Collaboration for Environmental Evidence
Library

CEE review 07-011

THE EFFECTIVENESS OF INTEGRATED FARM MANAGEMENT, ORGANIC FARMING AND AGRI-ENVIRONMENT SCHEMES AS INTERVENTIONS FOR CONSERVING BIODIVERSITY IN TEMPERATE EUROPE

Systematic Map Protocol

NICOLA RANDALL

Harper Adams University College, Newport, Shropshire, TF10 8NB , UK

Correspondence: nrandall@harper-adams.ac.uk
Telephone: +44 (0)1952 815347

Draft protocol published on website: 12 November 2007 - Final protocol published on website: 20 October 2008

Cite as: Randall, N. 2008. The effectiveness of integrated farm management, organic farming and agri-environment schemes as interventions for conserving biodiversity in temperate Europe. CEE protocol 07-011 (SR35). Collaboration for Environmental Evidence: www.environmentalevidence.org/ SR35.html.

1. BACKGROUND

Agriculture is the dominant land use throughout much of Western Europe, and since the 1940s, farming has increasingly become more intensive. This has resulted in widespread declines in many groups of organisms associated with farmland (Robinson & Sutherland, 2002). Farmland birds in particular are well documented (Fuller *et al*., 1995, but losses of other organisms are also much recorded. Bumblebee declines are especially marked (Carvell *et al*., 2004), and butterflies declined by 22.5% between 1994 and 2003 (Butterfly Conservation, 2006)

Following a green paper in 1985 which addressed the environmental impact of agriculture (CEC 1985), agri-environment schemes (AES) have been available to European Union member states under the Common Agricultural Policy (CAP) (Kleijn & Sutherland, 2003). However, schemes are subject to change due to ongoing reforms, and also vary between different countries.

In Britain, there are a number of schemes available that provide financial incentives to farmers to adopt environmentally friendly land management. In 2005 the Environmental Stewardship Scheme (ESS) was introduced to replace a number of previous schemes. ESS has three different entry levels, Entry Level Stewardship (ELS), available to all farmers, Organic Level Stewardship (OLS) available to organic farmers and Higher Level Stewardship (HLS) for targeted environmental management.

A number of studies have examined whether AES can be effective in conserving or increasing biodiversity (Kleijn & Sutherland, 2003; Kleijn *et al*., 2006 for example), but results appear to be variable (Whittingham, 2007). Marshall et al. (2005) suggested that landscape structure affects the success of farmland biodiversity initiatives. This may need to be addressed in future agri-environment schemes (Wittingham, 2007).

Similar questions are raised as to the effectiveness of organic farming on biodiversity. For example Hole *et al*. (2005) compared data from Europe, New Zealand, the US and Canada and suggested that organic farming increased biodiversity at every level of the food chain, yet a meta-analysis by Bengstsson *et al*. (2005) found that results varied between studies, and between organism groups and landscapes. Fuller *et al*. (2005[2]) suggested that the magnitude of biodiversity variation between taxa is because the scale of organic farms may be too low to affect species with large spatial needs.

Integrated farming has also been shown to increase biodiversity when compared with conventional farming (Berry *et al*., 2005) although results again vary between studies and species.

The question of how different farming systems compare in their effects on biodiversity and other environmental impacts was recently identified by policy makers and scientists as one of the top 100 priority policy-relevant ecological questions in the UK. The need to learn from AES to optimize future biodiversity gain and ecological benefits was also prioritised. (Sutherland *et al.*, 2006).

Using systematic review methodology, terrestrial biodiversity of farmland under different management interventions will be critically appraised. The review will consider the best

available evidence of the effectiveness of different management regimes in different situations (Table 1). Publication bias will be limited through the use of comprehensive literature searching (published and unpublished), specific inclusion criteria, and formal assessment of the quality and reliability of the studies retrieved. Subsequent data synthesis (qualitative and/or quantitative) will summarise evidence to provide guidance to land managers and highlight any gaps in the research evidence.

2. OBJECTIVE OF THE REVIEW

2.1 Primary question

How do farm-scale interventions, such as intergrated farm management, agri-environment schemes and organic farming impact on biodiversity compared with conventional farming in temperate Europe?

