CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW No. 11

THE EFFECTIVENESS OF LAND-BASED SCHEMES (INCL. AGRI-ENVIRONMENT) AT CONSERVING FARMLAND BIRD DENSITIES WITHIN THE U.K.

REVIEW REPORT

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COVER SHEET

Title	**The Effectiveness of Land-Based Schemes (incl. agri-environment) at Conserving Farmland Bird Densities within the U.K.**
Systematic review	**N$^{o.}$11**
Reviewer(s)	Roberts, P.D. (PDR) & Pullin, A.S (ASP)
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Amendments due to draft consultation	° The summary, introduction, results and discussion sections of the review document were edited in light of comments received from stakeholder groups. ° Scheme and bird data was separated into winter and summer meta-analyses. ° Additional quality assessment of the primary studies. ° Meta-regression of possible reasons for heterogeneity undertaken on winter scheme data, with "total" farmland bird densities. ° More guidance on experimental design is provided including an explanation of pseudoreplication. ° More advice on policy ideas provided within the implications to policy and practice section. ° Referencing amended.
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SYSTEMATIC REVIEW SUMMARY

BACKGROUND

Farmland bird species have suffered considerable population declines and range restrictions over the past three decades. This has been highlighted as an issue of major concern, throughout many western European countries. Numerous studies have focused on the possible causes for the decline of farmland bird species, however, it was not until the 1990s that the full scale and of this problem became apparent. The combination of agricultural intensification, especially after the U.K. joined Europe and the Common Agricultural Policy, weed control through the increased use of herbicides, the change from spring sown crops to autumn cropping systems and increased stock densities are all agreed to be primary causes of this dramatic decline (Donald *et al*. 2001; Vickery *et al*. 2001; Berendse *et al.* 2004).

Based on large scale monitoring across Europe the value of agri-environment schemes have been questioned due to mixed results across plant, invertebrates and bird species (Kleijn, *et al.* 2006). This systematic review seeks to clarify the situation within the UK, by assessing the available evidence within the public domain on the effectiveness of land-based schemes (incl. agri-environment schemes), at the prescription level, when possible, at conserving farmland bird species densities.

OBJECTIVES

What effects do the different land-based schemes (especially agri-environment) and their prescriptions have on (a) total farmland bird densities and (b) individual species densities within the U.K.?

SEARCH STRATEGY

Electronic databases
ISI Web of Knowledge (WoK), Science Direct (Agricultural and Biological Sciences), JSTOR, Blackwell Synergy, Index to Theses, COPAC, Royal Agricultural College, Wildlink, Countryside Council of Wales (CCW) WebCat, Centre for Ecology & Hydrology (CEH) web catalogue, Directory of Open Access Journals.

Other searches
In addition further internet searches using www.alltheweb.com, and http://scholar.google.com/ (Google Scholar Beta). The following U.K. statutory bodies and NGOs were contacted and/or libraries searched: EN, SNH, CCW, Joint Nature Conservation Committee (JNCC), BTO, RSPB, BirdLife International, NFU, Farming and Wildlife Advisory Group (FWAG), Defra, National Trust, & UK Wildlife Trusts. All searches were conducted during March/April 2005.

STUDY SELECTION CRITERIA

Studies were included if they fulfilled the following selection criteria:

Bird Population as Subject
Studied one (or more) of the following farmland bird species:
Bullfinch (*Phrrhula pyrrhula*), Cirl Bunting (*Emberiza cirius*), Corn Bunting (*Miliaria calandra*), Corncrake (*Crex crex*), Goldfinch (*Carduelis carduelis*), Greenfinch (*Carduelis chloris*), Grey Partridge (*Perdix perdix*), Jackdaw (*Corvus monedula*), Lapwing (*Vanellus vanellus*), Linnet (*Carduelis cannabina*), Reed Bunting (*Emberiza schoeniclus*), Red-backed Shrike (*Lanius collurio*), Rook (*Corvus frugilegus*), Skylark (*Alauda arvensis*), Song Thrush (*Turdus philomelos*), Spotted Flycatcher (*Muscicapa striata*), Starling (*Sturnus vulgaris*), Stone Curlew (*Burhinus oedicnemus*), Tree Sparrow (*Passer montanus*), Turtle Dove (*Streptopelia turtur*), Whitethroat (*Sylvia communis*), Woodpigeon (*Columba palumbus*), Yellowhammer (*Emberiza citronella*), Yellow Wagtail (*Motacilla flava*).

Interventions of Interest
Farms entered into land-based, agri-environmental schemes, or experimental plots/land/fields which simulated past, present or future land-based options/prescriptions.

Outcome Measures
Any of the following measures: 1) the number of birds, 2) density of bird species (territory, nest, etc.), 3) overall change in individual species' abundance over time.

Types of Study (Comparator)
A plot, field or site that is not included within a land-based scheme/prescription. The experimental design of the article was required to be a randomised control/block trial, control trial, site comparison, or time series experiment with a baseline. Articles were excluded if they were 1) only qualitative, 2) speculating on ideal land-based scheme designs without presenting evidence to support the authors recommendations, 3) based on the outputs of models.

DATA ANALYSIS

Meta-analysis was used to combine the effect sizes across all studies and test their level of significance. Sensitivity analyses were performed on the data to determine the effect of the inclusion/exclusion of different seasons (Summer and Winter densities), farmland bird species and individual prescriptions.

MAIN RESULTS

The searching of all electronic databases and the internet produced 5506 references. After duplicates were removed a total of 3070 unique references remained for assessment at title and abstract stage, of which 305 required full text assessment against the above inclusion criteria. Subsequent assessment yielded a total of 30 studies which were relevant for inclusion within the systematic review.

