

New Priorities for Arable Plant Conservation



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Common Poppy *Papaver rhoeas* at Ranscombe farm James Peat/ Plantlife.

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For more information on arable plants see the website: www.arableplants.org.uk

Executive summary

Arable flora is the most threatened group of plants in Britain today. From being a commonplace element of the farmed landscape, and indeed the bane of farmers' lives in past decades, modern agricultural techniques have brought many species to the verge of extinction. Fifty-four species are considered rare or threatened, whilst seven species are extinct in the arable setting.

Far from being opportunistic weeds, cropping up wherever ploughed land exists, increasingly, the complexity of arable plant communities is being recognised. For example, no fewer than 48 different arable communities have been identified, reflecting subtle variations in soil, aspect and climate, whilst many rarer arable plant species show a high fidelity to certain historic areas.

Late in the day, conservationists have focused conservation attention on the arable landscape, recognising the precarious state of many characteristic farmland plants, insects and birds. From the plant perspective, it is encouraging to note that even the rarest of arable species often respond well to sympathetic management. Over ten thousand plants each of Cotswold Pennycress and Broad-leaved Cudweed appeared in Worcestershire and Kent respectively, within just a few months of sympathetic farming without herbicides: these are amongst our rarest arable species, confined to a handful of UK sites and both fully protected by law.

Nature conservation policies now *potentially* provide the mechanisms through which effective arable plant conservation could be achieved. The UK Government's Arable Field Margin Habitat Action Plan (HAP) seeks to expand the area of cultivated, unsprayed field margin in England by an additional 4,619 hectares to 10,000 hectares by 2010. On the ground, the new Entry Level Stewardship (ELS) scheme offers farmers a range of management options that could provide a sustainable future for our most valued arable plant communities and species.

Plantlife's *Arable Plants Project* has been monitoring the effectiveness of arable plant conservation over the past two years, and through a scheme run in partnership with the Farming and Wildlife Advisory Group (FWAG) has been implementing a programme to conserve key sites in five counties. But increasingly the project has been concerned that conservation effort is not being directed most cost effectively. This report highlights a number of issues of current concern to Plantlife, of which the key areas are:

- **Poor uptake of options:** For financial reasons, Entry Level Stewardship is proving popular amongst the farming community, and uptake has generally been good. However, each applicant is free to choose the most appropriate management options, often opting for boundary options (such as hedgerow and ditch management), whilst uptake for key in-field arable plant options has been low. Relatively low payment levels compared with the management input required for key uncropped cultivated margins has further discouraged widespread uptake.
- **Poor awareness about arable plants:** Rare arable plants continue to suffer from poor awareness amongst landowners, industry professionals and policy makers, and accordingly this low profile means that farmers are often unwilling to manage their land for 'weed' conservation. Matters are exacerbated by perceptions about less desirable, pernicious weed species that can 'infest' land managed for the conservation of rarer, more delicate growing species.
- **Use of sown conservation mixes:** Farmland birds have been chosen as a biodiversity indicator for the health of the arable environment but the widespread and popular use of sown birdseed and pollen and nectar mixes – often utilising non-native species – has 'artificially' favoured bird populations yet without necessarily improving the overall biodiversity of the farmed landscape.

There is an urgent need to focus attention on arable plants in the landscape, in part to reflect their continued rarity in Britain, but also to reflect the key role that they play towards the viability of rarer insects and birds, in their position at the base of the food chain.



JP MARTIN/PLANTLIFE

Cornflower *Centaurea cyanus* in field margin

Round-leaved Fluellen *Kickxia spuria*



JP MARTIN/PLANTLIFE



SIMON WILLIAMS/PLANTLIFE

Poppy field in Oxfordshire

Summary of recommendations to ensure delivery of arable plant conservation

Dense-flowered Fumitory
Fumaria densiflora

NICK STEWART/PLANTLIFE



1. Stewardship review: A review of Entry Level Stewardship is required to increase the uptake of high value in-field arable options

- Future reviews of available Stewardship schemes should require land managers to select effective in-field options in key arable plant areas.
- Stewardship payments should be reviewed and increased to encourage uptake of key cultivated margin options and reflect the increased management burden on the farmer and high value to biodiversity.