2.2 Secondary question *(if applicable)*

Which farming regimes are most effective for increased diversity of particular groups of species (eg birds, mammals, invertebrates, plants)? Do results vary between land and output types (eg. Upland, lowland, arable, livestock)

Table 1. Components of the primary and secondary systematic review questions

Subject	**Intervention**	**Outcome**	
		Primary	**Secondary**
Farmland biodiversity i.e. abundance/diversity of flowering plants, birds, mammals and invertebrates for example.	Farming type -organic -integrated farm management -conventional -named agri-environment schemes and individual prescriptions	Biodiversity This could be measured by diversity/abundance/ species richness of different groups of organisms	Effect on diversity of different groups including: Birds, mammals, plants, invertebrates (pollinators, natural enemies, nutrient cycling species.) Effect on abundance of each of the above type of organism Effect of land/output type eg. -upland/lowland -arable/livestock

3. METHODS

3.1 Search strategy

The following general computerised/web databases will be searched:

1) ISI Web of Knowledge (incl.ISI Web of Science and ISI Proceedings)
2) Science Direct
3) Blackwell Synergy
4) IngentaConnect
5) Directory of Open Access Journals
6) COPAC
7) Scirus (All journal sources)
8) Scopus
9) Index to Theses Online
10) Digital Dissertations Online
11) Agricola
12)CAB Abstracts
13) Natural England's "Wildlink"
14) Centre for Ecology and Hydrology online database
15) JSTOR
16)Conservation Evidence.com
17 Conservation Online

Other specific/specialised databases will be search where identified or recommended by experts within the field.

In addition, web searches will be performed using the search engines: www.alltheweb.com, http://scholar.google.com and www.dogpile.com. The first 50 hits (.doc .txt.xls and .pdf documents where this can be separated) from each data source will be examined for appropriate data. No further links from the captured website will be followed unless to a document/pdf file.

The following search terms will be utilised on each of the database and web searches. (*indicates a wildcard).

1) ***Farm* AND biodiversity***
2) ***Organic* AND *biodiversity***
3) ***Farm* AND diversity***
4) ***Farm* AND abundance***
5) ***Farm** AND **species***
6) ***Agri-environment***
7) ***Farm*AND bird****
8) ***Farm** AND **invertebrate****
9) ***Organic* AND *species***
10) ***Agri-environment* AND *species***

Bibliographies of articles viewed at full text will be searched for relevant articles missed by previous searches. Recognised experts, practitioners and authors will be contacted for further recommendations and for provision of relevant unpublished material or missing data.

Searches of publications from United Kingdom, European and United States statutory and non-statutory organisations will also be included.

3.2. Study inclusion criteria

The inclusion and exclusion criteria will be applied by one reviewer to all potential studies at the title and abstract level. Where there is insufficient information to make an informed decision regarding a studies inclusion, then relevance to the next stage of the review process (full text assessment) will be assumed. A second reviewer will examine a random subset of at least 25% of the reference list (up to a maximum of 2000 references) to assess repeatability of the selection criteria. Kappa analysis will be performed, with a rating of 'substantial'(0.6 or above) being required to pass the assessment. Disagreement regarding inclusion or exclusion of studies will be resolved by consensus, or following assessment by a third reviewer. If the Kappa value is low, the reference list will be reassessed against adjusted inclusion and exclusion criteria. The same subset of references will be re-assessed by a second reviewer with Kappa analysis. Reviewers will then consider articles viewed at full text for relevance, either excluding them from, or admitting them to, the review.

- **Relevant subject(s):**

All studies that investigate some aspect of biodiversity or species diversity on farmland will be considered for inclusion into the systematic review, irrespective of habitat or spatial scale. The scope will be Temperate Europe, (i.e. For this study, all European countries west of Russia, but excluding Spain, Italy, Portugal, and all countries south of Austria, Hungary and Romania). A record will be made of the geographical area in case of distribution patterns of variation.

- **Types of intervention:**

All interventions that aim to increase biodiversity on farmland will be considered valid for inclusion initially. The review may be restricted at a later stage, if there is too much or too little literature available to assess all interventions. In this case, the intervention(s) with the most available literature will become the focus of the review.

- **Types of comparator:**

A comparator (e.g. conventionally farmed plot) is required for inclusion within formal meta-analysis. Articles lacking a comparator will be included within qualitative analysis and summarised within tables.

- **Types of outcome:**

Differences or similarities in biodiversity on different farm types, and differences or similarities in biodiversity following management changes on farmland will all be considered.

- **Types of study:**

Any study that investigates biodiversity on farmland will be considered.

- **Potential reasons for heterogeneity:**

Habitat type
Longitude/latitude
Altitude
Farming regime
Length of time farmed under same regime.
Previous farming regimes on land.

3.3 Study quality assessment

Reviewers will assess the methodologies used by all articles accepted at full text. Study quality will be scored according to a hierarchy of evidence adapted from systematic review guidelines used in medicine and public health (Stevens & Milne

1997) and conservation (Pullin & Knight 2003); e.g. a randomised control trial would be weighed higher than a site comparison study. A second reviewer will examine a random subset of at least 25% of the selected studies to assess repeatability of study quality. Disagreement regarding study quality will be resolved by consensus or following assessment by a third reviewer.

