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Failure of EU Biodiversity Strategy in Mediterranean farmland protected areas

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ABSTRACT

The main populations of several globally threatened bird species survive in Mediterranean agroecosystems. Consequently, a number of areas considered important for the conservation of these birds are currently protected by EU legislation. The European Common Agricultural Policy (CAP), conceived to increase agricultural production, has no restrictions in these protected areas, which creates a conflict between current agricultural policy and legislation on biodiversity conservation. Long-term monitoring of flagship bird species in a Mediterranean protected area shows significant population declines. Similar declines also affect common farmland bird species in others agricultural protected areas, confirming a failure of the EU Biodiversity Strategy. If Europeans want to conserve these landscapes and their biodiversity, the present conservation model should change in farmland areas. Solutions must involve the prohibition of agricultural intensification, and the implementation of sustainable farming practices different from current CAP subsidies.

1. Introduction

Agriculture in the Mediterranean Basin is the oldest in human history; it began in the Neolithic (ca. 8000–10000 years BP), when hunters in the Near and Middle East started producing their own food supply, and laying the foundations for the domestication of plants and animals. Since then, Mediterranean agricultural landscapes have been shaped by humans. This farming system has acquired a biodiversity of its own over the centuries, in a co-evolution of agriculture and nature (Blondel & Aronson, 1999). Fortunately, in spite of the rapid change of farming practices in the last decades, some traditional agro-ecosystems are still present in Europe, which have been distinguished as High Nature Value (HNV) farming systems. HNV arable farming is characterized by a combination of low intensity land use and a diversity of land covers and land uses in a mosaic-like pattern. Low intensity farming systems have production cycles with low inputs and are ecologically sustainable (Oppermann, Beaufoy, & Jones, 2012). HNV farmlands are valuable habitats for birds, and to maintain their structural complexity is critical for conserving their bird communities (Morelli, Jerzak, & Tryjanowski, 2014). In the Mediterranean Basin, HNV agriculture in dry (annual rainfall < 700 mm) open areas historically led to a human-induced agro-pastoral habitat where the main land use has been extensive cereal crop with legumes, vineyards and olives. It is in this open landscape (also known as pseudo-steppe) where the main European populations of several globally threatened bird species survive (Bota, Morales, Mañosa, & Camprodon, 2005; IUCN, 2017; PCEBMS, 2016), highlighting its key function for biodiversity conservation.

Establishment of protected areas has been the predominant biodiversity conservation approach for decades. These areas are recognized as the most important core units for conservation, given their positive effects on biodiversity worldwide (Chape, Harrison, Spalding, & Lysenko, 2005; Gray et al., 2016). The European Union (EU) has developed policies to conserve threatened habitats and species through supranational legislation and the EU 2020 Biodiversity Strategy (BS). The pillars of EU nature legislation are the directives on the conservation of habitats (92/43/CEE, Habitat Directive) and on the conservation of wild birds (79/ 409/EEC and 2009/147/EC, Birds Directive). These directives require member states to identify and classify Special Protection Areas (SPAs), to build Natura 2000 (N2000), an international conservation network based on an extensive number of protected sites across EU countries. Two of the main targets of the BS (Target 1 “Fully Implement the Birds and Habitats Directives” and Target 3 “Increase the contribution of agriculture and forestry to maintaining and enhancing biodiversity”) make explicit mention of habitat and species conservation. This policy and N2000 deliver benefits for biodiversity in Europe (Donald et al., 2007) and contribute to the Convention on Biological Diversity (CBD) agreements (Beresford, Buchanan, Sanderson, Jefferson, & Donald, 2016). In fact, conservation policy in Europe has been proposed as a model for emerging conservation issues globally (Boitani & Sutherland, 2015).

