Integrating Strategies for Wildlife Management into Agri-environment Payment Schemes: A Decision Support Approach

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Abstract

The Entry Level Stewardship scheme gives farmers in England access to payments for managing their farms for the benefit of wildlife. Points are awarded for adopting a number of management practices from a list of options, and when a threshold value has been reached payments are calculated on an area basis. However, if biodiversity is to benefit as much as possible for a given expenditure of time and effort on the part of the farmer, and money on the part of the government, then careful selection of options is imperative. Farmers cannot be expected to have a detailed knowledge of the ecological requirements of different species; therefore, options are likely to be chosen that meet the scheme's points requirements for the minimum of cost and effort. This paper describes one approach taken that addresses this problem.

The University of Hertfordshire and Royal Society for the Protection of Birds (RSPB) have produced an interactive software tool that allows a more informed choice of options to be made. This uses a questionnaire approach to obtain information on a farm's habitat features in order to provide site-specific recommendations. An initial wildlife assessment is made of the options being considered by the farmer. A detailed understanding of the ecological requirements of important bird, animal and plant species, appropriate to farms of different types is then used to determine any gaps in the requirements met by the selected options, and to highlight alternative or additional options that will fill these gaps. Although, such a system cannot guarantee that farmers will select the options that will maximise wildlife benefit, it does provide them with the information they need to make informed decisions, and therefore offers the possibility of environmental improvements over a significant area of the country.

Key words: biodiversity, agri-environment, decision support, environmental management.

1 Introduction

In 1962, the European Union (EU) introduced the Common Agricultural Policy (CAP) with the aim of making Europe self-sufficient by the 1980s. However, the use of subsidies and guaranteed prices to encourage increased production, was so successful that by the 80s there were surpluses of many major crops (Kleijn and Sutherland, 2003). These either had to be exported, stored or disposed of; which was a drain on financial resources, distorted world markets, was very unpopular with the public, and wasn't always in farmer's best interests either (European Commission, 2004). As a result, the emphasis of the CAP was forced to change, such that support has, in the main, been 'decoupled' from production, with the emphasis instead being placed on the broader rural economy and environment (Condliffe, 2000). Decoupled payments now make up the majority of the money paid to farmers under the CAP (93% in 2005, as opposed to around 10% only a decade earlier), and although the bulk of this is in the form of the

Single Payment Scheme (area based), payments for participation in agri-environment schemes have increased to £257 million (TSO, 2005). As a result, they are an increasingly important source of income for UK farmers, creating an opportunity to use them to encourage desirable farm management practices, for the benefit of farmland biodiversity and environmental protection.

It is now widely recognised that post-war production increases have come at a significant cost to wildlife, as is clearly illustrated by the changes that have taken place in farmland bird populations (Fig. 1). The observed patterns are however, consistent with those reported for a much broader range of species (POST, 2005), including insects such as bumblebees and butterflies, and mammals such as the Brown hare (*Lepus europaeus*). The latest statistics from the annual Breeding Bird Survey (RSPB, 2005), show that populations of farmland birds are well below their pre-1970 levels, mainly due to a marked decline in the 1970s and 80s (Newton, 2004). These declines were particularly severe for species specialising in farmland habitats; with numbers of the 19 species on the government's farmland bird indicator of sustainability, falling by an average of more than 40%, and some down by as much as 80% (e.g. the Grey partridge - *Perdix perdix*). In turn, since agriculture accounts for around 70% of the UK's land area (Sutherland, 2004), this has had a significant impact on overall UK populations. However, UK government now has a Public Service Agreement target of reversing the long-term decline in farmland birds by 2020 (Bradbury and Allen, 2003), and their populations (as assessed by the Breeding Bird Survey) have been adopted as one of the country's indicators of sustainability (Defra, 2006). As a result, biological recovery has been enshrined in government policy.

Amongst the key tools for delivering biological recovery, are the agri-environment schemes, which in England come under the banner of Environmental Stewardship (ES). These provide funding to farmers who deliver effective environmental management on their land (RDS, 2005a); and it is hoped that Entry Level Stewardship (ELS) in particular, will be extensively adopted. This requires little by way of specialist knowledge or skills (beyond those inherent in competent farming) and entry is guaranteed if the requirements of the scheme are met. All farmers need to do to take part is adopt a selection from 60 management options for which points are awarded. If farmers can achieve an average of 30 points per hectare (or 8 points per hectare for Less Favoured Area land in parcels of 15ha or more), they can enter the scheme with a flat-rate payment of £30 per hectare (RDS, 2005b). It is therefore hoped that this scheme will be adopted over a wide area (1,345,000ha by the end of 2005, considerably more than any other scheme), and result in significant environmental benefits.

