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The potential impacts of the 2003 reform of the Common Agricultural Policy and the EU accession on farmland birds in Hungary

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1 Introduction

Hungary joined to the European Union in May 2004. The two most important, but possible conflicting, consequences of the accession, from a conservation point of view, are the transposition of the Common Agricultural Policy (CAP) and of the EU Nature Directives. It indicates the conflicts between these two policies is that while the 79/409/EC directive on the protection of wild birds requires the member states to maintain the populations of all bird species occurring naturally within their in favourable conservation status, still the conservation status of farmlands birds is the most critical in the EU Member States. This is generally attributed to the intensification of agriculture, which was partly stimulated by the CAP through subsidising the modernisation of farms and through high prices agricultural products.

In the New Member States from Central and Eastern Europe, the conservation status of farmland birds is generally considered more favourable than in Western Europe. However, several organisations are concerned that the introduction of the CAP will have a negative impact on bird populations, and on biological diversity in general, in the New Member States. In the meantime, the EU-accession and the CAP-reform offers new tools for the Hungarian nature conservation in the form of cross-compliance, agri-environmental measures, compensatory payments at Natura 2000 and Less Favoured Areas.

2 Objectives

The aim of this research was to explore the potential impacts on farmland birds of the new system of agricultural subsidies being gradually introduced in Hungary following the accession and the CAP reform. To this end the following issues were investigated:

1. What **economic and land-use changes** can be expected due to the EU accession and to the 2003 CAP reform?
2. Which bird species can be **potentially affected** by the expected changes in Hungary?
3. Is there any **actual differences in probability of occurrence and in density** of common farmland bird species related to the expected main land-use changes?
4. Which factors influence **effectiveness of the agri-environmental measures** targeted at the conservation of Great Bustard *Otis tarda* in Hungary?

3 Materials and methods

3.1 Potential impacts of the EU accession and the CAP reform and potential receptors

The EU accession and the CAP reform are likely to result in the following land-use changes:

- Increased pesticide use;
- Consolidation and specialisation of farms;
- Intensification of grassland management;
- Land abandonment ;
- Afforestation.

An Access relational database was developed to identify the species potentially sensitive to these impacts. This made possible considering simultaneously several resource requirements of the species, which cannot be implemented in the traditional matrix methods. The database included data on the food and habitat requirements of the species based on the section on Agricultural and grassland habitats in Appendix 3 from Tucker és Evans (1997). A series of queries were developed to identify species sensitive to certain land-use changes following the logic outlined below:

(1) Selection of species using the habitat (i.e. grassland, arable land).
(2) Selection of species using the resource or requiring the environmental conditions affected by the land-use change (e.g. intensification of grassland management, afforestation).
(3) Assessment of the likelihood of sensitivity of the species based on the required agricultural area in its home range and considering its specialised use of the resource.

3.2 Impacts of the expected habitat changes on common farmland birds

The probability of occurrence and the difference in density of 39 species at different agricultural habitats was modelled on the basis of data from the Common Bird Monitoring (MMM) scheme of the Hungarian Ornithological and Nature Conservation Society. Data from 2,926 sample plots with 100 meters radius from the year 2003 were analysed.

The **probability of occurrence** was modelled with logistic regression. Factors influencing the occurrence of the species were identified using the Á-NÉR categories present at the sample plots as independent variables and applying the stepwise backwards elimination technique. The predictive power of each model was evaluated using the area under the ROC curve (AUC).

The difference in the **density** of farmland birds in various arable crops was evaluated on the basis of data from 864 homogenous sample plots. The following pairs of habitats were tested using the Mann-Whitney test with the exact method: small parcels versus large fields (land consolidation), large fields of cereal versus maize, sunflower or oilseed rape (change of crop pattern), fallow land versus small parcels or large fields

(set-aside), abandoned land versus cultivated arable land (land abandonment).

3.3 Case study on the evaluation of the effectiveness of agri-environmental measures for Great Bustard

The potential effectiveness of the agri-environmental measures was evaluated in case of Great Bustard. First, a stochastic reproduction model was developed to evaluate the impacts of various farming techniques and the uptake level of the scheme on the fertility of a model population. Next, a stochastic matrix model was used to study the impact of changes in fertility on the viability of the population.