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At the same time, expansion of industrial agriculture has led to a decline in biodiversity and to ecosystem degradation worldwide (Green, Cornell, Scharlemann, & Balmford, 2005), and unsustainable agricultural practices (land consolidation, intensification, use of pesticides) are currently a major conservation problem for species and habitats in Europe (Henle et al., 2008). The Common Agricultural Policy (CAP), the main management instrument for agriculture in Europe, has led to intensified crop growing, because of its price-support policies. As a consequence, farmland birds are declining severely in all EU Member States where CAP applies (Donald, Green, & Heath, 2001). Even after its last reform, the "greener" CAP is also failing to meet the objective of preserving biodiversity (Pe'er et al., 2014), and common farmland birds continue declining in the whole continent (1980–2014 trend −58% for EU, PCEBMS, 2016). Through the declaration of SPAs and N2000, it was expected that problems derived from intensive agriculture could be reduced in protected areas. The European Commission initiated in 2014 a process aimed at assessing the Birds and Habitats Directives for biodiversity conservation. However, the detailed long-term studies needed for such assessments are scarce or lacking in most areas and future N2000 research should focus on agricultural habitats (Orlikowska, Roberge, Blicharska, & Mikusiński, 2016). Our aim is to examine whether protected areas under legislation and Natura 2000 network in agricultural landscapes are effective in conserving biodiversity. We expected that populations of farmland bird species would show positive trends inside SPAs. We assess this by evaluating the population trend of threatened bird species (flagship species) in a protected agricultural area over 15 years.

2. Materials and methods

2.1. Study area

Populations of flagship farmland birds (Fig. 1) were monitored in the Special Protection Area for Birds "Estepas cerealistas de los ríos Jarama y Henares" (SPA ES139, European Natura 2000 Network; 40°5′N 3°0′W, 331 km^2, 792 m a.s.l., Central Spain). The climate in this region is Mediterranean semi-arid and the main land use is dry cereal farmland (largely barley *Hordeum vulgare* and wheat *Triticum aestivum*). Historically, these cereals have been grown here following an extensive two-year rotation cycle (cultivated/uncultivated). In the first year winter cereals are sown in October-November and harvested in July. The stubble is usually left until next winter, when it is ploughed. This area has been highlighted as a steppe bird hotspot in the Iberian Peninsula (Traba, Morales, & Suárez, 2007) and was designated as an SPA in January 1993 in application of the Birds Directive (79/409/EEC Directive), the same year when CAP started to apply without restrictions. Furthermore, in July 2006 the area was designated as a Site of Community Importance (SIC) under the Habitats Directive (92/43/EEC Directive).

2.2. Study species

(1) The Great Bustard (*Otis tarda*) is a large farmland bird with high sexual size dimorphism. It is globally threatened, with ca. 60% of its world population found in Spain that depends of traditional agriculture (IUCN, 2017). Every year since 2000, we counted the breeding population (absolute abundance) and estimate the annual productivity; (2) the Little Bustard (*Tetrax tetrax*) is a medium-sized, globally threatened steppe bird experiencing a rapid decline in the Western Palaearctic. Intensive agriculture has been identified as the primary threat and cause of this continuing decline. Currently, the Iberian Peninsula holds more than half of the world breeding population (IUCN, 2017); (3) the Black-bellied Sandgrouse (*Pterocles orientalis*) is a medium-size steppe bird classified as vulnerable in Europe and Spain. The largest population in the world is found in the Iberian Peninsula, where it has shown a decreasing trend for the last few decades (IUCN, 2017); and, (4) the Montagu's Harrier (*Circus pygargus*) is a ground-nesting raptor that breeds mostly in croplands across Western Europe. It declined in many

Fig. 1. Four flagship species representing the bird community of dry open arable land in the Mediterranean Basin (all included in the IUCN Red List of Threatened Bird Species). This community, adapted to traditional agriculture practices, was described for the first time in 1958 as "*Melanocorypha* biocenosis", referring to the genus of the Calandra Lark (*M. calandra*), the most common bird at that time (Valverde, 1958). Left: From top to bottom, Montagu's Harrier (*Circus aeroginosus*), Little Bustard (*Tetrax tetrax*), Black-bellied Sandgrouse (*Pterocles orientalis*); Right: Great Bustard (*Otis tarda*).

Table 1
Annual population growth rate of four flagship bird species in SPA ES139.