However, since providing the requirements of specialist farmland wildlife is complex, it often requires a good deal of expertise, if site-specific benefits for wildlife are to be delivered. Consequently, some authors have called into question the ability of agri-environment schemes to promote biological recovery. Although it is generally agreed that UK agri-environment policy has been a success in having a significant impact on the landscape, supporting traditional farming methods, and allowing the protection/re-creation of both wildlife habitats and visual features in the countryside (Whitby, 2000), it is less clear whether there has been an equivalent improvement in biodiversity. Those studies that have examined the effect of agri-environment schemes on biodiversity, have shown mixed results, since although the diversity of arthropods generally seems to improve quite readily, that of plants rarely shows much improvement, and the impact on bird species is very variable (Kleijn and Sutherland, 2003). As a result, Kleijn *et al.* (2004) question whether simple measures applied at the field scale are sufficient to conserve, never mind restore, high levels of biodiversity. Therefore, uptake of agri-environment schemes

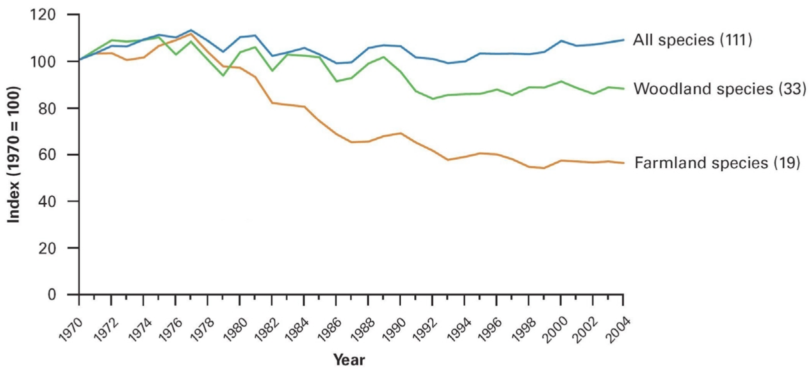

Fig. 1 UK wild bird population framework indicator (RSPB, 2005).

alone may not guarantee that their environmental goals will be met, even on those rare occasions when goals have been clearly set (Kleijn and Sutherland, 2003). The same authors point out that the lack of specific factors may restrict biological recovery, even when a number of other factors have been addressed. It is clear therefore, that if ELS is to stand the best possible chance of delivering ecological benefits, then complementary options must be selected; since the biodiversity benefits of agri-environment schemes will only be realised if the management prescriptions are tailored towards to the ecological needs of target taxa (Bradbury and Allen, 2003). However, so long as targeting does occur, there is evidence that benefits can be delivered. For example, the provision of weedy cereal stubbles (to provide winter food) and invertebrate-rich grassland (to provide summer food) under the Countryside Stewardship Scheme did result in the recovery of the Cirl bunting (*Emberiza cirlus* - Peach *et al.*, 2001).

There is strong circumstantial evidence that widespread agricultural intensification has played a significant role in the decline of many specialist farmland birds (Aebischer *et al.*, 2000). In a review of the factors identified as resulting in decline for a wide range of farmland birds (Newton, 2004), loss of habitat, food supplies and/or nesting sites (all of which can result from agricultural intensification), were found to be contributory factors in many cases, with the relevant combination being species dependent. Similar factors are also thought to be important for other taxa; for example, higher European hare populations tend to be "associated with the presence of a diversity of crops, some pasture, fallow land and small woodlands" (Smith *et al.*, 2005). This sort of work has made it possible to draw conclusions as to the requirements of different species groups, and in many cases, it is the provision of these resources that forms the backbone of biological recovery programmes (Bradbury and Allen, 2003).

2 Project Aims and Objectives

The objective of this project was to develop a decision support system that would enable farmers to obtain site-specific advice on suitable combinations of ELS options for the support of farmland biodiversity. This was to be done by distilling the expertise of a range of ecologists into a readily available, user friendly format, and thereby, provide general access to the sort of information normally only available through costly and infrequent face-to-face advisor visits. The aim being to encourage the selection of options with a good chance of providing tangible ecological benefits over a significant proportion of the country.

3 Approach Taken

The approach taken in order to achieve the goals of this project was to develop a logical 'option evaluation process' based on sound science and then to translate this into a user friendly decision support system that would not require the user to understand the underlying methodology.

3.1 Development of an Option Evaluation Process

The 'option evaluation process' consists of a series of methodological steps (Fig. 2); each designed to provide part of the information required to provide the user with site-specific recommendations.

