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An applied farming systems approach to infer conservation-relevant agricultural practices for agri-environment policy design

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ABSTRACT

The Common Agricultural Policy (CAP) has shown difficulties in meeting its environmental objectives, namely in supporting biodiversity-friendly farming systems that remain under pressure to intensify or abandon. Proposals to address this have ranged from increasing the focus on highly tailored and targeted agri-environment schemes, to promoting broad-brush policies such as those recently implemented in the Greening of the CAP. Both options have been criticised due to questionable cost-effectiveness. Alternatives based on agri-environment policies oriented to support conservation-relevant farming systems have been suggested, but they have faced operational difficulties related primarily to obtaining the necessary data to define farming system typologies. Here we investigated whether a simplified approach based on a coarse farming system typology built from incomplete data on land-use and livestock, such as that available in CAP paying agencies, could be used to infer on a wider range of conservation-relevant farm management practices and, ultimately, to select the farming systems qualifying for premium payments. Based on data collected by a farm-survey on a High Nature Value farmland area in southern Portugal, we show that some farming systems are consistently associated with conservation-relevant practices related to the use of herbicides, stubble grazing, creation of wildlife plots and early cereal harvest. The traditional system involving the rotational production of cereals and sheep grazing on fallows showed the most favourable balance of land uses and farm management practices with positive conservation effects. Results underlined the potential of farming systems as a framework for developing agri-environment policy.

1. Introduction

A large part of Europe's biodiversity depends on ecosystems provided by traditional and low-input agricultural systems (Bignal and McCracken 1996; Kleijn et al., 2009). These systems are declining due to agriculture intensification or abandonment, which are driven by social, economic and political changes that have occurred during the last decades (Stoate et al., 2009; Latacz-Lohmann and Hodge 2003; Batáry et al., 2015; Lomba et al., 2015), with negative consequences for farmland biodiversity (Donald et al., 2002; Latacz-Lohmann and Hodge 2003; Reidsma et al., 2006). To support the sustainability of these conservation-relevant farming systems, agri-environment schemes (AES) have been implemented under the Common Agricultural Policy (CAP) of the European Union (EU) (European Commission, 2005). Although AES positive outcomes have been documented (e.g. Primdahl et al., 2003; Boatman et al., 2008), their effectiveness seems to be limited due to high transaction costs undermining farmers' voluntary participation, high administrative expenditure, poor environmental performance, and failure in safeguarding high conservation-value farming systems (e.g. Kleijn et al., 2001; Kleijn and Sutherland, 2003; Siebert et al., 2006; Defrancesco et al., 2008; Weber, 2013; Pe'er et al., 2014; Ribeiro et al., 2014; Batáry et al., 2015).

There are essentially two contrasting views to the way agri-environment policies should be designed towards achieving

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greater effectiveness, generally matching CAP Pillars 1 and 2 (European Commission, 2013a; Poláková et al., 2011). On the one hand, Pillar 1 horizontal policy instruments such as the new Green Direct Payments and its Ecological Focus Areas, were recently proposed under the CAP reform 2014–2020 to safeguard and improve farmland biodiversity, and are now mandatory across the EU (European Commission, 2013a; European Commission, 2013b). These broad-scope agri-environment policies offer the advantage of eliminating or significantly reducing transaction costs, but their effectiveness in protecting farmland biodiversity and agroecosystems may be limited, due to poorly specified conservation objectives and low effectiveness of mandatory commitments (Pe'er et al., 2014). They are also more attractive to Member States because they are usually fully funded by the CAP budget, without the need for co-financing.

In marked contrast with these broad-brush policy options, some authors advocate increasing the focus on Pillar 2 agri-environment schemes tailored to meet biodiversity conservation objectives at the local level (e.g., small regions or even individual farms), even at the expense of high administrative costs (e.g. Armsworth et al., 2012). Although the environmental benefits of such complex schemes are potentially high, their sustainability is uncertain due to the high transaction costs involved and the downward trend of the EU budget for Rural Development (Mettepenningen et al., 2011; Weber, 2013), in addition to requiring co-financing by member states. Alternatives are thus needed that conveniently address the trade-offs between scheme precision and administrative costs (Weber, 2015), providing more focused management prescriptions than those achieved by the horizontal policies, while reducing the costs required by local-level schemes (Poláková et al., 2011).