Species	Period	Intrinsic Population Increase (r)
Great Bustard	2000[a]–2015[a]	−0,010
Little Bustard	2000[b]–2013[a]	−0,075
Black-bellied Sandgrouse	2005[c]–2015[a]	−0,061
Montagu's Harrier	2001[d]–2015[e]	−0,069

[a] Our unpublished data.
[b] García de la Morena et al. (2001).
[c] Palacín et al. (2006).
[d] Iberis (2001).
[e] GREFA (2015).

areas due to farmland intensification, which led to decreases in habitat quality and food resources, and also to an important increase in direct mortality of chicks through harvesting operations. Spain holds ca. 25% of the European population of the species (excluding Russia, IUCN, 2017). Conservation interventions to decrease nestling loss during harvest have been adopted since the late 20th century in Spain. Most of these have been based on reactive approaches aimed at increasing productivity rates through active management including the removal of the nestlings during harvesting operations and their relocation to the same, or a safe place nearby, or the maintenance of a relatively small buffer zone of unharvested standing crop around the nest (Cardador et al., 2015).

2.3. Census methods

2.3.1. Great Bustard

Each census was conducted by three teams each consisting of two observers, using 4 × 4 vehicles, following itineraries at low speed, with frequent and prolonged stops at vantage points, to carefully scan for birds using binoculars and telescopes 20–60×. Censuses were carried out in late March under favorable weather conditions (no fog, rain or wind).

2.3.2. Little Bustard

The survey method consisted of car transects throughout the whole potential area, using the track network, with 5-min stops every 500 m, to watch and listen for little bustard males. Males detected acoustically were searched for visually in order to determine their exact positions. To estimate the trend of the little bustard in the SPA ES139, we carried out two complete surveys in May 2012 and 2013, and compared the results with previous counts with the same census methodology (García de la Morena, Morales, & García, 2001).

2.3.3. Black-bellied Sandgrouse

It is a gregarious species, in which flocking behavior reaches a peak during winter. Surveys were carried out in this season following the method described in Palacín et al. (2006), which consists of 4 × 4 vehicle transects at low speed following the trail network, stopping at vantage points to observe with binoculars and spotting scopes, and to listen for birds calling.

2.3.4. Montagu's Harrier

Data on the breeding population of Montagu's Harrier was provided by the population monitoring program of harriers in Madrid (GREFA, 2015; Iberis, 2001).

2.4. Populations trends

Population trends of flagship species in SPA ES139 were assessed by means of the population growth rate (Sibly & Hone, 2002). This parameter is adequate to compare population growth during a limited period of time. We used the standard equation defining exponential growth $N_{t+1} = N_t e^{rt}$ where N_{t+1} is the population size at time t + 1, N_t is the population size at time t, r is the rate of population growth (intrinsic rate of increase), t is the time interval, and e is the natural logarithm base.

2.5. Farmland bird index

This indicator integrates the population abundance and the diversity of a selection of common bird species associated with specific habitats (PCEBMS, 2016). Farmland birds are highly dependent on cultivated land as their feeding ground during most of the year, and as a nesting ground during the breeding season. European Common farmland birds are represented by 39 species (Table S1). An agreed European list of bird species is used, from which each country chooses the species to be covered by the data collected in the field. This means that different species are covered in each country, according to their occurrence. This indicator is considered to be the best available dataset and also to be indicative of the general environmental status for the EU.

3. Results

The four monitored species have shown decreasing trends (Table 1). Their annual population decreases have been -7.5% for Little Bustards, -6.9% for Montagu's Harriers, -6.1% for Black-bellied Sandgrouses and -1% for Great Bustards. Similar declines also affect other farmland species in protected agricultural SPAs, resulting in a clear negative trend of the Index for farmland birds at country level, both inside and outside protected areas (Fig. 2., Supplementary material).

4. Discussion

In Atlantic Europe, causal factors of declines of biodiversity, and specially of farmland birds, have been known for years and are related to agricultural intensification (Newton, 2004; Robinson & Sutherland, 2002): reduction in landscape diversity, field enlargement through hedgerow removal, more chemical applications, increased mechanization, etc. This industrial agriculture has reduced food supplies and suitable breeding and foraging habitats. As a result, reproductive and survival rates are reduced for many species.

