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Managing Arable Farmland for Biodiversity

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Summary

To mitigate the negative effects of modern, intensive arable farming on biodiversity, farmers should:

- **establish a network of grass margins and beetlebanks throughout the farm**
- **provide wild bird seed mixes over the winter**
- **provide pollinator habitat during the summer**
- **maintain a diverse mix of crops and retain at least 10% of the land as winter stubbles**
- **consider reduced herbicide inputs and variable crop density on parts of the farm**

Introduction

Arable farming has intensified and is carried out on a larger scale than it was a few decades ago, which has led to the loss of important habitats for wildlife and a decline in farmland biodiversity. Yet just a few changes to farming practices and the careful siting of short term features such as wild bird seed and unharvested conservation headland, and more permanent features such as hedges, grass margins and beetlebanks can create a diverse network of habitats suitable for a range of species.

Arable farmers that are claiming Basic Payment Scheme (BPS) may need to meet the greening requirements, including managing 5% of their arable land as Ecological Focus Area (EFA). There are 6 EFA options: field margins, buffer strips, fallow, catch crops, cover crops and nitrogen fixing crops. Some of the options are weighted; field margins and buffer strips are worth 1.5 times their size, catch crops and cover crops are weighted at 0.3 times their size, and nitrogen fixing crops are worth 0.7 times their size, fallow is not weighted so 1 ha is worth 1 ha towards EFA. There is potential to choose EFA options that will maximise environmental benefit whilst also ensuring cross compliance rules are adhered to. Options such as field margins and buffer strips can be sited to protect watercourses and hedges to meet EFA requirements, cross compliance regulations and create valuable linked habitat for a range of species.

Farmers that wish to manage greater areas of their farm for biodiversity can apply for funding for the creation and management of a range of habitats under the Agri-Environment Climate Scheme (AECS). The scheme runs from 2015 to 2020 and at the time of writing there is one application round per year. The scheme is competitive and generally applications with a range of options to manage a variety of habitats to maximise biodiversity benefit will score well. Arable options under AECS include wild bird seed, water margins, grass strips, beetle banks, unharvested conservation headlands, winter stubbles, forage brassicas and green manures. Successful applicants will be entered into a 5 year agreement and are required to manage options according to the guidance, maintain a management diary and claim the grant annually on their Single Application Form. Rules and payments may be updated during the lifetime of the scheme. Full guidance is available online at https://www.ruralpayments.org/publicsite/futures/topics/all-schemes/basic-payment-scheme/greening-guidance/

Grass Margins and Beetle Banks

Arable farmland experiences high levels of disturbance through cultivation, harvesting and other management practices. Providing a framework of semi-permanent habitat features such as grass margins and beetle banks throughout the farm benefits arable biodiversity, as it can support wildlife that is unable to persist in the adjacent crops. Grass strips provide a habitat for small mammals and invertebrates, including beneficial insects such as predators of crop pests and pollinators. These in turn provide food for farmland birds such as grey partridge, finches, buntings, barn owls and kestrels, while grey partridges and bumblebees may use grass strips for nesting. These biodiversity benefits can be combined with other environmental benefits such as providing buffer strips for watercourses.

The width of grass margins is often determined by the width of the machinery being used to establish them, but they are typically

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between 2m and 6m in width. Grey partridges will readily nest in 2m wide margins, particularly when they are adjacent to hedges, while margins of 5m width or wider are better for hunting barn owls and for increasing the abundance and diversity of pollinator insects [1].

Grass field margins should ideally form a network that spreads throughout the arable landscape, rather than being isolated fragments or confined to a small part of the farm. Research has shown that 4.3km-6.9km of 2m-wide grass margins per square kilometre are required to halt and reverse the decline of grey partridge in the absence of predator control [2]. This equates to 0.9-1.4% of the arable area. For barn owls it is estimated that 14-21ha of rough field margins are required within 2km of nesting and roosting sites in arable landscapes, which equates to 1.1-1.7% of the landscape [3]. An overall aim of putting 1-2% of the arable area into grass margins, with 4-7km per 100ha is therefore likely to deliver significant biodiversity benefits.

Where arable fields are larger than 16-20ha, it is difficult to achieve more than 4-5km of field margins per 100ha and it can be beneficial to establish beetle banks (grass strips across the middle of the field), which should aim to divide large fields into blocks of about 10ha. By leaving gaps wide enough for sprayers and combine harvesters at each end of the beetle bank, the field can still be worked as one large unit.