2. Targeting hotspots – cost effective conservation: Key arable plant sites should be targeted for conservation action

- Key arable plant areas with very rare species or exceptional assemblages should be targeted for appropriate management across a range of different soil types, to ensure that Stewardship resources are used effectively.
- The GENESIS database requires regular updating with Important Arable Plant Area (IAPA) data to ensure accurate targeting of agri-environment scheme options at key arable plant sites.

3. Promotion of natural regeneration: Natural plant communities should be favoured over sown seed mixes

- Greater emphasis is required on encouraging uptake of naturally regenerated margin habitats rather than artificial food sources for birds and insects.
- An assessment of difference in bird and insect populations on naturally regenerated ‘weedy’ margins compared with sown margins should be completed.
- Training should be provided to ensure that necessary botanical skills are held or accessible to the industry.

4. More best practice advice and flexible management required

- Agri-environment scheme prescriptions need to allow more flexible weed control practice and give better guidance on the use and timing of cultural methods to discourage a build-up of pernicious weed species.
- More advice and detail on where to site and how to manage for rare arable plants should be provided to land managers.

5. Research requirements within arable plant conservation

- Research into seed longevity and other ecological attributes (e.g. fecundity and competitiveness) needs to be undertaken to identify which species are more successful than others at completing their annual life cycle.
- Further trials should be implemented to investigate different methods of weed control. The focus should be on cultural methods, comparing the effect of cultivation technique, depth and timing on both desirable and undesirable species. The use of herbicides in managing rare arable plant margins also requires more detailed analysis, both in terms of the use of different active chemicals and timing of applications.

1. Arable plants in Britain: diversity

1.1 Diversity of arable communities and flora

Over 150 members of the British flora are characteristic of the arable environment, sharing the same ecological niche as the crops amongst which they grow. Whilst many are now regarded as ancient introductions into Britain, their distribution in this country reflects complex geological, climatic and management factors which makes them of equal importance as grassland or woodland plant communities (Byfield & Wilson, 2005; Wilson & King, 2003). As a result, no fewer than 48 distinct types (communities and subcommunities) of arable vegetation have been described from Britain (Fig 1): some are widespread and with few or no rare arable plant species present, whilst others are highly localised and may be noted for a rich diversity of threatened species (Rodwell, 2000).

1.2 Richness of different areas of Britain

Far from being ubiquitous weeds, many arable species are very particular about where they grow, associating with particular species and exhibiting a long-standing fidelity to certain sites or areas, depending on nuanced differences in soil, topography, climate and land use. Many populations of rarer species have been recorded from particular fields for decades or even centuries, their fluctuations reflecting the changes in the management of arable landscapes. This combination of site 'loyalty' with the ability of the majority of species to lay dormant, yet viable, in seed banks for many years means that successful conservation can often be delivered by providing the right management in the right place.

The site specific nature of arable plant populations means that careful targeting of management is required to achieve maximum species conservation. Accordingly, Plantlife has developed a methodology to assess the importance of particular sites for arable species. The Important Arable Plant Areas methodology (Byfield & Wilson, 2005) is derived from the internationally recognised Important Plant Areas (IPA) model (Anderson, 2002) and assesses arable sites based on the presence of either a single threatened species and/or exceptional assemblages of arable species. The 'outstanding assemblages' criterion assesses sites based on a scoring system that tallies the individual score of 120 indicator species present, weighted according to their rarity and decline across Britain, and allows botanists, conservationists and others to instantly assess the value of a site – be it of county, national or European importance.

This same cumulative scoring methodology provides a useful tool with which to assess the relative richness of individual vice-counties (VCs), based on the presence or absence of the indicator species, although it does not take account of the relative abundance of such species from county to county (Fig 4). The two vice-counties within Britain with the greatest cumulative species score are Berkshire and North Essex (with a score of 378)

¹ More recent survey data from Phil Wilson (and not NBN Gateway data) was used for the following species: *Adonis annua*, *Ajuga chamaepitys*, *Alyssum alyssoides*, *Bunium bulbocastanum*, *Centaurea cyanus*, *Echium plantagineum*, *Filago gallica*, *Filago lutescens*, *Filago pyramidata*, *Fumaria reveri*, *Galium tricornutum*, *Lavatera cretica*, *Lythrum hyssopifolium*, *Polycarpon tetraphyllum*, *Teucrium botrys*, *Thlaspi perfoliatum*, *Valerianella rimosa*, *Veronica praecox*, *Veronica triphyllos*, *Veronica verna*. *Alopecurus myosuroides* has been omitted due to its nature as a problem weed, in spite of showing some decline across Britain in recent decades.