The CAP, conceived to increase agricultural production, implies intensification, and this process has no restrictions inside SPAs. Thus, in protected European farmland habitats there is a conflict between current agricultural policy and legislation on biodiversity conservation. For example, in our study case, the breeding success (a key population parameter annually estimated through the productivity, i.e., number of yearlings divided by the number of adult females in September) of the Great Bustard has a significantly negative trend over the last 20 years

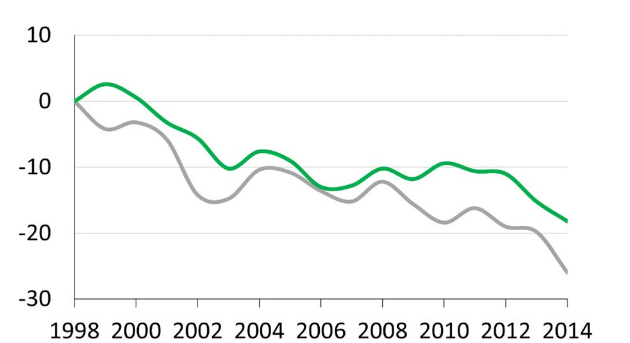

Fig. 2. Spanish Farmland Bird Index (Supplementary material) for agricultural Important Bird Areas (green line) and unprotected agricultural areas (grey line) (modified from SEO/BirdLife, 2015). All SPAs are included in the Important Bird Areas, a global network of key conservation areas identified by BirdLife International (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.).

(our unpublished data). Decreasing great bustard productivity can be related to agricultural intensification, since the diet of young bustards is mainly insectivorous (50% in the first six months, Bravo, Ponce, Palacín, & Alonso, 2012), and like many other birds, survival of juveniles depends on the presence of insects (Benton, Bryant, Cole, & Crick, 2002; Wilson, Morris, Arroyo, Clark, & Bradbury, 1999). Negative effects of agricultural intensification are also shown by the fact that birds of Mediterranean agroecosystems currently survive on traditional agriculture landscapes, characterized by a dry farmland mosaic, where field margins are abundant. In recent years, land consolidation and transformation of traditional vineyards has reduced the availability of suitable habitats for many birds (Palacín, Alonso, Martín, & Alonso, 2012). Finally, intensive agricultural practices cause an increase in direct mortality: e.g., early harvesting or ploughing fallows kills nestlings of some ground-nesting species (Arroyo, García, & Bretagnolle, 2002). Furthermore, species linked to these agriculture areas are experiencing high rates of non-natural mortality caused by the installation of fences and other obstacles (e.g. electricity lines) in these open landscapes (Martín et al., 2007; Palacín, Alonso, Martín, & Alonso, 2017).

Conflicts between biodiversity conservation in Mediterranean farmlands and EU Agricultural Policies are known since the 1990s (Tella, Forero, Hiraldo, & Donázar, 1998), and agri-environmental measures (AES) and LIFE programs are being developed to try to solve these conflicts, but these programs have not been efficient and need more strategic investment (Fischer, Hartel, & Kuemmerle, 2012; Hermoso, Clavero, Villero, & Brotons, 2016). Nowadays the problem has worsened and farmland birds continue to disappear across the whole continent, in protected and unprotected agricultural areas (Fig. 2). At present, the European conservation model for agricultural areas needs a thorough revision and cannot be considered an example to be followed by emergent countries.

5. Conclusions

If Europeans want to conserve these landscapes and their biodiversity, solutions must involve the prohibition of agricultural intensification and pesticides inside SPAs, and the implementation of sustainable agricultural practices independent from current CAP subsidies. It is necessary to implement long term specific measures that favor both, farmers' economies and biodiversity conservation. Industrial agriculture should be carefully revised and alternative farmland practices must be developed in order to re-establish the original scenario of one of the oldest human-made landscape worldwide.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi: https://doi.org/10.1016/j.jnc.2018.02.008.

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