When planning a network of margins, it is sensible to start with strips alongside watercourses, where they will deliver additional environmental benefits as buffer strips, and where they are likely to build on existing narrow strips of riparian vegetation which already form a refuge for plants and invertebrates that could colonise wider margins. Away from watercourses, margins alongside hedges are particularly valuable, particularly as nesting cover for grey partridges, while south-facing, sheltered margins are likely to be more attractive to insects, particularly if there is a wild flower component to the margin. Heavily shaded north-facing edges of forestry plantations or areas with overhanging trees may be attractive locations due to their poor agricultural productivity, but the biodiversity benefits of margins in such locations are likely to be limited.

A recent innovation in field margin creation is the development by the James Hutton Institute of what are termed 'magic margins' to minimise soil erosion on sloping fields. When establishing these margins a potato drill and tied ridger are used to create ridges along the length of the margin or beetlebank, with small dams to retain water in the channels between the ridges. When placed at the bottom or across the middle of even a gently sloping field, these margins can significantly reduce soil loss, and the retention of water between the ridges increases their value for invertebrates and foraging birds. Ridged margins can also reduce the likelihood of margins being used as access routes by vehicles and people.

When establishing margins, the seed mix should include a variety of grass species to provide structural diversity and variety of larval food that will benefit invertebrates. A mixture of taller, tussock-forming species such as Cocksfoot and Timothy should be mixed with finer grasses that will provide a dense sward, such as Red Fescue, Common Bent and Meadow Grass. A wild flower component is important to maximise the benefits to pollinating insects, particularly on south-facing, sheltered margins. Tall, robust species such as Common Knapweed, Yarrow, Red Clover and Oxeye Daisy are likely to persist best in tussocky grass margins.

Cutting or scarifying the field margins opens up vegetation structure and can increase floristic diversity with associated benefits to pollinator insects. However, it can also destroy the tussocky structure of the grassland, reducing its value for other invertebrates and the small mammal prey of barn owls and kestrels. Cutting margins lower than 10cm should be avoided to protect tussocks. Rotational cutting of margins on a 2-3 year cycle is another way of balancing the management requirements.

Funding Options

Grass margins and beetlebanks can be funded as part of the AECS, and there is an additional capital payment to help cover the cost of establishment if required.

Farmers that claim Basic Payment Scheme and that need to meet the greening requirements can manage field margins and water margins as part of their EFA. Margins are an attractive option to meet the EFA requirement of 5% of the total arable area as they are weighted at 1.5, meaning that 1ha of margin equates to 1.5ha of greening. If managed alongside a hedge they must be at least 2m in width (up to a maximum of 20m) to ensure that they also meet the cross compliance rules of no cultivation within 2m of the centre of the hedge. Field margins that are not adjacent to a hedge can be between 1 and 20m wide. Buffer strips are grass margins managed alongside a watercourse, and must be between 2 and 20m wide, measured from the top of the bank. For both these options there are further rules on management which can be found in the latest greening booklets available on ruralpayments.org.

Wild Bird Seed Cover

Wild Bird Seed mixes (sometimes referred to as unharvested crops or game cover) are a useful way of providing seed food for farmland birds during the winter, and particularly in late winter/early spring, when a 'hungry gap' occurs as other seed sources in the landscape are used up. They also provide cover and protection from predators for grey partridge over the winter and during the summer can provide a nesting site for species such as corn bunting, brood cover for partridge chicks and can support invertebrates, including pollinators, particularly if annual pollinator plants are included in the seed mix.

Suitable seed mixes typically include cereals (for buntings and sparrows) and smaller, oil-rich seeds (for finches). Providing three cereals provides a better supply of grain throughout the winter as each species drops their seed at different rates over the winter. Oats drops its grain quickest while triticale retains its grain the longest, and barley is intermediate, so these three cereals make a good combination. Smaller oil-rich seeds can be provided by brassicas such as mustard, rape or kale, but linseed is a better option to avoid problems with clubroot in brassicas. Quinoa can also be a good source of small seeds, but does not always establish well in colder or less fertile soils.

Wild bird seed mixes should be established in late spring and left unharvested until at least March the following year. Pesticides and herbicides should not be applied, and fertiliser is not required, although a low rate of 30kg N/ha (up to 90kg N/ha for kale) may be used to aid establishment on less fertile soils. Mixes including kale that can be left for a second year have been popular in the past, but the amount of seed available for birds in the second year is likely to be lower, particularly if the kale does not establish properly in the first year. Consequently, one year mixes are now preferred. Long-term game cover mixes using species such as canary-grass provide cover for game birds, but do not produce much seed for smaller birds and therefore have limited benefits for biodiversity.