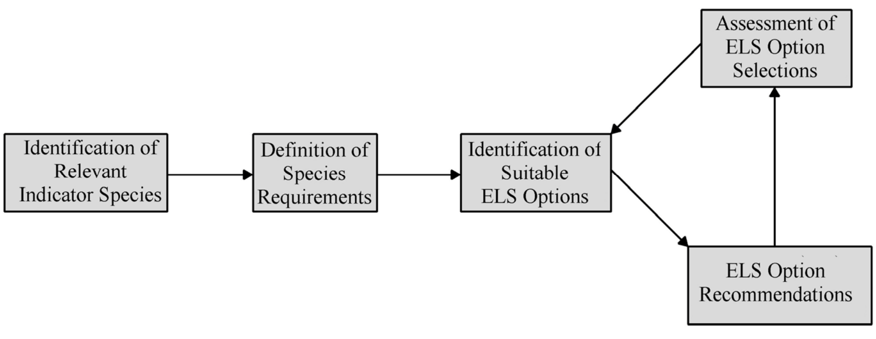

Fig. 2 Diagrammatic representation of the decision making process.

1. Identification of Relevant Indicator Species: Given the large number of bird and other species to be found on English farms, it would be impractical to provide individual recommendations for them all. Instead, a core set of 17 key species (or species groups) were identified (Table 1), that would be representative of the range it may be appropriate to encourage on different types of farm. Between 7 and 8 of the most appropriate indicator species/groups were then associated with each of the basic farm types (arable, grassland, mixed, and upland); these were the most likely species to benefit on the given farm type, for which default recommendations would be generated (although this list could be extended at the discretion of the user). This process provided a clear focus for the later assessments, and provided a degree of simplification that would significantly reduce the complexity of the recommendations made.

2. Definition of Species Requirements: Since the indicator species will only be catered for on a given farm, if their environmental requirements have been met, it was necessary to develop a system for defining those requirements that would provide a robust basis from which to assess the extent to which requirements have been met. For bird species, mammals, and pollinating insects, it was determined that there are three broad requirements, namely nesting habitat, summer foraging habitat and winter foraging habitat (except for migratory birds); whilst for other species groups, this was simplified to a simple requirement for the presence of suitable habitat. However, it was recognised that each of the species requirements could be met through one or more types of farmland feature. Consequently, a set of 23 'farm factors' (physical characteristics and management practices) was defined, each of which could play a role in providing one or more of the requirements for the indicator species (e.g. Table 2). For example, areas of spring-sown crops, unimproved grassland, or rushes can provide suitable nesting habitat for lapwing. Most of the features that the programme asks about are features that applicants have to mark on their farm map (known as the Farm Environmental Record) as part of their application. Expert judgement was then used to set quantifiable targets for the provision of each 'farm factor', which could then be adopted as 'farm targets' for any farms on which they are deemed appropriate given the stated farm characteristics. For example, where hedgerows are present, the target is to produce 4km of suitably managed hedgerows per 100ha of land (excluding LFA land).

3. Identification of Suitable ELS Options and Recommendations: Not only can the species requirements be met through a number of 'farm factors' (step 2), but each of these can in turn be achieved using one or more of the options available under the ELS scheme. Therefore, for each of the 'farm factors' adopted in step 2, the extent to which each of the options available under the ELS scheme contributed to that factor was assessed. Equations were then developed to show how 'farm factors' could be met using ELS options. These provide the basis for the recommendations made within the technology transfer software developed for this project. For example (Equation 1), one of the farm factors (the provision of a seed food source - on an arable farm) can be met using options EF2 (wild bird seed mixture), EF3 (wild bird seed mixture on set-aside land), EF6 (over-wintered stubbles) and EG2 (wild bird seed mixture in grassland areas); however, EF6 is not as productive (per unit area) as measures specifically intended to produce a seed food source. Consequently, options EF2, EF3 and EG2 are given ten times the weighting of EF6, and the target becomes:

$$(0.1 \times EF6) + (EF2+EF3+EG2) \geq 1\% \text{ of non-LFA farmed area} \quad (1)$$

4. Assessment of ELS Selections: The final methodological step is to evaluate the options selected by a farmer against the suggested requirements determined in the above manner. For each of the key indicator species, the extent to which its various requirements have been met is calculated and defined as being in one of three categories:

- Met - The 'species requirement' has been met using some or all of the relevant 'farm factors' (e.g. equation 1 ≥ 1%).
- Partially met - The 'species requirement' has been partially met (e.g. equation 1 > 0 and < 1%).
- Not met - None of the relevant 'farm factors' have been selected (e.g. equation 1 = 0).

This enables clear conclusions to be drawn as to any areas of weaknesses in the ELS options selected, and recommendations to be made that may improve the provision of habitat and or food resources. Then when amendments have been made to the selected options, these too can be assessed in a circular process of evaluation and amendment.

Table 1 Default key indicator species/species groups. Those associated with specific farm types are allocated appropriate letters. A: arable, M: mixed, G: grass, U: upland. (Lower case: only if certain features are present on the farm - for example, dragonflies are only included if ponds, wet ditches or watercourses are present).