Method for ranking areas using the IAPA accumulative scoring methodology:

Taking the basic listing of declining arable species from the IAPA criteria and using 10 km square data from the NBN Gateway (post-1980 plus additional figures from Phil Wilson¹), it has been possible to develop a species list for each Vice County and Joint Character Area. Using the weighted scoring methodology described in Section 1.2, a species assemblage total for each area has been drawn up.

Berkshire and North Essex are the two vice-counties with greatest species richness based on weighted assemblage score.



Corn Marigold
Chrysanthemum segetum

BOB GIBBONS/PLANTLIFE

Fig 1 – Arable communities and subcommunities within the Open Vegetation element of the National Vegetation Classification (Rodwell, 2000).

| OV | Open vegetation |
|-------|---|
| OV1 | <i>Viola arvensis</i> - <i>Aphanes microcarpa</i> community |
| OV2 | <i>Briza minor</i> - <i>Silene gallica</i> community |
| OV3 | <i>Papaver rhoeas</i> - <i>Viola arvensis</i> community |
| OV4 | <i>Spergula arvensis</i> - <i>Chrysanthemum segetum</i> community |
| OV4a | <i>Spergula arvensis</i> - <i>Chrysanthemum segetum</i> community: Typical subcommunity |
| OV4b | <i>Ranunculus repens</i> - <i>Sonchus asper</i> subcommunity |
| OV5 | <i>Digitaria ischaemum</i> - <i>Erodium cicutarium</i> community |
| OV6 | <i>Cerastium glomeratum</i> - <i>Fumaria muralis</i> community |
| OV6a | <i>Cerastium glomeratum</i> - <i>Fumaria muralis</i> community: <i>Aphanes microcarpa</i> - <i>Ranunculus muricatus</i> subcommunity |
| OV6b | <i>Cerastium glomeratum</i> - <i>Fumaria muralis</i> community: <i>Valerianella locusta</i> - <i>Barbula convoluta</i> subcommunity |
| OV6c | <i>Cerastium glomeratum</i> - <i>Fumaria muralis</i> community: <i>Vicia hirsuta</i> - <i>Papaver dubium</i> subcommunity |
| OV7 | <i>Veronica persica</i> - <i>Veronica polita</i> community |
| OV8 | <i>Veronica persica</i> - <i>Alopecurus myosuroides</i> community |
| OV9 | <i>Matricaria perforata</i> - <i>Stellaria media</i> community |
| OV9a | <i>Matricaria perforata</i> - <i>Stellaria media</i> community: <i>Anagallis arvensis</i> - <i>Viola arvensis</i> subcommunity |
| OV9b | <i>Matricaria perforata</i> - <i>Stellaria media</i> community: <i>Poa annua</i> - <i>Galeopsis tetrahit</i> subcommunity |
| OV9c | <i>Matricaria perforata</i> - <i>Stellaria media</i> community: <i>Elymus repens</i> - <i>Potentilla anserina</i> subcommunity |
| OV9d | <i>Matricaria perforata</i> - <i>Stellaria media</i> community: <i>Bilderdykia convolvulus</i> - <i>Veronica persica</i> subcommunity |
| OV10 | <i>Poa annua</i> - <i>Senecio vulgaris</i> community |
| OV10a | <i>Poa annua</i> - <i>Senecio vulgaris</i> community: <i>Polygonum persicaria</i> - <i>Ranunculus repens</i> subcommunity |
| OV10b | <i>Poa annua</i> - <i>Senecio vulgaris</i> community: <i>Polygonum aviculare</i> - <i>Matricaria perforata</i> subcommunity |
| OV10c | <i>Poa annua</i> - <i>Senecio vulgaris</i> community: <i>Agrostis stolonifera</i> - <i>Rumex crispus</i> subcommunity |
| OV10d | <i>Poa annua</i> - <i>Senecio vulgaris</i> community: <i>Dactylis glomerata</i> - <i>Agrostis capillaris</i> subcommunity |
| OV11 | <i>Poa annua</i> - <i>Stachys arvensis</i> community |
| OV11a | <i>Poa annua</i> - <i>Stachys arvensis</i> community: <i>Chenopodium album</i> - <i>Euphorbia helioscopia</i> subcommunity |
| OV11b | <i>Poa annua</i> - <i>Stachys arvensis</i> community: <i>Cerastium fontanum</i> - <i>Bryum rubens</i> subcommunity |
| OV12 | <i>Poa annua</i> - <i>Myosotis arvensis</i> community |
| OV12a | <i>Poa annua</i> - <i>Myosotis arvensis</i> community: Typical subcommunity |