A useful rule of thumb is to aim for at least 1ha of wild bird seed cover per 100ha of farmland, although 3-5ha of brood

habitat (which can include wild bird seed cover and conservation headlands) is recommended per 100ha for grey partridge conservation. Grey partridge benefit from long strips or small patches (c.0.25ha) of wild bird cover evenly spaced around the farm, as this suits their territorial nature in spring time, but very narrow strips (<10m) are vulnerable to rabbit and deer damage and should be avoided. Nesting corn buntings prefer larger blocks of at least 1ha that extend further from the field edge. In the winter, flocks of smaller farmland birds like to have a safe place of retreat such as a hedge, scattered trees and shrubs or overhead wires, so locating wild bird cover next to these features increases its value. Locations next to buildings or watercourses run the risk of rat infestations, so are probably best avoided.

As there are some similarities between the recommended size, location and overall extent of wild bird seed and pollinator plots within arable farmland, there may be some value in rotating these two features at 3-4 year intervals on the same plots of land. This may help to maintain fertility and deal with the build-up of weeds on wild bird cover sites.

Funding Options

Wild bird seed is an option under the AECS scheme. Farmers that are managing field margins or fallow as part of their EFA may wish to sow wild bird seed to further enhance the biodiversity benefit of these options. EFA fallow requires an arable area to be taken out of production between the 15th of January and the 15th July, with no production activities during this time, with the exception of cultivation to establish wild bird seed or wild flower mix if desired. Fallow can be brought back into production after the 15th of July, but to have benefit for farmland birds, if wild bird seed is sown it should be left in situ until the following spring. The sowing of wild bird seed mix would be a good option for areas that are going to be managed as fallow for EFA for more than one year as the establishment of a wild bird seed plot will help to control arable weeds, as well as providing valuable habitat for farmland birds.

Pollinator Habitat

Pollinating insects such as bees and hoverflies require a supply of nectar and pollen from spring through to autumn, so a variety of flowering plants are required, spread throughout the arable landscape. Shrubs such as Gorse, Blackthorn and Hawthorn are important nectar sources early in the year, along with Primrose, Dandelion and Cowslip. During mid-late summer, sown mixes can be established to provide a suitable resource. In broad terms there are three types of pollinator mix that can be sown:

Native wild flower meadow mixes typically comprise a mix of 80% fine-leaved grasses and 20% native wild flowers of a variety of species. Once established they are usually cut once a year in late summer or autumn (August-September), with the cuttings removed. The seed mix is quite expensive, but a grant may be available towards this. This mix requires care to establish and manage successfully, particularly on fertile soils, but can provide a long-term, high quality habitat for 10-20 years or more.

Pollen and nectar mixes comprise a small number of species (e.g. Red Clover, Birdsfoot Trefoil, Alsike Clover and Common Knapweed) that may be sown with or without grasses. These mixes are cheaper and easier to establish on fertile soils and require little management. However, they will only last for 3-4 years and are unlikely to provide as high quality habitat as well-established native wild flower mixes. However, they can also double as green manures, improving soil structure and organic matter for following crops.

Annual pollinator mixes typically comprise species such as Crimson Clover, Vetch and Phacelia sown without grass or with annual Italian Ryegrass. They can also double as green manures. Having a mix of species that flower over a longer period is better than having single-species stands, which may attract all the Bumblebees from a wide area for the short period that they are flowering, but might not boost the overall population, due to shortages of flowering plants during the rest of the season.

It is difficult to say exactly how much pollinator habitat would maintain pollinator populations but a useful rule of thumb is to aim for at least 1.25-2.5% of the arable farmland area, and to always have some pollinator habitat within a radius of approximately 250m. This can be achieved by a network of flower-rich margins or by having five evenly-spaced blocks of 0.25-0.5ha of pollinator habitat per 100ha of farmland [4]. Sheltered, south-facing areas are likely to provide the best conditions for these features. For practical farming reasons, awkward field corners or steeper slopes are often well suited to this type of management.

By including native wildflowers within grass margins and beetlebanks and by including annual pollinator species within wild bird seed cover crops, it is possible to use some of these habitats as part of the overall pollinator habitat on the farm, although they may have fewer flowering plants than habitats specifically managed for pollinators. Rotating pollen and nectar mixes with wild bird seed cover on the same plots of land every 3-4 years may be helpful to maintain fertility and control weed build-up in areas that lend themselves to being taken out of production for biodiversity measures.

