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Viewpoint

Spatial heterogeneity and farmland birds: different perspectives in Western and Eastern Europe

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One of the most dramatic declines of biodiversity in Europe has been the collapse of farmland bird populations (Donald *et al.* 2006). The loss of habitat heterogeneity is suggested as being an important driver behind this loss, and operates at a range of spatial scales from specialization of land-use on farms and across farmed landscapes to the disappearance of hedgerows and fallows and the homogenization of crop sward structure (Benton *et al.* 2003). Most of our knowledge of agricultural practices and farmland bird ecology, however, is from a few countries only, with 76% of papers in the Web of Science originating from the UK, France, Netherlands, Spain, Germany and Sweden, and less than 10% from Central and Eastern European countries (Donald *et al.* 2002, Kleijn & Báldi 2005, paper numbers are from a search on the Web of Science from 1975 to 28 August 2010 for '('agricultur*' OR farmland) AND ('species richness' OR biodivers*) AND bird*'). Common features of most of these Western countries are the severe long-term decline of farmland bird populations and high levels of agricultural intensification (use of agrochemicals, mechanization, etc.). Most Central and Eastern European countries (CEECs) experience different biogeographical and climatic conditions, and have different economic and agricultural conditions with recent entry to the EU and the application of the Common Agricultural Policy, and a change from a socialist to market-regulated economy in the 1990s. Therefore, most of the knowledge on farmland bird ecology only partially covers the variation in farming systems, bird population status, biogeographical conditions and socioeconomic background across Europe. Inevitably, any generalization based on this biased knowledge may be misleading (Kleijn & Báldi 2005, Whittingham *et al.* 2007).

We highlight a potential problem if research evidence were to be generalized across different parts of Europe to guide conservation strategies, for example by applying knowledge of farmland bird ecology in Western Europe to the CEECs. We focus on farmland heterogeneity as an example because this is delivered by a wide range of management options in agri-environment schemes (AES) designed to reverse biodiversity losses. These include the creation and maintenance of hedgerows, beetle banks or field margins. Many studies have indicated a positive correlation between species richness or abundance of farmland birds and landscape heterogeneity (Benton *et al.* 2003), but these results were based mostly on Western European evidence, and a critical evaluation of the impact of farmland heterogeneity across European farmland systems is still missing. Indeed, there is an increasing interest in the topic recently due to several still open questions, of which geographical restriction is only one (Batáry *et al.* 2011, Fahrig *et al.* 2011, Pickett & Siriwardena in press).

Heterogeneity of farmland has changed during the history of agriculture (e.g. Sutherland 2004). These changes include land conversions and shifts in landscape-level patterns. Therefore, heterogeneity should only be promoted if there is evidence that biodiversity loss stems from loss of previous heterogeneity. Many Western European grasslands, for example, were heavily homogenized in the 20th century, as stone walls and hedges were removed to create large, economically more profitable fields (Robinson & Sutherland 2002). However, in some cases the original landscapes may have been more homogeneous than the modern systems that have replaced them. In such cases, increasing heterogeneity may result in further habitat fragmentation, with harmful consequences to the original biodiversity (Fahrig 2003). Examples are large-scale semi-natural grassland systems in CEECs, such as the *puszta* grasslands in Hungary. These semi-natural grasslands cover more than 1 million hectares in Hungary and are the result of centuries of extensive livestock grazing. The baseline system is a vast open landscape with grasslands scattered with small wetlands, a few trees, woodlots and farms (Báldi *et al.* 2005). Accordingly, recent conservation management actions in these grassland landscapes aim to decrease heterogeneity, with the removal of structures such as lines of bushes in the pastures of Kiskunság National Park (http://www.knp.hu), or hundreds of kilometres of drainage channels in the Hortobágy National Park (http://www.hnp.hu). There is therefore evidence of a beneficial role of homogeneous farmland landscapes from different areas of Europe. These include the nega-

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tive effects of farmland diversity on some specialist bird species (Chiron *et al.* 2010), the negative correlation between breeding grassland bird density and edge density (Batáry *et al.* 2007a), preference of Little Bustard *Tetrax tetrax* for large grassland fields (Silva *et al.* 2010), and the avoidance of heterogeneous farmland by some migrating species at stopover sites (Dänhardt *et al.* 2010). The correlation between biodiversity and agricultural heterogeneity clearly varies between positive and negative in different systems in Europe.

The effects of heterogeneity need not be restricted to species richness and abundance only. For example, increased heterogeneity may promote nest predation (Batáry & Báldi 2004). Indeed, grassland specialist species, which nest and forage on the ground, tend to prefer homogeneous landscapes (e.g. Morris & Gilroy 2008).

Therefore, although heterogeneity at a landscape scale is a key driver of bird richness and abundance (Benton *et al.* 2003), it can work in both directions. In contrast, local-scale heterogeneity, such as variation in grass height or cover, usually has positive effects on true grassland birds in any system (e.g. Erdős *et al.* 2009, Vickery *et al.* 2009).