| OV12b | <i>Poa annua</i> - <i>Myosotis arvensis</i> community: <i>Dicranella staphylina</i> - <i>Bryum</i> spp subcommunity |
| OV13 | <i>Stellaria media</i> - <i>Capsella bursa-pastoris</i> community |
| OV13a | <i>Stellaria media</i> - <i>Capsella bursa-pastoris</i> community: Typical subcommunity |
| OV13b | <i>Stellaria media</i> - <i>Capsella bursa-pastoris</i> community: <i>Matricaria perforata</i> - <i>Poa annua</i> subcommunity |
| OV13c | <i>Stellaria media</i> - <i>Capsella bursa-pastoris</i> community: <i>Fumaria muralis boreaei</i> - <i>Euphorbia helioscopia</i> subcommunity |
| OV13d | <i>Stellaria media</i> - <i>Capsella bursa-pastoris</i> community: <i>Urtica dioica</i> - <i>Galium aparine</i> subcommunity |
| OV14 | <i>Urtica urens</i> - <i>Lamium amplexicaule</i> community |
| OV15 | <i>Anagallis arvensis</i> - <i>Veronica persica</i> community |
| OV15a | <i>Anagallis arvensis</i> - <i>Veronica persica</i> community: <i>Stellaria media</i> - <i>Convolvulus arvensis</i> subcommunity |
| OV15b | <i>Anagallis arvensis</i> - <i>Veronica persica</i> community: <i>Legousia hybrida</i> - <i>Chaenorhinum minus</i> subcommunity |
| OV15c | <i>Anagallis arvensis</i> - <i>Veronica persica</i> community: <i>Agrostis stolonifera</i> - <i>Phascum cuspidatum</i> subcommunity |
| OV16 | <i>Papaver rhoeas</i> - <i>Silene noctiflora</i> community |
| OV17 | <i>Reseda lutea</i> - <i>Polygonum aviculare</i> community |
| OV18 | <i>Polygonum aviculare</i> - <i>Chamomilla suaveolens</i> community |
| OV18a | <i>Polygonum aviculare</i> - <i>Chamomilla suaveolens</i> community: <i>Sisymbrium officinale</i> - <i>Polygonum arenastrum</i> subcommunity |
| OV18b | <i>Polygonum aviculare</i> - <i>Chamomilla suaveolens</i> community: <i>Plantago major</i> subcommunity |
| OV19 | <i>Poa annua</i> - <i>Matricaria perforata</i> community |
| OV19a | <i>Poa annua</i> - <i>Matricaria perforata</i> community: <i>Senecio squalidus</i> - <i>Epilobium angustifolium</i> subcommunity |
| OV19b | <i>Poa annua</i> - <i>Matricaria perforata</i> community: <i>Lolium perenne</i> - <i>Capsella bursa-pastoris</i> subcommunity |
| OV19c | <i>Poa annua</i> - <i>Matricaria perforata</i> community: <i>Atriplex prostrata</i> - <i>Chenopodium album</i> subcommunity |
| OV19d | <i>Poa annua</i> - <i>Matricaria perforata</i> community: <i>Chamomilla suaveolens</i> - <i>Plantago major</i> subcommunity |
| OV19e | <i>Poa annua</i> - <i>Matricaria perforata</i> community: <i>Elymus repens</i> subcommunity |
| OV20 | <i>Poa annua</i> - <i>Sagina procumbens</i> community |
| OV20a | <i>Poa annua</i> - <i>Sagina procumbens</i> community: Typical subcommunity |
| OV20b | <i>Poa annua</i> - <i>Sagina procumbens</i> community: <i>Lolium perenne</i> - <i>Chamomilla suaveolens</i> subcommunity |
| OV21 | <i>Poa annua</i> - <i>Plantago major</i> community |
| OV21a | <i>Poa annua</i> - <i>Plantago major</i> community: Typical subcommunity |
| OV21b | <i>Poa annua</i> - <i>Plantago major</i> community: <i>Lolium perenne</i> subcommunity |
| OV21c | <i>Poa annua</i> - <i>Plantago major</i> community: <i>Polygonum aviculare</i> - <i>Ranunculus repens</i> subcommunity |
| OV22 | <i>Poa annua</i> - <i>Taraxacum officinale</i> community |
| OV22a | <i>Poa annua</i> - <i>Taraxacum officinale</i> community: <i>Senecio vulgaris</i> subcommunity |
| OV22b | <i>Poa annua</i> - <i>Taraxacum officinale</i> community: <i>Cirsium vulgare</i> - <i>Cirsium arvense</i> subcommunity |
| OV22c | <i>Poa annua</i> - <i>Taraxacum officinale</i> community: <i>Crepis vesicaria</i> - <i>Epilobium adenocaulon</i> subcommunity |