Funding Options

Under the AECS there is funding for the creation and management of species-rich grassland, which can be used to create native wild flower meadows. Wild flower or pollen and nectar mixes could also be sown as part of the fallow option to meet EFA requirements, and would be best sited on areas that will remain fallow for a few years, or at least leave the plot in place until late autumn to allow the plants to mature and flower.

Commercial Crop Management

While much emphasis is placed on the value of non-crop habitats for arable farmland biodiversity, the way arable crops themselves are managed can also be adapted, often with relatively small adjustments, to improve their value for wildlife.

Crop Diversity

Autumn sown cropping does not allow for the retention of winter stubbles and often produces crops that are too dense and tall in the spring for ground-nesting birds such as Lapwings, which nest in April, and Skylarks producing second broods later in the summer. However, spring cropping can lead to the destruction of Lapwing nests through cultivation and can result in very little cover for Skylark first broods, particularly in a late spring, where spring sown fields may still be bare soil in early May. Having a mixture of winter and spring cropping is likely to have the greatest benefits for wildlife, particularly in areas where there is very little grassland to provide cover early in the year.

The crop diversification requirements of greening help to achieve this objective, but on large farms, there may still be a temptation to block-crop large, contiguous parts of the farm with each crop. However, for farmland biodiversity (and crop health), it is more beneficial to spread the mix of crop types throughout the farm.

Retention of Winter Stubbles

Stubbles left after the harvesting of cereals have the potential to provide rich feeding areas for farmland birds over the winter, particularly if some spilled grain and weed seeds are present in the stubble. Declining populations of Skylarks and Yellowhammers have been shown to recover when 10-20ha of stubble is present per km^2 of farmland [5].

Lighter soils are more suitable for late ploughing and also for lower herbicide inputs and are therefore best suited for retention of stubbles. Combining the retention of stubbles with reduced or no herbicide use on the preceding crop will considerably increase the benefits of the stubble for biodiversity. Avoiding pre-harvest desiccants should be considered the minimum requirement, but field trials suggest that not applying herbicide to spring barley typically results in a yield loss of 2.5-3.0%, the cost of which can be offset by herbicide savings. [6]. However, this would require fields with a low burden of weeds that are likely to interfere with harvesting, such as couch, black-grass and cleavers, and will probably require the management to be rotated around fields on an annual basis to prevent the build-up of other weeds to a level that is economically damaging.

Stubble management is better suited to barley or oat fields, which generally require lower inputs than wheat and are better for farmland birds [7]. Managing whole fields, rather than part-fields will benefit species that prefer to feed near the field margin (e.g. finches and buntings) as well as those which prefer the middle of the field (e.g. skylarks).

Having a range of stubble heights offers benefits to a variety of species, with longer stubble offering shelter from predators for grey partridge and skylark, and shorter stubble favoured by species such as sparrows, finches and buntings [8]. The stubbles themselves should be retained as late as possible before sowing (at least to the end of February) as the early spring is the period when food is scarcest for seed-eating birds.

Heavy grazing and applying high levels of manure or slurry to stubbles is likely to reduce their value to farmland birds, and in any case applications of organic manure should be made immediately before ploughing for nutrient management reasons.

Funding Options

There is a retention of winter stubble option under the AECS which offers payment to retain a stubble until 1st March, but it is limited to 10ha per year per location code. To further increase biodiversity value and soil organic matter there is the option to follow winter stubbles with a green manure, which has a higher annual payment and a capital payment to cover the cost of establishing the green manure crop.

Conservation headlands

Conservation headlands were developed by the Game and Wildlife Conservation Trust to provide brood rearing areas for grey partridge. They are strips of land at the edge of fields that receive little or no pesticide or herbicide to maximise the diversity of plants and insects within the strips to provide a rich feeding area for partridge chicks, and also benefits other farmland birds that need insect food. As a minimum, conservation headlands should not be sprayed with insecticides or broad-leaved herbicides. Conservation headlands are typically between 6-24 metres wide, with the size of the sprayer boom generally the main factor in determining the width. Excessive weed growth in the margin can be minimised by reducing fertiliser inputs to the headland and by rotating headlands around the farm. Depending on the market for the adjacent crop, farmers may decide not to harvest the conservation headland (effectively using it as a simple form of wild bird cover), or to harvest it separately from the main crop (for example cutting and baling as arable silage on mixed farms).

Funding Options

Funding for conservation headlands can be sought under the AECS, with limits on the amount that can be claimed depending on the size of the holding.

