



Research article

Assessing the effect of agricultural land abandonment on bird communities in southern-eastern Europe

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ABSTRACT

Agricultural land abandonment is recognized as a major environmental threat in Europe, being particularly pronounced in south-eastern Europe, where knowledge on its effects is limited. Taking the Balkan Peninsula as a case study, we investigated agricultural abandonment impact on passerine communities at regional level. We set up a standard methodology for site selection (70 sites) and data collection, along a well-defined forest-encroachment gradient that reflects land abandonment in four countries: Albania, Bulgaria, Croatia and Greece. Regardless the different socio-economic and political histories in the Balkans that led to diverse land abandonment patterns in space and time, rural abandonment had a consistent negative effect on bird communities, while regional-level analysis revealed patterns that were hidden at local level. The general trends were an increase of forest-dwelling bird species at the expense of farmland birds, the decline of overall bird species richness, as well as the decline of Species of European Conservation Concern (SPECs) richness and abundance. Many farmland bird species declined with land abandonment, whereas few forest species benefited from the process. In conclusion, our results support CAP towards hampering rural land abandonment and preserving semi-open rural mosaics in remote upland areas, using a suite of management measures carefully tailored to local needs. The maintenance of traditional rural landscapes should be prioritized in the Balkans, through the timely identification of HNV farmland that is most prone to abandonment. We also suggest that coordinated transnational research is needed, for a better assessment of conservation options in remote rural landscapes at European scale, including the enhancement of wild grazers' populations as an alternative in areas where traditional land management is rather unlikely to be re-established.

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1. Introduction

With about 50% of all European species depending upon agricultural habitats (Kristensen, 2003), land abandonment, along with agricultural intensification, is considered a major threat to biodiversity within the European Union (Balmford et al., 2009; Butler et al., 2010; European Union, 2012). The resulting re-growth of

forest and large scale agricultural monocultures are the two major causes of habitat heterogeneity loss (Jongman, 2002; Klijn, 2004), which negatively affects biodiversity (Kati et al., 2010). While the impact of agricultural intensification on bird communities, has been well studied (e.g. Chiron et al., 2014; Donald et al., 2001; Krebs et al., 1999), only recently has land abandonment drawn similar attention (MacDonald et al., 2000; Russo, 2006).

Forest encroachment is recognized to have a negative effect on bird species of open and ecotone habitats bird species (Butler et al., 2010; Farina, 1997; Nikolov, 2010; Regos et al., in press; Sirami et al., 2008; Vallecillo et al., 2008), with some of them threatened to disappear from much of their distribution (Preiss et al., 1997). It is

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also reported that High Nature Value (HNV) farmlands, defined as those agricultural areas that support high species and habitat diversity, or species of European conservation concern (SPEC) (Andersen et al., 2003; Beaufoy et al., 1994; EEA, 2004), suffer significant biodiversity loss due to abandonment (Pointereau et al., 2008). Many SPECs are associated with farmland and the adverse effects of abandonment on them have been a major concern for conservationists during the last decades (e.g. Brambilla et al., 2009, 2010; Chiatante et al., 2014; Verhulst et al., 2004). However, vegetation succession following land abandonment is reported to positively influence forest birds (Gil-Tena et al., 2009; Laiolo et al., 2004; Regos et al., in press; Seoane and Carrascal, 2008; Sirami et al., 2008). Thus, an assessment of the gains and losses of this process is currently needed to define succinct conservation targets at European level, including poorly studied areas, such as the Balkans.

Unfavourable living conditions and economically unsustainable management of agricultural land have gradually led to rural depopulation, especially in remote and marginal farming systems of low productivity in southern Europe (Baldock et al., 1996; Geri et al., 2009; Rey Benayas et al., 2007). The ecological dynamics of succession, in combination with the reduced effectiveness of subsidies and the aging of the population, have often accelerated farmland abandonment (European Union, 2012; Figueiredo and Pereira, 2011; Gellrich et al., 2007). This phenomenon is particularly pronounced in the Balkan Peninsula, where people have abandoned the primary sector, despite the different socio-economic drivers. In Greece, rural abandonment occurred mostly in the beginning of the 20th century, as well as during the period from the 1950's until the 1970's, when the agricultural income crisis in the hilly and mountainous areas led to massive migration (Petmezas, 2006). In former communist countries, such as Albania and Bulgaria, the phenomenon was triggered by the sharp change of the political and economic system in the beginning of the 1990s, after the privatization of the land and the transition from a local to a centralized market economy (Baumann et al., 2011; Milenov et al., 2014). At the same time, former Yugoslav republics, such as Croatia, have undergone severe land abandonment between 1991 and 1995 due to acts of war (Mikulic et al., 2014).