Data pertaining to four land-based schemes (Arable Stewardship Pilot Scheme, Countryside Stewardship, Organic Cropping and Set-aside) and two individual prescriptions, (Stubble and Wild-Bird Cover) were captured by the systematic review process. In addition data pertaining to 18 of the desired 24 species was captured with varying number of datasets covering either winter or summer densities.

Winter data
All four schemes and the two prescriptions contained significantly higher winter densities of total farmland birds (all species analysed together). The individual species analyses provided mixed results concerning their comparative utilisation of agri-environment scheme fields and conventional cropping systems. Data pertaining to 15 of the 18 species (83%) were captured (no data were available on Cirl Bunting (*Emberiza cirius*), Lesser Whitethroat (*Sylvia curruca*) and Yellow Wagtail (*Motacilla flava*)). Of the 15, eight species (Corn Buntings (*Miliaria calandra*), Greenfinch (*Carduelis chloris*), Grey Partridge (*Perdix perdix*), Lapwing (*Vanellus vanellus*), Linnet (*C. cannabina*), Rook (*Corvus frugilegus*), Skylark (*Alauda arvensis*) and Song Thrush (*Turdus philomelos*)) had significantly higher densities on agri-environment fields compared to conventional cropping. No species had higher densities on conventional agricultural fields compared to those fields entered under agri-environment scheme agreements.

Summer data
Mixed results were observed for the summer. Data were only available for Arable Stewardship Pilot Scheme, Organic Cropping and Set-aside. Both Organic Cropping and Set-aside contained significantly higher summer densities of total farmland birds, while the Arable Stewardship Pilot Scheme made no significant difference. No data were available on individual prescriptions for summer bird densities.

For the individual species analysis, data pertaining to 17 of the 18 species were captured (no data were available on Tree Sparrows (*Passer montanus*)). Six (Cirl Buntings, Grey Partridge, Lapwing, Rook, Skylark and Woodpigeon (*Columba palumbus*)) had significantly higher densities on agri-environment fields compared to conventional cropping. Ten species (Corn Bunting, Goldfinch, Greenfinch, Jackdaw (*C. monedula*), Lesser Whitethroat, Linnet, Reed Bunting (*E. schoeniclus*), Song Thrush, Starling (*Sturnus vulgaris*) and Yellowhammer (*E. citrinella*)) showed no statistically significant difference in density on either land-based schemes or conventional agricultural fields. Yellow Wagtail had significantly higher densities on conventional cropping fields compared to those entered into agri-environment schemes.

CONCLUSIONS

Available evidence, within the public domain, supports the effectiveness of land-based schemes for maintaining higher densities of farmland bird species, especially during winter periods, compared to conventionally cropped fields. Land-based scheme prescriptions provide additional food resources for wintering bird species at a vital time of the year, when resources had previously been depleted by the intensification of farmland within the U.K.

Although "total" farmland bird densities increase, it is important to appreciate which bird species respond positively to each scheme or, more importantly, to each individual management prescription/option. This is especially important if the targeted species have restricted ranges (e.g. Cirl Bunting) or are migratory (e.g. Lesser Whitethroat and Yellow Wagtail). It would be a waste of resources and possibly detrimental for target species (i.e. reducing densities and restricting ranges further) if inappropriate prescriptions were established in particular areas. Unfortunately, only a partial picture can be developed as there was insufficient high quality experimental evidence readily available within the public domain to analyse the effectiveness of each of the individual prescriptions available under umbrella land-based schemes. However, the evidence does highlight the effectiveness of wild bird (seed) cover and winter stubbles to provide suitable habitat and food resources for a range of farmland bird's wintering periods.

Further guidance is required in future agri-environment scheme documentation provided to farm/land managers. The objectives of each prescription within the scheme should be clearly described, providing managers with a greater understanding of why each prescription might benefit the biodiversity on their farm/land.

The evidence synthesised within this review, although allowing the assessment of the effectiveness of fields entered into land-based management schemes to contain significantly higher farmland bird densities, does not allow conclusions to be drawn on how bird species population trends respond to these additional resources. Whether species are simply redistributing between the available resources by aggregating in fields under agri-environment management and deserting conventional fields (no change in population trend), or experiencing increased breeding success or over-winter survival rate (positive population trend) giving evidence of species recovery, is unknown.

Currently, there appear to be two scales used to measure the success of land-based schemes. The first is an "overall scheme" scale which is used at political or policy level. Therefore if total farmland bird species abundance, or even individual species are increased due to introduction of land-based schemes then that scheme can be considered a success. The second measures success of land-based schemes at the individual "prescription" scale, and thus has greater biological meaning. It is therefore disappointing that datasets for only two prescriptions were captured. Even though the individual prescriptions were based on knowledge of bird resource needs, prior to being introduced as an option in land-based schemes, their effectiveness still needs to be ascertained to ensure that they are delivering the results that were initially predicted, in addition to the overall scheme's effectiveness.

Further investigation into farmland bird population trends is required via manipulative factorial or randomised controlled experiments, although these are both resource intensive in terms of time and finances. Careful consideration must be given to the level of replication, as the assessment of land-based interventions such as agri-environment schemes requires large units of replication. Alternatively, comparisons of outcome metrics such as over-winter survival, breeding productivity/fledgling survival, within the various landscape scales (fields/farms/regions) with and without land-based scheme options would allow the identification of farmland bird species population trends and provide suitable data to model national population trends.