Suárez-Seoane et al., 2002; Woodhouse et al., 2005) with limited data on such impacts emerging from the NMS (but see Herzon et al., 2006; Nikolov, 2009; Verhulst et al., 2004). In particular, there are few data to indicate how bird abundance and species richness might change with agricultural abandonment (Sirami et al., 2007).

In 2002 and 2003, just before Poland joined the EU in 2004, birds and farmland habitats in 180 1-km squares encompassing the spectrum of agricultural intensity in Poland were surveyed (Sanderson et al., 2009). In 2009, 71 of the squares originally surveyed in 2002 were resurveyed in order to quantify any intervening agricultural change and assess its impact on farmland bird populations. Given the broad spectrum of agricultural intensity in Poland and the tendency in other parts of Europe for already productive areas to intensify agricultural production and less intensive areas to become abandoned (Donald et al., 2002), it was expected that both agricultural intensification and abandonment would have taken place, possibly with differing patterns in different regions. The aims were to test this hypothesis, to examine whether any changes in agricultural management were correlated with farmland bird species richness and abundance, and to assess whether the earlier quantitative predictions regarding the relationships between farmland birds and agricultural management (Sanderson et al., 2009) had been met.

2. Methods

2.1. Field methodology

71 1-km squares in three regions in Poland were surveyed in their entirety for breeding birds in both 2002 and 2009. These regions covered much of the spectrum of the agricultural management and crop type occurring in Poland (GUS, 2003). The regions were Western Wielkopolska (WK; 168150E, 528350N), Pomorze Gdańskie (PM; 188400E, 548050 N) and Północne Podlasie (PD; 238150E, 53800N). A 50 km × 50 km grid was laid over the centre of each region and 30 1-km squares randomly selected for survey in 2002, of which 25 were randomly selected for resurvey in 2009 in WK, 22 in PM and 24 in PD. Only squares surveyed in both years were considered in the analyses. Squares containing less than 75% farmland in 2002 were removed from the original sample and replacements selected.

Each square was surveyed twice for all bird species by experienced bird surveyors. The first visit took place between April 10th and May 10th starting between 6:00 and 7:00 a.m. (Central European Summer Time), the second between May 20th and June 20th, starting between 5:00 and 6:00 a.m. Each visit lasted from 2 to 3 h. All birds seen or heard were marked on a 1:10,000 scale map. Birds were not counted in bad weather conditions such as heavy rain, fog or strong wind. The square was surveyed evenly using UK Breeding Bird Survey transect methodology (Baillie et al., 2010) adapted to cover the whole square by using a route from which all parts of the square could be surveyed, excluding woodland and built-up areas. The route was marked on a map in order to replicate the survey during the second visit.

During the second visit in each survey year a habitat survey was carried out, with the areas covered by different habitat types plotted on similar 1:10,000 maps. In 2002, any field borders not appearing on the maps were added manually. In 2009, missing field borders were added manually to aerial photographs supplied by the Centre for Spatial Management (www.geoportal.pl) This allowed the mapping exercise to be carried out more quickly, but as missing or changed boundaries were added manually in both years, this would not have affected the calculation of cover of different habitats. The effect of this change on length of field boundary recorded was assessed by comparing the relationship between wood and scrub cover and wood and scrub edge length in 2002 and 2009: as they remained closely correlated in 2009 (r^2 in 2002 = 0.87; r^2 in 2009 = 0.80), this indicates that the change in the way field boundaries were recorded did not affect the length of boundary recorded. The following land cover types were distinguished in each year: arable; recently abandoned, set-aside or unused farmland; grassland; wooded areas; and "other" (buildings, roads, etc.). Fieldworkers were asked to record whether an increase in wooded areas resulted from new plantations or natural growth. Recently abandoned, set-aside and unused farmland and grassland were combined in the analysis as "low-intensity farmland" to assess whether loss of low-intensity farmland and structurally similar habitats affected farmland bird populations and species richness (Wretenberg et al., 2010). Most agricultural grassland in Poland is semi-natural rather than improved and therefore constitutes a low-intensity habitat (EEA, 2004). Habitat maps were digitised and the length of woody edge habitat and area of each crop type calculated. Maps from 2002 and 2009 were overlaid to assess the main outcome for fallow land (no change, return to crop or grass production or succession to scrub or woodland).

2.2. Analytical methods

All analyses were carried out in R 2.11.1 (R Development Core Team, 2010). Changes in habitat (arable land cover; low intensity farmland cover; total farmland cover (i.e. the cover of all habitats other than wood and "other"); wood cover; wood edge length) were analysed using linear mixed models in the package lme4 (Bates and Maechler, 2010), with models fitted using REML. Models were fitted with region and year as fixed categorical variables (to allow year to function as a before–after treatment factor) and a year:region interaction to examine the differences in habitat change between regions. Models were also fitted without the interaction to obtain an overall parameter estimate across all regions for year. Square identity was fitted as a random factor in all models. The package lme4 does not provide p values for linear mixed models as these are approximate at best (Zuur et al., 2009); inference is therefore drawn from t values, considered significant if >2 or <−2.