Information and Advice note

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Compiled by Graham White.
For further information, contact Graham White at RSPB
on 01767 680551, or by e-mail at graham.white@rspb.org.uk

Arable reversion to grassland.

Introduction

Arable land can be reverted to grassland to increase the variety of habitat in predominantly arable areas. It may also help to buffer or link-up areas of important grassland, to protect and extend existing habitats, to strengthen farm landscapes, to facilitate public access, or to protect underlying archaeological features. Water quality can be improved through reverting areas vulnerable to soil erosion. The creation of wet grasslands can help to reduce flooding elsewhere in the river catchment.

This Information and Advice Note provides guidance on how to set about arable reversion in order to create grassland habitats of value to wildlife, and in particular, will focus on the creation of wet grassland habitats for breeding waders.

The benefits for wildlife are as follows:

- Arable reversion to grassland helps create a mixed farmland landscape beneficial to wildlife. For example, Lapwings nest on arable land but their chicks prefer to forage for food on grassland.
- The resultant habitat can support ground-nesting birds such as Lapwing, Curlew, Yellow Wagtail and Skylark, as well as small mammals and a variety of invertebrates, such as grasshoppers and bumble bees. Snipe and Redshank may nest on wet grassland.
- The grassland can be a valuable food source for a variety of birds. It does not have to be botanically rich to be good for birds; its structure is as important as species composition. Soil invertebrates, such as earthworms and insect larvae, benefit from the lack of cultivation. Grasslands that support broad-leaved plants, such as Dandelion and Sorrel, are good for seed-eating birds such as Linnets.
- Where conditions are appropriate, botanically-rich swards can be created.

The UK Biodiversity Action Plan (BAP) has a target of 5,000 hectares of wet grassland to be created on arable land. With breeding waders in mind, the target conditions include a low growing sward, moist soil conditions in spring and a high invertebrate biomass.

Assessing the potential for arable reversion

It is important to consider the most appropriate location for reversion in order to maximise the benefits. Factors that will determine the potential will include the location, geology, soil type and drainage (see Table 1). Ideal fields for reversion will be of low productivity and those that have been in arable production for less than ten years. Such fields may still have desirable grassland species in the seed bank. The resulting vegetation will be the community of plants best suited to the conditions. In most circumstances, soils suitable for reversion to botanically-rich grassland will be nutrient-poor and have a soil phosphorus index of zero or one. Soil assessments will help determine the plants that will re-establish and give an indication of the possible weed burden.

Where re-wetting is also being considered, the aim is to combine water control and appropriate land management to produce the desired wet grassland habitat. Larger areas may facilitate more economically viable grazing or better control of water levels. Where necessary, specialist advice should be sought. Table 1 identifies the issues that need to be considered.

Table 1. Key issues to be considered in arable reversion		
Issue	**Rationale**	**Points to consider**
Geographic location	Newly created habitat may be only slowly colonised by target species.	• What are the target species? They should ideally be present in the locality to enable colonisation.
Site location and size	Surrounding habitat, site size and access are important in achieving successful restoration.	• Colonisation will be quicker if adjacent to existing diverse grassland. • Is the site large enough to meet the objectives? Larger sites will attract more species and offer greater flexibility. • Can the appropriate grazing or cutting management be provided to maintain the ideal habitat?
Hydrology and soils	Ideal fields for reversion will be of low productivity. Where wet grasslands are the target, control of water is critical to achieving results.	• Are the soils suitable? Assess soil pH, fertility and nutrient levels. How long has the site been in arable? • Can water levels be maintained throughout the spring and early summer? (water control structures will be needed in many cases). • Does altering the drainage affect other land? Consult with appropriate authorities to ensure there is no conflict.
Potential conflict with other features.	Reversion should NOT be considered where there is a conflict of interest.	• Does the land have existing conservation value; eg rare arable plants?

Soils

Arable soils frequently suffer from compaction, poor structure and low organic levels, all of which may cause problems. Excessive compaction is a problem but a little may be beneficial (see below). Compaction pans may occur, particularly in sandy and silty soils, but less so in clay soils because of their shrink/swell character. Once grassland is established, poaching by grazing animals may also cause soil structure damage, the damage being particularly severe if there is free water present.

Soils should be assessed by examining soil removed from a small, vertically-sided pit dug with a spade to around 30cm deep. A soil sample can be removed for inspection, and broken carefully apart so that it breaks along the weakest planes. Factors to consider are the soil's porosity (is it loose and friable or tightly packed?), its colour (blue suggests water-logging), and the presence of compaction features such as plough pans or surface poaching. If a problem is identified, remedial work should be undertaken before reversion is attempted.

Subsoiling or slotting may alleviate compaction within the soil, but it will not generate good structure on its own. It will however, generate cracks to let air and water in, and it will improve the drainage. Soil structure improvement takes place through the natural processes of wetting and drying which induce swelling and shrinkage. It also takes place through root and organism activity (eg earthworm and fungal hyphae). This should be encouraged by a good deep root development, avoiding prolonged waterlogged conditions, using low pressure machinery and avoiding grazing when free water is present.