Crop density

Bare crop patches: Manipulation of crop density through the creation of small bare patches ('skylark plots') has been shown to benefit breeding skylarks in areas where winter cropping predominates. Skylarks struggle to raise second broods in winter cereals due to the density of the crop making it difficult for them to forage. Leaving at least two bare plots of 16-24m^2 per hectare of winter cereal provides sufficient foraging area to boost the number of skylark chicks produced [9]. The plots are created simply by switching off the drill for 3-8m lengths (depending on the drill width), which results in a negligible loss of crop production. Skylark plots have not been widely used in Scotland due to the higher proportion of spring cropping here and because the skylark population was previously relatively stable in comparison to the English population. However, there has been a decline in skylark numbers since 2010, so skylark plots might be worth considering in areas of predominantly winter cropping. This type of management is suited to large fields (>10ha) and plots should not be closer than 4m to the edge of the field to reduce the risk from predators such as foxes that tend to move along field margins.

Dense crop patches: More recent research has indicated that corn buntings breed more successfully in weedy or undersown crops, but that dense strips of crop where seed sowing overlaps occur provide an attractive nesting site in otherwise weed-free crops. If these strips are close to the edge of the field, predation risk is high, but providing deliberate overlaps between passes of the seed drill in the centre of large fields may benefit this species [10].

Precision farming and integrated crop management

Much of the loss of arable biodiversity can be attributed to increased intensification, particularly inputs of pesticides and fertiliser and as a result, making the most efficient use of inputs is likely to have less impact on biodiversity. Although a full discussion of this topic falls outside the scope of this technical note, making use of precision farming technology and integrated crop management techniques is likely to reduce pesticide and fertiliser inputs that impact on biodiversity as well as reducing costs.

Other Habitats and Features

Within arable farmland there are often small areas of other habitats, particularly along field boundaries and corners. Wetland areas are used by a range of arable farmland birds, particularly as foraging areas due to the density of above and below ground invertebrates that they support. Waders such as oystercatchers

and lapwing will benefit from such features where they are close to spring cereal fields for nesting, while tree sparrows and reed buntings are also known to benefit from wetland habitats adjacent to arable farmland. Maintaining existing wetland features and creating new small wet scrapes or ponds on the edge of fields through alterations to drainage are likely to add to the biodiversity value of the farm.

Areas of gorse, hawthorn, blackthorn, elder and hazel scrub in rough corners or along field boundaries provide nesting habitats, particularly for species such as tree sparrow, yellowhammer and linnet and, in the case of hawthorn, blackthorn and elder, provide berries for food in the autumn. The value of flowering shrubs as an early food source for pollinating insects must not be overlooked either. Existing scrub should be retained as far as possible and where scrub is scarce, consideration should be given to planting native shrubs in field corners or other awkward areas for cultivation.

Hedges are a traditional field boundary feature in some parts of the country and new hedges have been planted through agri-environment schemes in many areas. They provide similar benefits for biodiversity as scrub, particularly where there is a wide or dense hedge base. Cutting hedges annually reduces berry production and results in hedges that provide less cover for nesting birds. Cutting a proportion of the hedges on a farm on a rotation of about 3 years maximises the benefit for wildlife, particularly if they are managed alongside a grass field margin strip. Hedge cutting should only take place between September and February inclusive, to avoid the bird nesting period, and ideally should not take place until December to avoid cutting when berries are at their most abundant.

Although large amounts of woodland in an arable landscape can reduce its attractiveness to open-country species such as skylark, corn bunting and lapwing, maintaining or planting small areas of native trees and shrubs at field corners or in gullies and steep slopes can increase the overall diversity of habitats and provide nesting habitats for species such as tree sparrows and barn owls.

Funding Options

Payments are available through the AECS for wetland creation and management, small-scale native tree and shrub planting, creation of ponds, management of hedges, and in some areas, creation of new hedges.

Landscape diversity of habitat, structure and species is key. Arable farmers should aim for a variety of habitats to provide nesting sites, a food source and shelter for a range of species. Linked habitats, such as grass margins to connect wild bird seed plots and hedgerows, creates valuable wildlife corridors. Structural diversity further improves the attractiveness of farmland to wildlife, where hedgerows are used to break up the monotony of large arable fields, and hedgerow trees add more nesting sites and possible food sources. Where new habitats are created, for example new hedges or pollinator strips, a diversity of hedgerow plants and a varied seed mix increases the suitability of the habitat to more species.

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