In general, most large-scale European programmes, such as CORINE Biotopes or even Natura 2000, were developed in Western Europe (that is, in the 'old' EU), and some did not perform well in Hungary (Batáry *et al.* 2007b). Earlier, this was largely inevitable, as knowledge from other parts of Europe was restricted. Recently, there has been an increasing need to widen the geographical scale of the evidence used in farmland bird conservation, a tendency which should be encouraged and used in the near future to achieve a better understanding of the farmland management – biodiversity relationship for the benefit of conservation across the many varied landscapes of Europe.

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REFERENCES

Báldi, A., Batáry, P. & Erdős, S. 2005. Effects of grazing intensity on bird assemblages and populations of Hungarian grasslands. *Agric. Ecosyst. Environ.* **108**: 251–263.

Batáry, P. & Báldi, A. 2004. Evidence of an edge effect on avian nest success. *Conserv. Biol.* **18**: 389–400.

Batáry, P., Báldi, A. & Erdős, S. 2007a. Grassland versus non-grassland bird abundance and diversity in managed grasslands: local, landscape and regional scale effects. *Biodivers. Conserv.* **16**: 871–881.

Batáry, P., Báldi, A. & Erdős, S. 2007b. Is there a need to reconsider species conservation priority lists? The effects of different lists on the evaluation of habitat importance in Hungarian grasslands. *Bird Conserv. Int.* **17**: 35–43.

Batáry, P., Fischer, J., Báldi, A., Crist, T.O. & Tscharntke, T. 2011. Does habitat heterogeneity increase farmland biodiversity? *Front. Ecol. Environ.* **9**: 152–153.

Benton, T.G., Vickery, J.A. & Wilson, J.D. 2003. Farmland biodiversity: is habitat heterogeneity the key? *Trends Ecol. Evol.* **18**: 182–188.

Chiron, F., Filippi-Codaccioni, O., Jiguet, F. & Devictor, V. 2010. Effects of non-cropped landscape diversity on spatial dynamics of farmland birds in intensive farming systems. *Biol. Conserv.* **143**: 2609–2616.

Dänhardt, J., Green, M., Lindström, A., Rundlöf, M. & Smith, H.G. 2010. Farmland as stopover habitat for migrating birds – effects of organic farming and landscape structure. *Oikos* **119**: 1114–1125.

Donald, P.F., Pisano, G., Rayment, M.D. & Pain, D.J. 2002. The Common Agricultural Policy, EU enlargements and the conservation of Europe's farmland birds. *Agric. Ecosyst. Environ.* **89**: 167–182.

Donald, P.F., Sanderson, F.J., Burfield, I.J. & van Bommel, F.P.J. 2006. Further evidence of continent-wide impacts of agricultural intensification on European farmland birds, 1990–2000. *Agric. Ecosyst. Environ.* **116**: 189–196.

Erdős, S., Báldi, A. & Batáry, P. 2009. Nest site selection and breeding ecology of Sky Lark (*Alauda arvensis*) in a Hungarian farmland. *Bird Study* **56**: 259–263.

Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. *Annu. Rev. Ecol. Evol. Syst.* **34**: 487–515.

Fahrig, L., Baudry, J., Brotons, L., Burel, F.G., Crist, T.O., Fuller, R.J., Sirami, C., Siriwardena, G.M. & Martin, J.-L. 2011. Functional landscape heterogeneity and animal biodiversity in agricultural landscapes. *Ecol. Lett.* **14**: 101–112.

Kleijn, D. & Báldi, A. 2005. Effects of set-aside land on farmland biodiversity: comments on Van Buskirk and Willi. *Conserv. Biol.* **19**: 963–966.

Morris, A.J. & Gilroy, J.J. 2008. Close to the edge: predation risks for two declining farmland passerines. *Ibis* **150**(Suppl. 1): 168–177.

Pickett, S.R.A. & Siriwardena, G.M. In press. The relationship between multi-scale habitat heterogeneity and farmland bird abundance. *Ecography*, doi: 10.1111/j.1600-0587.2011.06608.x.

Robinson, R.A. & Sutherland, W.J. 2002. Post-war changes in arable farming and biodiversity in Great Britain. *J. Appl. Ecol.* **39**: 157–176.

Silva, J.P., Palmeirim, J.M. & Moriera, F. 2010. Higher breeding densities of the threatened Little Bustard *Tetrax tetrax* occur in larger grassland fields: implications for conservation. *Biol. Conserv.* **143**: 2553–2558.

Sutherland, W.J. 2004. A blueprint for the countryside. *Ibis* **146**(Suppl. 2): 230–238.

Vickery, J.A., Feber, R.E. & Fuller, R.J. 2009. Arable field margins managed for biodiversity conservation: a review of food resource provision for farmland birds. *Agric. Ecosyst. Environ.* **133**: 1–13.

Whittingham, M.J., Krebs, J.R., Swetnam, R.D., Vickery, J.A., Wilson, J.D. & Freckleton, R.P. 2007. Should conservation strategies consider spatial generality? Farmland birds show regional not national patterns of habitat association. *Ecol. Lett.* **10**: 25–35.