However, it should be noted that compaction can also provide some beneficial qualities. It may create perched water conditions, allowing 'scrapes' and other shallow water features, which provide an additional food source for breeding waders. Compaction may also limit plant growth and produce a thin sward, which may be diverse under certain low nutrient conditions. Poaching may also create valuable features for invertebrates and plants. The ideal situation will depend on the site objectives, a limited amount of compaction is to be tolerated and may be beneficial, significant compaction is likely to be damaging, particularly in terms of run-off and water quality, and require some remedial action.

Where wet grassland habitats are the objective, 2-3 years of establishment and good management are ideally required before flooding commences. Going straight from arable to flooded conditions tends to produce weak soils with poor structure. These are difficult to manage as they provide little support to machinery and stock in wet conditions and may be poor in soil invertebrates. Even in later years, extensive and prolonged flooding and/or poaching should be avoided.

Natural regeneration or sowing?

There is some debate over the question of whether to sow or to allow natural regeneration. The key issues are as follows:

- Seeding will promote a **rapid sward development** that will stabilise the soil. However, natural regeneration can also be rapid (depending on the conditions) but is more unpredictable. On low productivity soils, natural regeneration will be slower but will include a greater diversity of species. The assumption that rapid sward development is always good should be challenged; a thin sward with bare patches will be beneficial in some cases. The approach should be considered against the objectives.

- Seeding and rapid sward development will minimise (but not necessarily avoid) any **weed infestation**. This is perhaps the primary reason given for seeding and many projects using natural regeneration have run into problems with weeds, whether they be rushes, thistles or other species. The key issue is management; natural regeneration must be coupled with management techniques to ensure that rank species do not dominate (see below). Distinction must also be made between short-lived ruderal species, which will die out as the sward develops, and persistent problem species.

- The **structure** of seeded grasslands is often extremely uniform as opposed to the more varied structure that develops under natural regeneration due to the more uneven distribution of species. Sward structure may be enhanced by using the appropriate grazing stock.

- Seeding may introduce **target species** if these are absent in the seed bank. However, evidence suggests that the species that come to dominate will be determined largely by the soil conditions. A study of hay spreading, autumn and spring sown commercial mixtures, and natural regeneration showed no significant differences between grassland communities established after three years. Similarly, a study of three seed mixtures containing the same species but sown in different proportions and rates, showed no significant differences after three years. The distribution of species was related to hydrological regime not seed mixture or sowing rate (Gilbert 2000). Wet grasslands in particular, have been shown to develop the characteristic community within a few years of changing the hydrology on an improved rye grass pasture (Lyons and Ausden 2003). Where wet grassland is the objective, sowing an expensive seed mix may well be a waste of money as the sward is naturally species-poor and dominated by common species such as Creeping Bent and Marsh Foxtail. Seeding with a mix of a few common species, or a grass nurse crop, is likely to result in species-poor grassland. This may be less significant on a wet grassland site, however where a floristic copy of a species-rich sward is required, seeding a full seed-mix onto a site with appropriate soils and hydrology may gain the greatest number of species.

- It is assumed that natural regeneration will provide **gaps for colonisation** by interesting plants. Natural regeneration will start with a greater variety of species, but many will be ruderals that will die-out as the sward develops. Regeneration on low productivity soils can produce very interesting results, with a great range of species, but in most cases, colonisation by further interesting species will be slow if there is no nearby source for colonisation.

- Commercial mixes may contain **seeds of non-local/native origin,** even if local origin is specifically ordered. Such plants are frequently vigorous, affecting the sward structure, and difficult to eradicate.

- Seed mixes are generally expensive, and although natural regeneration may require more management in the early stages, is likely to win out on **cost.**

In summary, the choice of sowing or natural regeneration will depend on the objectives, the local conditions and the ability to manage. Natural regeneration is most likely to succeed where the soil contains a suitable seedbank or is adjacent to a seed source. A considered approach may be to allow spring germination to assess the potential for natural regeneration. The resultant sward should be critically assessed and managed appropriately. If uncontrollable problems arise, the growth can be sprayed off and a suitable seed mix sown in the autumn.

Site preparation, sowing and seed mixes

It is possible to establish a wide range of grass and flower species, although grasses generally establish more successfully. It is preferable to sow a limited range of locally native flowers, ideally using seed of local provenance and certainly avoiding foreign cultivars. Commoner wildflowers establish fairly easily, as they are

more likely to be suited to the local conditions. Target the seed mix to the local conditions and the desired end result. If a commercial mix is used, ideally chose low-growing rather than taller grasses. Spreading green hay from a donor site can be a successful alternative method.

The key points are as follows:

- Create a fine and firm seedbed. Where a weed-dominated sward has been tackled prior to sowing by spraying off, do not re-till the land.
- Broadcast seed onto the soil surface, followed by rolling to ensure good seed-soil contact. Do not use fertiliser.
- Sow seeds ideally in late summer/early autumn (ideally to avoid both drought and frost) but in milder areas may be delayed until mid-September. This allows establishment before winter. The sowing rate will depend on the soil fertility and the speed at which green cover must be achieved, but is usually 10-20 kg per ha.
- Spring sowing can be successful but there is a greater risk of drought killing young seedlings. However, on winter waterlogged soils, sowing in spring/early summer may be an option to consider. Cultivation should avoid the main nesting period. Early nesters, such as Lapwings, will be nesting from the end of March until the end of May.
- Additional sowing of new species may be undertaken into gaps in subsequent years.