Measures against land abandonment have only recently been integrated in the Common Agricultural Policy (CAP), as from 1972, and for a 20-year period, it was mainly supporting intensive agricultural production for self-sufficiency (Van Zanten et al., 2013). This agricultural intensification policy accelerated land abandonment, as less productive agro-systems became economically unviable. However, after 1992, the CAP shifted towards an income support subsidy system introducing environmental protection as a concern (Lefebvre et al., 2014; Lowe et al., 2002; Vanslebrouck and VanHuylenbroeck, 2005). Nowadays, the CAP constitutes a key pillar of the EU policy (41.3% of the European Union's total budget for 2014–2020), incorporating measures against land abandonment since 2010 (European Commission, 2013). However, the effectiveness of agro-environmental schemes has been criticized (Kleijn et al., 2011; Wrška et al., 2008), with HNV farming systems still remaining economically unviable (Lomba et al., 2014). Politicians argue that the latest CAP reform of 2013 has taken a big step towards “greening”, but it is believed that it is unlikely to benefit biodiversity much in practice, as several regulations preclude small scale farms from receiving direct payments (Pe'er et al., 2014).

Yet, the CAP has not shaped agricultural landscapes in the Balkans, where traditional farming is still the case in several areas, and HNV farmland area designation is at an early stage, if at all implemented, as most Balkan countries are no EU members

or have only recently joined it (EEA, 2012). Similarly, CAP configuration was mostly fed by the experience from Central and Western Europe, and knowledge from SE Europe is largely lacking, in particular at regional scale (Sirami et al., 2008). In an effort to bridge the knowledge gap in the understudied Balkan area, this paper combines data on bird communities and forest encroachment from four Balkan countries (Albania, Bulgaria, Croatia and Greece). Our aim is to explore the effect of rural land abandonment on passerine communities at regional level, using a common methodological framework: sampling bird community in systematically placed circular plots within randomly selected abandoned sites that well represent the land abandonment gradient in terms of forest encroachment. We focused in particular on farmland birds and species of conservation interest, as agricultural landscapes host the largest proportion of “threatened” birds in Europe and they are considered a conservation priority (Defra National Statistics, 2013). We attempted to identify the trends of species richness and abundance along the land abandonment gradient, considering different species groups, and to pinpoint the species most affected. We finally discuss our research findings in terms of agricultural management and policy schemes, under the light of CAP, given the expected enlargement of EU towards including new Member States from the Balkan Peninsula.

2. Material and methods

2.1. Data set

Our dataset consisted of bird-count data collected in 70 sites (fixed 1 km × 1 km “European Environmental Agency” grid cells), located in the Balkan Peninsula (Appendix; Fig. A1). It combined raw bird count data from one country (12 sites in Albania) with published datasets from three countries, namely 18 sites in Bulgaria (Dyulgerova et al., 2015), 20 in Croatia (Mikulic et al., 2014), and 20 in Greece (Zakkak et al., 2014). Different methodological approaches were adopted for site selection in the four countries, due to the different socio-economic factors and political histories that have triggered land abandonment in the Balkans. These approaches included the comparison of historical areal imagery from 1945 with current ones, as well as land use change data from the Corine Land Cover database, in order to designate past agricultural land under the process of land abandonment (Dyulgerova et al., 2015; Mikulic et al., 2014; Zakkak et al., 2014). However, all approaches respected the following common methodological guidelines, so that the selected sites reflected a distinct land abandonment gradient, in terms of forest encroachment. All candidate grid cells had to be located within the vegetation zone of temperate broadleaved deciduous forests, covering four ecological regions: Balkan, Dinaric mountains, Pannonian, and Pindus mountains mixed forests (Olson et al., 2001), in order to eliminate the noise of vegetation type diversity in result interpretation. Moreover, sites had to include more than 50% abandoned arable land, identified from aerial imagery (1945–1970), and less than 30% cover of water bodies, settlements or roads, while all sites had to be undisturbed from natural catastrophes such as fires. All grid cells satisfying the above criteria (423 grid cells) were classified in four classes of forest encroachment, in terms of woody vegetation cover (1: 0–25%, 2: 25–50%, 3: 50–75% and 4: 75–100% – hereafter FE classes). These FE classes proved good representatives of the land abandonment gradient in Greece, as they were significantly correlated with the period of abandonment, when the grazing effect was considered (Zakkak et al., 2014). Finally, we applied a random classification algorithm to select the sampling sites. The final dataset of the 70 sites selected had a minimal cover of water bodies (less than 1% cover in 92% of sites,

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