Small-flowered Catchfly *Silene gallica*



JP MARTIN/PLANTLIFE

followed by Surrey (367), North and South Hampshire (360 & 357 respectively), South Wiltshire (342) and Cambridgeshire (332): in short, southern and eastern counties of Britain score most highly, demonstrating the species richness of the areas, at least in terms of rare and/or declining species (Fig 2).

A similar analysis for Scotland ranks Midlothian as supporting the richest diversity of species with a score of 177. East Ross and Cromarty and Moray follow with scores of 118 and 117 respectively. Interestingly, in Wales, Denbighshire in the north has the highest score with 193, followed by Monmouthshire (190) and Pembrokeshire (155), both on the south coast (Fig 3).

The distribution of arable plant diversity in England was then examined more closely by carrying out the same weighted scoring exercise but applying them to Joint Character Areas (JCAs). It is apparent how closely the distribution matches the richest Natural Areas mapped by English Nature (now Natural England) (Porley, 1997). As JCAs are smaller than Natural Areas the hot spots can be highlighted in more detail (Figs 5 and 6).

The differences in species richness across Britain is further supported by the work of Walker *et al.* (2006) who found clear regional differences in the diversity of rare species of arable field margins. Sites in south-east, south-west and eastern England were the most diverse, whilst those in the north-east were the most species-poor.

Fig 4 - Richness of British vice-counties based on cumulative weighted scores for 120 rare and/or declining species.