The **reproduction model** takes into account the growth of the vegetation, the timing of certain agricultural works, and simulates the impacts of the uptake level on the fertility of a Great Bustard population of 25 females under three alternative nest site selection mechanisms (vegetation height only, preference to alfalfa or to agri-environmental fields). In addition to the impact of the up-take level and various alternative agri-environmental prescriptions, the potential impact of a possible Natura 2000 compensatory payment scenario was also evaluated. The parameters of the reproduction model were estimated partly based on the literature, partly on the analysis of nest safeguard data collected between 1998 and 2005 at Dévaványa and in Bihar. The sensitivity of the model parameters was assessed using the maximum possible values.

The impact of the uptake level of the agri-environmental schemes on the **viability** of a model Great Bustard population was evaluated using a matrix population model. In this, the fertility rates were based on the output of the reproduction model. The development of alternative models with winter

mortality and without it made it possible to compare the potential impact of agri-environmental measures aimed at reducing winter mortality (i.e. sowing oilseed rapes). The sensitivity of the population to fecundity and survival rates, hence to the factors influencing them, was evaluated on the basis of the sensitivity analysis of the deterministic model and stochastically by reducing survival rates in 1% steps.

4 Results

4.1 Identification of species sensitive to the potential land-use changes

Based on their food and habitat requirements, most farmland bird species will be affected by the afforestation, land consolidation, land abandonment and increased insecticide use.

4.2 Modelling habitat requirements of common farmland birds

The influence of the presence of Á-NÉR categories on the occurrence of common farmland bird species were modelled and described by the author. In case of 10 species the predictive power of the model was poor (AUC = 0.60–0.69), in case of 17 species it was fair (AUC = 0.70–0.79) and in case of 7 species it was good (AUC = 0.80–0.89). The group with poorly performing models included mainly more abundant species which require the juxtaposition of several habitat types (e.g. Wood Pigeon *Columba palumbus*, Starling *Sturnus vulgaris*, Red-backed Shrike *Lanius collurio*, Tree Sparrow *Passer montanus* and Greenfinch *Carduelis chloris*). Contrarily, the species which were modelled with better results, usually had more specialised habitat requirements (e.g. Black-tailed Godwit *Limosa limosa*, Roller *Corracius garrulus*), or avoided certain

habitats (such as the Slylark *Alauda arvensis* the wooded areas, or the Blackbird *Turdus merula* the open habitats).

There was a significant positive relationship between the presence of **small parcels** and the occurrence of the Quail *Coturnix coturnix*, the Skylark, the Crested Lark *Galerida cristata*, the Barn Swallow *Hirundo rustica* and the Whinchat *Saxicola rubetra*. From these, the Skylark also shows significant positive association with cereal, maize, sunflower and oilseed fields, the Quail with cereal and sunflower, the Crested Lark with cereal and maize and the Whinchat with oilseed rape.

The Wood Pigeon, the Barn Swallow, the Red-backed and Lesser Grey Shrikes *Lanius minor*, the Tree Sparrow, the Starling and the Blackbird occurrence showed significant positive relationship with **field margins**.

Significant positive associations were found between the presence of **fallow** and the presence of Skylark, Linnet *Carduelis cannabina*, Yellowhammer *Emberiza citrinella*, Woodlark *Lullula arborea*, Corn Bunting *Milliaria calandra* and the Stonechat *Saxicola torquata*.

The presence of Turtle Dove *Srepotopelia turtur*, Starling, Yellowhammer, Red-backed Shrike, Whitethroat *Sylvia communis*, Barred Warbler *S. nisoria*, Blackbird and Song Trush *T. philomelos* showed association with **abandoned land**.

4.3 Comparative analysis of the density

Significant difference was fund in the density of Linnet, Greenfinch, White Stork, Wood Pigeon, Lesser Grey Shrike, Tree Sparrow, Whinchat, Starling and Lapwing *Vanellus vanellus* when plots in areas with **small parcels** were compared with plots in **large fields**. In all cases, the density was higher in the small parcels.

In case of large fields of **cereal and maize**, only the Skylark had significantly higher density in cereals at the level of $p < 0.05$. In case of **cereal and sunflower**, only the density of the Lapwing was significantly higher in sunflower. In case of **cereal and oilseed rape**, only the density of Whinchat was higher in oilseed rape fields.

