Collaboration for Environmental Evidence

Systematic Review No. *72*

WORKING TITLE: *DOES DELAYING THE FIRST MOWING DATE INCREASE BIODIVERSITY IN EUROPEAN FARMLAND MEADOWS?*

Draft Review Protocol

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Cover Sheet

Title	*DOES DELAYING THE FIRST MOWING DATE INCREASE BIODIVERSITY IN EUROPEAN FARMLAND MEADOWS?*
Systematic review	**N^{0}**.*72*
Reviewer(s)	*Jérôme Pellet and Judith Wunderlin*
Date draft protocol published on website	*April 24th 2009*
Date final protocol published on website	
Date of most recent amendment	*April 8th 2009*
Date of most recent SUBSTANTIVE amendment	*April 8th 2009*
Details of most recent changes	*April 8th 2009*
Contact address	*jerome.pellet@amaibach.ch*
Sources of support	*University of Bern, Institute of Ecology and Evolution , Division of Conservation Biology*
Conflicts of interest	*None declared*

1. Background

Concern about the decline of farmland fauna emerged in the late 1960's (Carson, 1962) and has amplified until today (Chamberlain et al., 2000; Krebs et al., 1999; Robinson & Sutherland, 2002; Scherr & McNelly, 2007). As a response, most countries have implemented agri-environmental schemes (AES), in which farmers are financially supported to modify their farming practice to provide environmental benefits. Agri-environmental schemes mostly aim at protecting and restoring farmland biodiversity (Kleijn & Sutherland, 2003). They are voluntary programmes in which farmers usually receive direct payments for providing services that go beyond current good agricultural practices, such as management of semi-natural habitats. Currently, 25% of European farmland is under some sort of agri-environmental contract (Kleijn *et al.*, 2001).

Hay and litter meadow are among the most common type of surfaces integrated in European AES. The most important management action on these surfaces is mowing. Mowing vegetation at least once a year has a positive effect on vascular plant species richness, especially when cuttings are removed (Parr & Way, 1988). Parr and Way (1988) also demonstrated that early-summer mowing has a detrimental effect on species richness of flowering plants. However, it has been suggested that later mowing dates (e.g. July 21st) might be more favourable for vascular plant biodiversity (Smith et al., 2000; Smith et al., 2002).

Anual mowing has a contrasting effect on invertebrates (Morris & Rispin, 1987; Volkl *et al.*, 1993). Although detrimental to many insects in the short term (Erhardt, 1985; Feber, Smith & Macdonald, 1996; New, 1997; Valtonen & Saarinen, 2005), mowing has a largely positive long term effect because it prevents the growth of bushes and trees and thus maintains semi-natural grasslands beneficial to a large number of heliophilous and thermophilous species. It has also been suggested that delaying dates of first mowing could be positive for multiple invertebrates, including butterflies, spiders, and ground beetles, depending on various vegetation structures (Knop *et al.*, 2006; Koller *et al.*, 2000; Morris, 2000; Pozzi, 2004).

For vertebrates, the situation is different: mowing renders food resources suddenly available (e.g. insects and rodents) that were so far hidden in the sward. Foragers may massively congregate towards these rich, although ephemeral food supplies (Arlettaz, 1996). On the other hand, ground-breeding birds are likely to be heavily impacted by early mowing.

While most AES have the manifest objective of restoring biodiversity and ecosystem services (Tscharntke *et al.*, 2005), they often bind farmers to threshold dates for agricultural operations. The date of the first mowing of meadows is usually defined as a trade-off between expected agricultural yield and impacts on wildlife. Given that this first mowing date is the most easily changed management practices (Chamberlain et al., 2000; Valtonen, Saarinen & Jantunen, 2006), it is the most likely to provide environmental benefits at little agronomic loss.

The objective of this review is to evaluate the evidences available to estimate the biodiversity benefits of a delayed mowing date on European farmland meadows.

2. Objective of the Review

2.1 Primary question

Does delaying the first mowing date increase biodiversity in European farmland meadows?