3.4 Data extraction strategy

Data will be extracted by one reviewer, and a random subset of at least 25% or the selected studies will be checked by another reviewer to verify repeatability and accuracy. Data regarding the study characteristics, quality design and results will be recorded using electronic data extraction forms. Where information regarding the reasons for heterogeneity is presented in the studies, it will be recorded.

3.5 Data synthesis

Methods of data synthesis will depend on the type of data presented in the accepted studies. As a minimum, all studies accepted for inclusion will be summarised qualitatively. Primary data will be collected from the author/organisation if it is not presented in the study write-up. Summary tables of study characteristics, study quality and results will be presented, accompanied by a narrative synthesis.

Quantitative analysis will be undertaken on any data suitable for formal statistical analysis. Where possible, meta-analysis for each of the interventions will be carried out with reasons for heterogeneity assessed by meta-regression (univariate or multivariate). If meta-analysis is not possible, then other appropriate statistical techniques may be performed.

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

No conflicts of interest to declare.

5. REFERENCES

Bengtsson J, Ahnstrom J, & Weibull AC (2005) The effects of organic agriculture on biodiversity and abundance: a meta-analysis. *Journal of Applied Ecology* **42** 2 pp 261-269.

Berry P, Ogilvy S & Gardner S (2005) *Integrated Farming and Biodiversity – English Nature Research Reports no. 634.* Adas, English Nature.

Butterfly Conservation (2006) *Agri-environment schemes and butterflies: Re-assessing the impacts and improving delivery of BAP targets Project report ref. BD1446* Defra

Carvell C, Meek WR, Pywell RF, Nowakowski M (2004) The response of foraging bumblebees to successional change in newly created arable field margins. *Biological Conservation* **118** 327-399

Fuller RJ, Gregory RD, Gibbons DW, Marchant JH, Wilson JD, Baillie SR, & Carter N. (1995[1]) Population declines and range contractions among lowland farmland birds in Britain. *Conservation Biology* **9** 1425-1441.

Fuller RJ, Norton LR, Feber RE, Johnston PJ, Chamberlain DE, Joys AC, Mathews F, Stuart R, Townsend MC, Manley WJ, Wolfe MS, MacDonald DW & Firbank LG. (1995[2]) Benefits of organic farming to biodiversity vary among taxa. *Biology Letters* **1** 4 pp 431-434.

Hole DG, Perkins AJ, Wilson JD, Alexander IH, Grice PV, & Evans AD (2005) Does organic farming benefit biodiversity? *Biological Conservation* **122** pp. 113-130

Kleijn D, Baquero RA, Clough Y, Diaz M, Esteban J, Fernadez F, Gabriel D, Herzog F, Holzshuh A, Johl R, Knop E, Kruess A, Marshall EJP, Steffan-Dewenter I, Tscharntke T, Verhulst J, West TM, & Yela JL, (2006) Mixed biodiversity benefits of agri-environment schemes in five European countries. *Ecology Letters* **9** 3 pp 243-254

Kleijn D, Sutherland WJ (2003) How effective are European agri-environment schemes in conserving and promoting biodiversity? *Journal of Applied Ecology* **40** 947-969

Marshall EPJ, West TM & Kleijn D (2005) Impacts of agri-environment field margin prescriptions on the flora and fauna of arable farmland in different landscapes. *Agriculture, Ecosystems and Environment* **113** pp 36-44.

Pullin AS & Knight TM (2001) Effectiveness in conservation practice: Pointers from medicine and public health. Conservation Biology **15** 1 pp 50-54

Robinson RA, Sutherland WJ (2002) Post-war changes in arable farming and biodiversity in Great Britain. *Journal of Applied Ecology* **39** 157-176

Stevens A and Milne R (1997) The effectiveness revolution and public health. Pp 197-225 *in* G. Scalley (ed). *Progress in Public Health*. Royal Society for Medicine Press, London UK.

Sutherland WJ, Armstrong-Brown S, Armsworth PR, Brereton T, Brickland J, Campbell CD, Chamberlain DE, Cooke AI, Dulvy NK, Dusic NR, Fitton M, Freckleton RP, Godfrey CJ, Grout N, Harvey HJ, Heldley C, Hopkins JJ, Kift NB, Kirby J, Kunin WE, MacDonald DW, Marker B, Naura M, Neale AR, Oliver T, Osborn D, Pullin AS, Shardlow MEA, Showler DA, Smith PL, Smithers RJ, Solandt J, Spencer J, Spray CJ, Thomas CD, Thompson J, Webb SE, Yalden DW, & Watkinson AR (2006) The identification of 100 ecological questions of high policy relevance in the UK. *Journal of Applied Ecology* **43** pp 617-627

Wittingham (2007) Will agri-environment schemes deliver substantial biodiversity gain, and if not why not? *Journal of Applied Ecology* **44** pp.1-5