Comparing **fallow land with small parcels,** there was a significant difference in the density of Yellowhammer, Whinchat and Lapwing. All of these species but Lapwing had a higher density in the fallow land. Comparing **fallow land with large fields**, there was significant difference in the density of Linnet, White Stork *Ciconia ciconia*, Yellowhammer, Grasshopper Warbler *Locustella naevia*, Wood Lark, Whinchat and Stonechat. In all cases, higher densities were found at the fallow land.

At areas being overgrown by bushes following **land abandonment**, only the Skylark had significantly lower density than on cultivated areas. Whilst, the density of Greenfinch, Yellowhammer, Turtle Dove, Blackbird and Song Trush was higher at the abandoned areas.

4.4 Evaluation of the potential effectiveness of the agri-environmental measures for Great Bustard in Hungary

4.4.1 The effect of various farming technologies on the breeding success of Great Bustard

According to the results of the simulation model, the number of chicks raised by a breeding female on average was at least seven times higher in **alfalfa** managed according to the requirements of the agri-environmental fields, except the ones mowed before 25 April, than in case of the conventional technology. It is important to note, however, that the chick

production in fields mowed before 25 April was even less than in conventionally managed ones.

In case of **grasslands**, there was a difference between the situation of grazing pastures and of the areas also utilised by mowing. The breeding success is not much lower in conventionally managed pastures than in meadows or pastures managed according to the agri-environmental prescriptions nor than in fallows representing the maximum breeding success. Contrarily, the number of chicks raised in grasslands mowed during the period of the first clutches was only half than in grasslands managed according to the agri-environmental prescriptions.

In case of **cereal**, only a small difference can be observed between the areas managed according to conventional or agri-environmental technologies.

4.4.2 The impact of uptake level of the agri-environmental measures

The proportion of nests in fields protected by agri-environmental has increased with the increasing level of up-take of the measures. However, the rate of increase was different depending on the nest site selection method assumed in the model.

The uptake level and the alternative prescriptions had significant impact on the fertility of the model population. The *post hoc* test confirmed that the average number of chicks raised by a female has increased with the uptake level in case of all models.

The fertility of the population under the Natura 2000 scenario was practically equal to ones under scenarios when the entire area was under agri-environmental measures. However, the scenarios representing alternative prescriptions did not show

any consistent pattern except that the scenario based on the ÖPUL prescriptions was better than any other one.

4.4.3 The effect of agri-environmental measures on the viability of the Great Bustard population

The extinction risk of the population within 100 years has declined from 33.1% to 0.5% when the model included the possibility of periodical catastrophic winter mortality and declined from 14.4% to zero without the possibility of the catastrophe. This shows that the measures targeted at preventing winter mortality – e.g. sowing oilseed rape and clearing the fields from snow – can improve the viability of the population as much as increasing reproduction by having 25% of the area is under agri-environmental measures.

The deterministic assessment of the matrix model shows that the deterministic growth rate is most sensitive to the change of adult survival and fertility, but only to less extent to the latter. Therefore, the agri-environmental programmes can compensate the impacts of factors (e.g. construction of power-lines) reducing survival only to a limited extent. This was confirmed also by the results of the stochastic simulation. Under the assumptions of the model, it was not possible to compensate more than 3% decline in survival rate with agri-environmental measures.

5 Theses

1. It is expected that the main land-use changes effecting farmland birds in Hungary will be the increasing pesticide use, the increasing consolidation and specialisation of farms, locally land abandonment and intensification of grassland management.

2. Most farmland bird species in Hungary are sensitive to afforestation, land abandonment, consolidation of farms and to the application of insecticides.

3. Both the modelling of their habitat associations and the comparative analysis of their densities in different farmland habitats provide evidence that areas with predominantly small fields are particularly important for common farmland birds. Unfortunately, it is expected that the extent of this form of farming will gradually decrease partly due to the increasing age of small holders, partly due to active incentives provided through the rural development programme in the form of support for young farmers and for early retirement.

4. Both empirical approach has confirmed the importance of fallow land for common farmland bird species also in Hungary, especially in comparison with large fields. The introduction of compulsory set-aside will provide an opportunity for the expansion of this habitat type. However, set-aside areas may not necessarily be managed as fallow and in line with the requirements of farmland bird species.

