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Review

Arable field margins managed for biodiversity conservation: A review of food resource provision for farmland birds

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ABSTRACT

Most arable field margins are sown grass strips which are limited in the avian food resources they offer but potentially supply grass seeds and, depending on the complexity of the sward structure, a range of arthropods. Adding perennial forbs to a grass mixture provides more diverse plant and invertebrate food resources for birds. The availability of seeds and invertebrates on uncropped margins is strongly influenced by management, particularly cutting, cultivation and herbicide use. Cropped margins with reduced chemical inputs and wild bird cover crops can provide relatively high food resources compared with a conventionally managed crop. However, resources are only present until harvest, their plant communities are relatively poor and arthropod abundance is usually lower than in uncropped margins.

The best winter food supplies for birds will be provided by options that create seed-rich habitats in winter. The best summer food supplies will be provided by options that create a structurally and floristically diverse sward. The least valuable margin in terms of food resources is a grass-only strip. On an area-for-area basis, field margins will potentially produce food resources for birds more cost-effectively than whole farm practices such as organic farming, though the value of margins will depend on their management and the diversity of margin types at a farm scale. Because no single margin type can provide the optimum year-round food supply, different types of margins should be incorporated at the farm level, but appropriate management (and further innovation in margin design) is needed to deliver their benefits. Field margins should be managed in conjunction with adjacent boundary features, especially hedgerows, to create complex structures that maximise nesting opportunities for birds and create habitats for a range of invertebrates.

Contents

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1. Introduction

Specially managed field margins have long been recognised as a means of integrating agronomic and environmental objectives on farmland. Their establishment and management has been widely advocated, in Britain and elsewhere (Boatman, 1994; Mineau and McLaughlin, 1996; De Snoo et al., 1994; Jörg, 1994) in past and current agri-environment schemes (Table 1). Field margins are consistently one of the most widely adopted conservation measures on farmland (e.g. Butler et al., 2007) and are important components of agri-environment schemes in the UK (e.g. Grice et al., 2007), Germany and Switzerland (e.g. Eggenschwiler, 2003; Kleijn et al., 2006; Aviron et al., 2007). Furthermore, under the last mid-term review of the EU Common Agricultural Policy (CAP), from 2012 onwards it will be obligatory for farmers to establish buffer strips along water courses as part of cross compliance, increasing the area of agricultural land under, what are effectively, narrow grass margins (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:030:0016:0099:EN:PDF). The potential wildlife value of field margins is highlighted by the inclusion of cereal field margins as one of the first 14 key biodiversity habitats in the UK for which costed 'Biodiversity Action Plans' were published by the UK Biodiversity Steering Group (Anon, 1995). A large number of declining farmland bird species (Siriwardena et al., 1998; Fuller, 2000), benefit from sympathetic management of field margins as foraging and nesting sites (e.g. Bradbury and Stoate, 2000; Rands and Sotherton, 1987). Several of these species are Red-listed as birds of Conservation Concern (Eaton et al., 2008), and included in the UK Government's Farmland Bird Index against which recovery targets have been set (Vickery et al., 2004).

A number of different options exist for field margin management but, despite their popularity (Boatman, 1994; Kleijn et al., 1998; Butler et al., 2007; Grice et al., 2007), there have been few attempts to assess the relative value of each for farmland biodiversity. This paper considerably extends an earlier review (Vickery et al., 2002) by offering a detailed assessment of the effect of field margin establishment and management practices on birds and their food resources, based largely on information and experience gained in a UK context. This review is timely given the recent concern that some agri-environment schemes may not be fulfilling their potential in terms of benefits to wildlife (Kleijn et al., 2001; Butler et al., 2007), the extensive uptake of field margin options within these schemes and the recent reforms to these schemes in the UK (Grice et al., 2007, http://www.defra.gov.uk/erdp/pdfs/es/es-promotional-booklet.pdf).

In this paper, field margins are defined (as in the UK Biodiversity Steering Group Report) as strips of land lying between crops and the field boundary, and extending for a limited distance into the crop (Anon, 1995). They fall into two broad categories: (i) uncropped, e.g. sown (with grass or grass and wildflower seed mixes) or left to regenerate naturally (including naturally regenerated or sown [temporary or long-term] set-aside margins) and (ii) cropped, comprising sown arable crops usually under modified management, such as conservation headlands, wild bird cover crops and pollen and nectar mixes. Cropped and uncropped margins can be managed in a range of ways particularly in terms of cutting, and/or cultivation. For the purposes of this review elevated grass strips or beetle banks (Thomas et al., 1991, 2002) established across fields and buffer zones (permanently vegetated strips of land 5–100 m, often but not always adjacent to water, Bradbury and Kirby, 2006) are not considered in detail but much of the information presented relating to sown grass margins will be relevant to these habitat types.

The review is structured in four broad sections. In the first, the effects on plants, invertebrates and birds, of a range of establishment approaches for uncropped and cropped margin types are described. Secondly, the impact of different management regimes on these margin swards and their associated wildlife is considered. Thirdly, this information is used to assess the relative value of current options for field margin management practice, for birds and their food resources, and, finally, the effects of margin width and location, at the farm and landscape scale are considered.

Several caveats should be borne in mind at the outset. First, the value of most margins will vary with geographic location, soil type (Nowakowski and Marshall, 1999; West et al., 1999; Critchley et al., 2004) and time after establishment (Bell et al., 1999; Smith et al., 1999; Bokenstrand et al., 2004). Second, field margins (as defined here) exclude boundary features, such as hedgerows and ditches, though these will heavily influence their value for wildlife. Hedgerows are an extremely valuable habitat for invertebrates (e.g. Maudsley, 2000; Alvarez et al., 2000; Varchola and Dunn, 2001; Millan de la Pena et al., 2003; Pywell et al., 2005a) and birds, providing food, shelter and nest cover (Macdonald and Johnson, 1995; Parish et al., 1995; Hinsley and Bellamy, 2000; Jobin et al., 2001). Third, the management of the adjacent crop will also affect the plant and animal communities of field margins, for example, as a result of fertiliser and herbicide drift (Marrs et al., 1991; Kleijn and Snoeijing, 1997; Kleijn and Van der Voort, 1997; Wilson, 1999).

Lastly, this review concerns the value to wildlife of contrasting field margin types, specifically plants and invertebrates and their value as food resources for birds. It does not consider the agronomic and economic implications of different approaches to field margin establishment and management. However, the cost and ease of management, effects on agricultural productivity, availability of financial support and the interests and motivation of landowners will all influence the extent to which field margin options are adopted (Guerin and Guerin, 1994; Wilson, 1997; Willock et al., 1999; Mathijs, 2003; Macdonald and Johnson, 2000; Oldfield et al., 2003). The aim of the review is to provide a synthesis of information on the role of field margins in enhancing populations of farmland wildlife and to inform the debate on the environmental benefits and cost-effectiveness of contrasting methods of their creation and management.