Subject	Intervention	Outcome measure	Comparator
Natural and semi-natural European farmland meadows	Delaying of the first mowing date	Changes in biodiversity (surrogate measures in multiple taxonomic groups)	Earlier first mowing regime

2.2 Secondary question *(if applicable)*

Do different taxa usually used to assess agri-environmental schemes (including, but not limited to ground beetles, butterflies, spiders, grasshoppers, birds…) respond differently to delayed mowing date in farmland meadow?

Does α–, β– and γ–diversity responds differently to such management changes?

Preliminary searches lead us to believe that few documents will be available to answer this last question. It is however an important one in order to find ways to restore large-scale farmland biodiversity.

3. Methods

3.1 Search strategy

The following web databases will be searched for relevant documents:

1. ISI Web of Science (http://apps.isiknowledge.com)
2. Science Direct (http://www.sciencedirect.com)
3. Scopus (http://www.scopus.com)
4. Ebsco (http://web.ebscohost.com)
5. Scientific Electronic Library Online (http://www.scielo.org)
6. JSTOR (http://www.jstor.org)
7. Agricola (http://agricola.nal.usda.gov/)
8. CAB Abstracts (http://www.cabi.org/index.asp)
9. PubMed (http://www.ncbi.nlm.nih.gov/pubmed/)
10. EMBASE (http://www.embase.com/)
11. Index to Theses Online (www.theses.com/)

Other more general search tools will be used to locate so called grey literature.

1. Google (http://www.google.com)
2. Google Scholar (http://www.scholar.google.com)
3. All the web (http://www.alltheweb.com)
4. Dogpile (http://www.dogpile.com)

Searches will be conducted in English, French and German using translations of the following logical search string:

Europe* AND (mowing OR cutting) AND (meadow OR grassland) AND (biodiversity OR richness)

The first 100 hits from each search will be kept. Any apparently relevant link will be followed one step away from the original hit. Each relevant document will be included in an EndNote X database.

3.2 Study inclusion criteria

The rough database will be scanned at the title and abstract filter level by two reviewers (or the first 200 items if more are found). Inclusion consistency will be checked with kappa statistics. If the agreement between the reviewers is less than $\kappa=0.6$, the inclusion criteria will be redefined to achieve a satisfactory agreement on a following set of title and abstract-level filtering.

- **Relevant subject(s):**

  Natural and semi-natural grasslands that are mown annually, including farmland meadows, agri-environmental schemes meadows, hay or litter meadows.

- **Types of intervention:**

  First mowing date delayed.

- **Types of comparator:**

  Comparison with similar meadows that are first mown on an earlier date.

- **Types of outcome:**

  Any biodiversity metric (taxonomic richness or species abundance in multiple taxonomic groups).

- **Types of study:**

  Scientific articles, PhD dissertations, MSc or BSc thesis, technical reports, book chapters and any other type of documents that fill the inclusion criteria.

3.3 Potential effect modifiers and reasons for heterogeneity:

Heterogeneity will come from the biogeographical regions included in European farmaland. Phenological shifts between southern and northern parts of the continent will also render the evaluation of absolute (Julian) dates delicate.

We also expect heterogeneity from the type of meadow considered, both from a phytosociological viewpoint (Arrhenatherion, Mesobromion, Molinion, Calthion, Filipendulion) and functional viewpoint (e.g. hay or litter meadow).

3.4 Study quality assessment

Studies will be classified following Pullin and Stewart (2006) methodology.

3.5 Data extraction strategy

Qualitative and quantitative data will be extracted form the documents that fill the inclusion criteria and reach a sufficient level of study quality.

If a sufficient amount of quantitative data (effect-sizes) can be extracted from the documents (or can be obtained from the authors), meta-analytical tools will be used (MetaWin program).

3.6 Data synthesis and presentation

Given the results of our preliminary searches, we believe that data synthesis will mostly be qualitative. It will be presented in a review including relevant documents, sources of heterogeneity, and major results obtained.

Dissemination of results will be mostly made through the CEE website, but output will be actively pushed towards European agro-environmental actors. Expected outcomes will include empirical ecological and agronomic data needed to improve the scientific basis for management decisions and policy making. These results will be communicated in multiple formats to public administrations, farmers' unions, and academic institutions in order to promote the development of evidence-based agri-environmental policies throughout Europe.

4. Potential Conflicts of Interest and Sources of Support

None declared.

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