5. According to the results of the simulation modelling the effectiveness of the Hungarian Great Bustard conservation measures mainly depend on the following factors (1) the proportion of the area under the scheme, (2) mortality rate of the population. According to the results of the simulation, the current extent of Great Bustard conservation measures under the Hungarian agri-environmental scheme is insufficient to ensure the favourable conservation status of the Hungarian population.

6. Alternative nest site selection assumptions showed that insufficient coverage of agri-environmental measures can

limit the effectiveness of agri-environmental schemes also in case of other species with similar conservation problem unless fields under agri-environmental measures preferred at nest site selection.

7. On the other hand, the results of the simulation also demonstrated that compulsory restrictions with compensatory payments on Natura 2000 areas restricted to the most sensitive crops (i.e. alfalfa and hay meadows) could increase the fertility of the population almost as much as paying agri-environmental subsidies over the entire area. Thus, Natura 2000 payments can present a more efficient alternative to agri-environmental measures under the new rural development regulation.

6 Conclusions and recommendations

1. Based on the analysis of the CAP reform and of the Copenhagen Agreement, it can be concluded that the EU accession of Hungary presents less risk to farmland birds than in case of the old Member States. This is because (1) the CAP encourages the production to a lesser extent than in the past, (2) it opens up new opportunities for nature conservation (cross-compliance, set-aside, agri-environmental measures, Natura 2000 compensatory payments). However, the higher institutional prices still encourage more intensive production, although this does not manifest yet fully due to the weaknesses of the institutions and logistics. Nevertheless, conservation interest should be more thoroughly integrated into the Hungarian agricultural policy to be able to comply with the requirements of the Birds Directive and to contribute to the achievement of the EU target of halting the loss of biodiversity by 2010.

2. Maintenance of grasslands will remain the major challenge for nature conservation because the development of grazing livestock is limited by quotas. Based on the analysis of the MMM data, abandoned land – especially in the hilly areas – hold higher density of several farmland species. However, the impact of reduced grazing is more negative at the Hungarian Plain especially for rare species. Setting the amount of area based payment for grasslands will be an important issue in relation to the introduction of the SPS. Considering the conservation of grasslands, it is recommended setting the rate of subsidies at least at the same level as for arable land. Agri-environmental subsidies can provide additional financial support and guidance.

3. With regards to the outstanding importance of weeds and insects to farmland birds it would be necessary to review the current rules for cross-compliance in Hungary. It would be more appropriate to limit the prescriptions requiring farmers to remove weeds and unwanted plants only to dangerous weeds. Farmers should receive advice on the management of set aside land and maintenance of small landscape features. In addition, maintenance activities on set-aside land should be also restricted during the breeding season while taking into account of the management needs of other taxa.

4. Although small-scale farming system are favourable for many farmland birds, it is likely that this will disappear gradually. Therefore, it is urgent to intensify research for understanding the key factors contributing to a higher density and diversity of birds in this habitat type. This should be followed by the development and experimental deployment of agri-environmental measures emulating the critical habitat characteristics at large scale. It is likely that the introduction of compulsory set-aside will make land

available to be managed with regards to the interests of nature conservation and game management if suitable incentives are available.

5. The New Hungary Rural Development Plan contains several measures (e.g. afforestation of agricultural and non-agricultural land, drainage, melioration) that might have negative impact on certain farmland bird species. The conservation of these should be ensured during the licensing procedure of individual projects. This opportunity already exists at Natura 2000 areas for the species the area was designated for. However, there is no similar protection available for other species and areas.

6. Following the modernisation of agricultural production, the agri-environmental measures will receive the largest budget from the New Hungary Rural Development Plan. Amongst these the Great Bustard conservation measures has prime conservation importance. The results of the simulation modelling suggest that the most effective measure would be to introduce compulsory restrictions on the mowing of alfalfa and grassland before 15 June in Special Protection Areas designated for the conservation of the species. Here, the income loss of farmers should be rather compensated through Natura 2000 payments than of having based the conservation of the species on the voluntary agri-environmental measures only. Nevertheless, agri-environmental measures can continue to play an important role, especially in improving winter survival through promoting the sowing of oilseed rape.

7. It is recommended to apply similar simulation modelling approach more widely to inform rural development policy addressing farmland biodiversity during the decision-making process such as selecting tools, allocating budget and targeting measures. However, this approach might be

not suitable for most other species yet due to lack of information needed for developing the models. Nevertheless, the modelling approach can help identifying information gaps and issues to be investigated in more detail.

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