The farming system framework might provide a relatively simple and practical approach to deal with this conundrum, by allowing consideration of groups of farms with similar typology, thereby avoiding the need to tackle the multiple idiosyncrasies of a large number of individual farms (Poláková et al., 2011; Poux, 2013). Farms included in the same farming system type often have similar resource bases, enterprise patterns, livelihoods, and household restrictions (Darnhofer et al., 2012; Ferraton and Touzard, 2009; Keating et al., 2001) and are expected to show common responses to market and policy drivers (Ribeiro et al., 2014). Also, they tend to be associated with specific agricultural practices and land-use patterns to which biodiversity components respond (Bamière et al., 2011; Calvo-Iglesias et al., 2009; Carmona and Nahuelhual, 2010; Ribeiro et al., 2016). Therefore, it is likely that significant benefits could be achieved through an agri-environment policy based on a farming systems selection criteria, whereby only farms operating a farming system considered beneficial to the conservation objectives would qualify for environmental payments.

Although this idea is potentially attractive, it also has some practical problems that need to be duly considered. An important issue is that developing farming system typologies is a key prerequisite of this approach, but this may be difficult due to the need to identify groups of farms with similar agricultural, economic and sociological characteristics (e.g. Andersen et al., 2004; Pointereau et al., 2010). Typically, the farm-level data needed to develop the typology is obtained through a large number of direct enquiries to individual farmers, but this is costly and time consuming. However, previous studies have shown that operational farming system typologies can be developed from data readily available to CAP paying agencies, derived from farmers' annual subsidy applications (Ribeiro et al., 2014). It is unknown, however, whether such data can capture comparable typologies to that developed from detailed field farm surveys. In particular, it is uncertain whether these broad typologies are associated with particular sets of land-uses and agricultural management practices with conservation relevance, which are usually the target of AES schemes (Batáry et al., 2015).

In this paper we address these issues through a case study developed in cereal-steppe landscapes of southern Portugal, which are representative of a High Nature Value Farmland type that is critical for open farmland birds of European conservation concern (BirdLife International, 2004). In previous studies we used data from the Portuguese CAP paying agency to show that in this region there are at least five main farming systems, which are strongly constrained by biophysical, structural and policy drivers (Ribeiro et al., 2014), and occur under a wide range of landscape conditions (Ribeiro et al., 2016). In here we built on these previous studies, using enquiries to individual farmers to: (i) develop a farming system typology based on farm characterization variables analogous to those available in CAP paying agencies, essentially describing land-uses and livestock husbandry; and (ii) assess how management practices with conservation relevance are associated with particular farming systems. Results were then used to discuss the potential of the proposed farming systems approach as a framework for developing agri-environment policy.

2. Materials and methods

2.1. Study area

The study was conducted in southern Portugal (approx. lat.: 3°42′N; long.: 8°05′W), in an agricultural landscape dominated by rainfed, low-intensity farming systems dedicated to cereal production and livestock grazing. The landscape is characterized by a smooth relief, with altitudes ranging ca. 100–200 m above sea level. The climate is Mediterranean, with hot dry summers and moderately cold and rainy winters. The study area limit was adjusted to include 39 local administrative areas encompassing the Special Protection Area (SPA) of Castro Verde, designated under EU Directive 79/409/CEE (Birds Directive). This SPA covers about 80,000 ha of farmland with high conservation value for several steppe birds of conservation concern, such as the great bustard (*Otis tarda* Linn.), little bustard (*Tetrax tetrax* Linn.) and lesser kestrel (*Falco naumanni* Fleischer) (BirdLife International, 2004). The area benefits from an AES set up in 1995 to support traditional farming systems based on extensive rotation of cereals with long term fallows and grazing sheep (Santana et al., 2014), claimed as main providers of the steppe habitat that led to the classification of this area. In recent years there has been a decline of these traditional systems and their replacement by specialized livestock systems, a trend that is partially attributed to recent CAP reforms (Ribeiro et al., 2014) and whose conservation impacts are largely unknown (Reino et al., 2010).

2.2. Farm characterization

We conducted direct enquiries to farmers from a sample of 199 farms, between March and May of 2013. The sample to be enquired was selected randomly from the overall set of ca. 350 farmers renewing their annual application to agricultural subsidies at the main farmers' association in the region, located at Castro Verde (Associação de Agricultores do Campo Branco), where most farmers deliver their annual declarations. Each farmer was interviewed personally by a technician, using a structured questionnaire aiming to obtain information on land-uses, livestock husbandry and farm management practices. From this questionnaire we derived a set of variables required to establish the typology of farming systems and to characterise agricultural management (Table 1).

Farm characterization variables focused on land-use and livestock husbandry (Table 1), because these are widely available in governmental agencies paying CAP subsidies (Ribeiro et al., 2014), therefore enabling replication in other locations. Land-use vari-