Grey partridge		Reed bunting	
Lapwing	a m g U	Corn bunting	
Curlew, redshank, snipe	m g u	Bats	A M G U
Skylark	A M G U	Brown hare	M
Turtle dove		Bumblebees, butterflies, moths	M G U
Song thrush	G	Predatory insects and spiders	A
Tree sparrow		Dragonflies	a m g u
Linnet	G U	Arable plants	a
Yellowhammer	A M		

Table 2 Farm factors and an example of the provision of species requirements (lapwing). N: nesting habitat, S: summer food, *: only applicable on farms with specific characteristics.

1 field boundary	2 hedges	3 rough grass	4 pollen and nectar	5 seeds on arable farm	6 seeds on grass farm	7 skylark plots	8 beetle banks	9 rare arable plants	10 unimproved grass	11 spring crops	12 rush management	13 soil protection	14 crop protection	15 nutrient management	16 manure management	17 in-field trees	18 boundary trees	19 ponds	20 wet ditches	21 watercourses	22 woodland	23 moorland
		S*					S		N S*	N	N S								S*			

3.2 The Software

To allow farmers to adopt the decision making process described above in their ELS applications (without needing to understand of the underlying science), a simple, questionnaire based, software system has been developed. This guides the user, step-by step, through the process of option selection and evaluation.

Step 1: Context setting - a basic assessment is made of the farm's type and habitat features. This provides a foundation on which to base later steps.

Step 2: Option recommendation - it is now possible to provide the user with some initial guidance, by clearly summarising those options of particular suitability to his farm. In doing so, the user is steered towards options likely to produce the maximum ecological benefit at an early stage.

Step 3: Option selection - options are selected from the list, with ones that are recommend highlighted (in red), and those for which the user is not eligible 'greyed out' to prevent inappropriate selection. Throughout this process, the points target for the farm is clearly displayed on every page, together with a running total of the points obtained so far.

Step 4: Option evaluation - the extent to which the selected options meet the requirements of the site-specific target species identified for the farm is determined, and a colour-coded system (green = met, blue = partially met, red = not met) used to highlight areas of weakness suitable for further consideration.

Step 5: Guidance provision - guidance is given on the farm recommendations that have not been met. In addition, clicking on the species name takes the user directly to a help page, where advice can be found as to which options may fill the gaps identified, as well as general information on the species in question. A printer friendly version of the report can be obtained, together with a summary of the options selected, for rapid transfer to the ELS application form.

In order to maximise the distribution and uptake of the software (and therefore environmental benefit), two forms of distribution were used. The most recent version is available, on a free to all basis, from the internet. However, since this is a large file, unsuitable for downloading over some internet connections, 45,000 CD versions were pressed. 20,000 were distributed free at agricultural shows, and by request; and the rest distributed with Farmers Weekly. As a result the CD launch received considerable publicity, such that summer 2005 saw supplies of the CD version being all but exhausted.

4 User Survey

In order to determine the extent to which the resulting software has been used by farmers, and the degree of benefit they feel they've obtained from it, a brief, face-to-face, survey of users was carried out by the RSPB whilst attending agricultural shows. With these aims in mind, questions were designed to ascertain whether farmers possessed a copy of the software, had tried it, had used it to plan their ELS application, and had absorbed recommendations of the software into those applications. In addition, respondents who had used the software were asked to rate it on a range of 1 (not at all useful) to 5 (very useful).

73 questionnaires were filled in by farmers, of which approximately 49% had a copy of the software, suggesting that distributing disks free with Farmers Weekly, had been successful in getting the software to a large number of potential users, thanks to its average circulation of 71,349, of which nearly 80% are sold in England (ABC, 2006). Of the farmers reached, almost ¾ had tried the disk, and ½ had used it while planning their ELS application, of which 61% stated that they had incorporated recommendations from the software into their final application. In their rating of the software, 83% of farmers felt that they had obtained some benefit from using the system, with over half giving it a rating in one of the top two classes. A similar pattern was observed when farm advisers were questioned, although only 8 advisers were available to fill in the questionnaire. Again half (4) had a copy of the disk, of which 3 had tried it and used it in their work, and they gave it an average rating of 4.3 (slightly higher than for individual farmers). These advisers were using the software during an average of approximately 6.5 applications.

5 Conclusion

By distilling the expertise of a range of ecologists into a simple to use and free to access tool, this project has delivered a system that allows farmers to use the sort of expertise that is normally only available through infrequent and costly advisor visits. In addition, it was possible to reach a significant proportion of the farmers for whom the ELS scheme is relevant. As such, it is hoped that it will make a significant contribution to ensuring that ELS options are taken up in an appropriate manner, leading to clear environmental benefits.

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