Management

It is essential that the correct management is undertaken in the early years of the grassland development. Weed problems are common and these must be tackled quickly and appropriately. The required management will be different on each site, and must be flexible enough to respond to the individual site conditions.

In the first year of establishment, the grassland may require topping up to three times to prevent the seeding of weeds. It is important to differentiate between ruderals that will decline as the sward develops and potential persistent problem species, such as docks, thistles, coarse grasses and rushes. Topping in late June is especially important to control thistles, and a later topping may be required depending on the re-growth. Maintaining dry conditions during establishment will help prevent rush domination.

To minimise harm to ground nesting birds, cuts before July should be no lower than 20 cms. In some circumstances, for example where breeding waders are present, adopting wildlife-friendly mowing practices, such as cutting from the centre outwards, or mowing from one side to the other, may benefit late nesting birds with chicks and other wildlife such as young hares.

Management in the early years may vary depending on the site and sward objectives. To encourage **floristic diversity**, spring grazing should be avoided in the first five years. The sward would ideally be left to flower and set seed before mowing in mid summer. Large amounts of mown grass will need to be removed. Grazing of the aftermath should take the sward down to between two and five cm for the beginning of the next growing season. Grazing improves soil-seed contact, increases tillering, and reduces the competition of vigorous plants. The regime will need to be varied in specific areas if weed problems arise.

Where **wet grassland** swards suitable for breeding waders are the objective, grazing management is particularly important. Grazing may be introduced in the first year, but topping may also be required. Grazing will improve sward structure by creating gaps but the type of grazing animal is important. Cattle create a diverse sward with a mosaic of vegetation heights. Grazing should again aim to create a short sward for the beginning of the next growing season. In order to encourage a good soil structure and colonisation by soil invertebrates, it is advisable not to flood new grassland in the first 2-3 years. Early flooding may initially attract many waterbirds but not only is it likely to lead to a crash in later years due to a lack of soil invertebrates, but it is also likely to lead to weed problems due to the inability to manage correctly. An appropriate water regime may be best implemented after 2-3 years; high spring water levels in soil, ditches and other water features (but not extensive surface flooding), with natural drying from June to allow ideal sward management. As the appropriate water regime is implemented, the sward will change to become dominated by those species able to tolerate the conditions.

Significant weed problems after the first year may need to be controlled, with a suitable herbicide applied ideally through a weed-wiper. In this case, some early grazing will be required to introduce a height differential before application of the herbicide. The long-term management regime can be implemented when the sward has established.

Other management considerations

Arable soils may be depleted of organic matter and nitrogen. Low organic matter may contribute to low earthworm populations. Where breeding waders are the objective, it may therefore be appropriate to apply well-rotted farmyard manure (FYM) at low rates. To reduce loss of nutrients, apply in late winter or early spring. FYM can have positive effects on insects and earthworms, which support a wide range of bird species such as breeding waders, Yellow Wagtails and Skylarks.

The floral diversity of species-poor swards may be enhanced in appropriate locations by spraying and harrowing patches or strips within the grassland and then sowing seed. A total-kill herbicide should be used and then an appropriate seed mix spread over the killed patches. The treated patches should not exceed 30% of the site.

Summary

- It is important to have clear objectives and to manage with these in mind, it may not be possible, for example, to achieve both botanically-rich grassland and a good breeding wader habitat.

- The need to sow seeds should be carefully considered. The resultant sward that establishes will reflect the soil and hydrological conditions and where wet grassland is the objective, sowing an expensive seed mix may well be a waste of money.

- Badly compacted soil conditions can be alleviated using subsoiling or slitting. Adding organic matter of low to moderate nutrient content during the dry grassland phase will speed up soil structure development and improve earthworm populations.

- Care is required in the early stages of grassland establishment and correct management of the sward is essential in order to prevent problems with weeds. Slippage in weed control is common; management must be flexible and responsive to the individual site to avoid this.

- Going straight from arable to wet grassland management tends to produce weak soils with poor structure, low in organic matter and soil fungi. These soils are difficult to manage as they provide little support to machinery and stock in wet conditions and may be poor in earthworms. Where wet grassland habitats are the objective, 2-3 years of establishment and good management are ideally required before flooding commences. Even in later years, extensive and prolonged flooding should be avoided.

- On-going wet grassland management should aim to maintain a good soil structure and presence of earthworms and soil fungi by avoiding prolonged saturated conditions and maintaining frequent wetting and drying cycles.

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Further reading.

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A complimentary set of Information and Advice Notes on Wader Scrapes and Re-wetting Grassland can be obtained from RSPB Conservation Management Advice. There are also available, leaflets for lowland and upland farmland habitats and species. Contact: graham.white@rspb.org.uk or telephone: 01767 680551.