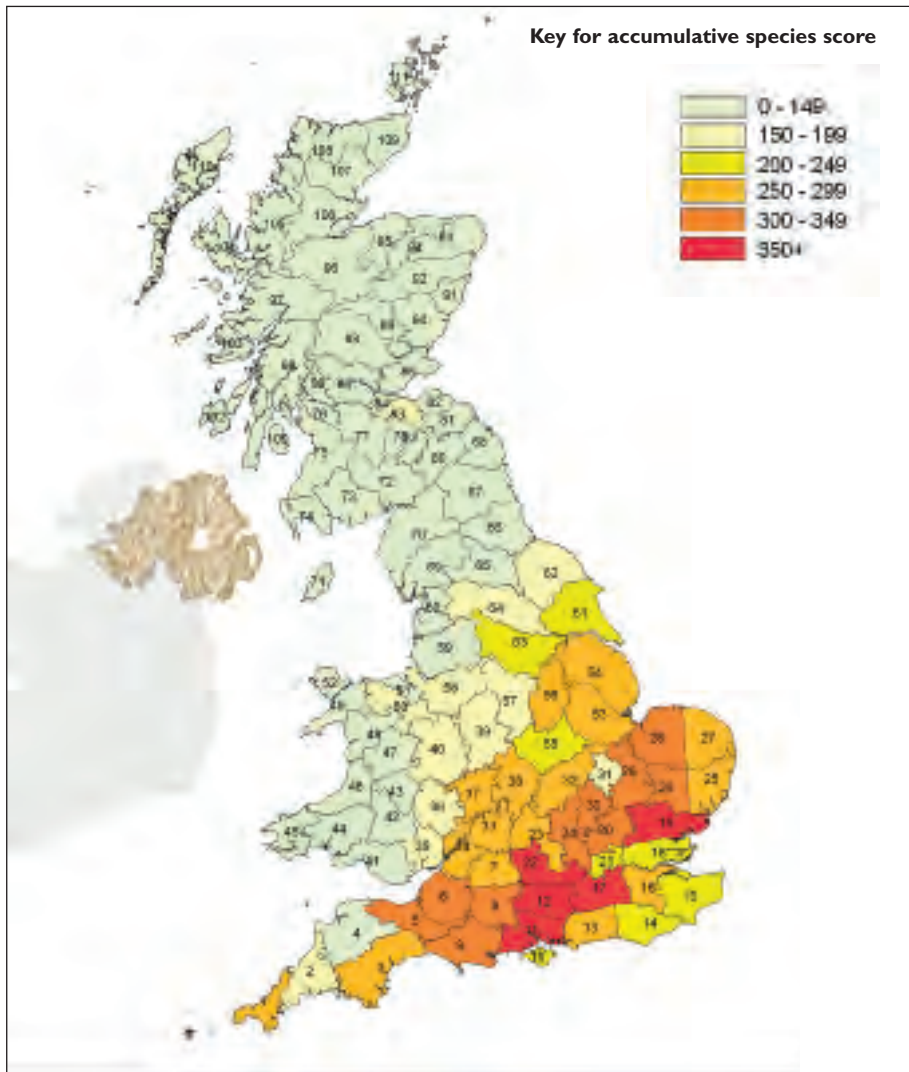


Fig 2 - The 15 richest vice-counties for arable plants in Britain (based on weighted assemblage score):

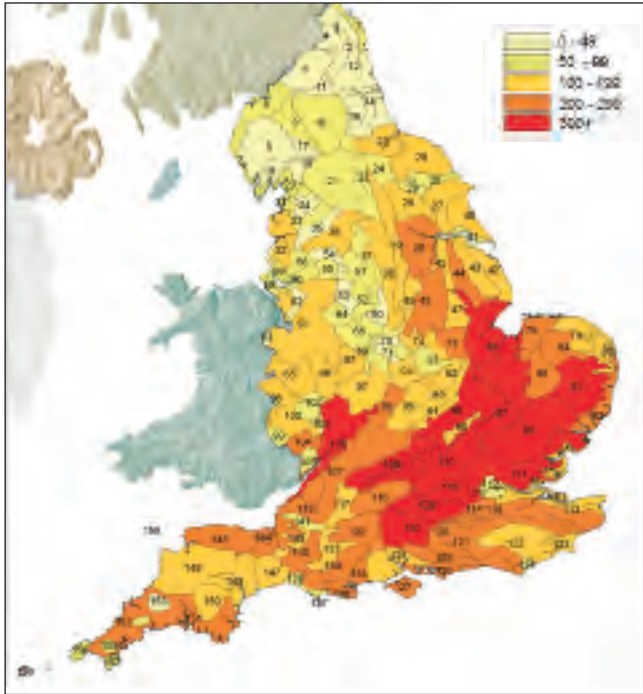
| English Vice County | Accumulative species score for VC |
|---------------------|-----------------------------------|
| 22. Berkshire | 378 |
| 19. North Essex | 378 |
| 17. Surrey | 367 |
| 12. North Hampshire | 360 |
| 11. South Hampshire | 357 |
| 08. South Wiltshire | 342 |
| 29. Cambridgeshire | 332 |
| 26. West Suffolk | 332 |
| 09. Dorset | 332 |
| 20. Hertfordshire | 329 |
| 06. North Somerset | 315 |
| 24. Buckinghamshire | 314 |
| 05. South Somerset | 314 |
| 28. West Norfolk | 309 |
| 30. Bedfordshire | 307 |

Fig 3 - The 15 richest vice-counties for arable plants in Scotland and all Welsh county scores (based on weighted assemblage score):

| Scottish Vice Counties | Accumulative species score for VC |
|---------------------------|-----------------------------------|
| 83. Midlothian | 177 |
| 106. East Ross & Cromarty | 118 |
| 95. Moray | 117 |
| 85. Fifeshire | 105 |
| 96. East Inverness-shire | 97 |
| 82. East Lothian | 96 |
| 90. Angus | 95 |
| 81. Berwickshire | 86 |
| 76. Renfrewshire | 86 |
| 73. Kirkcudbrightshire | 81 |
| 80. Roxburghshire | 80 |
| 77. Lanarkshire | 77 |
| 84. West Lothian | 75 |
| 92. South Aberdeenshire | 66 |
| 75. Ayrshire | 62 |

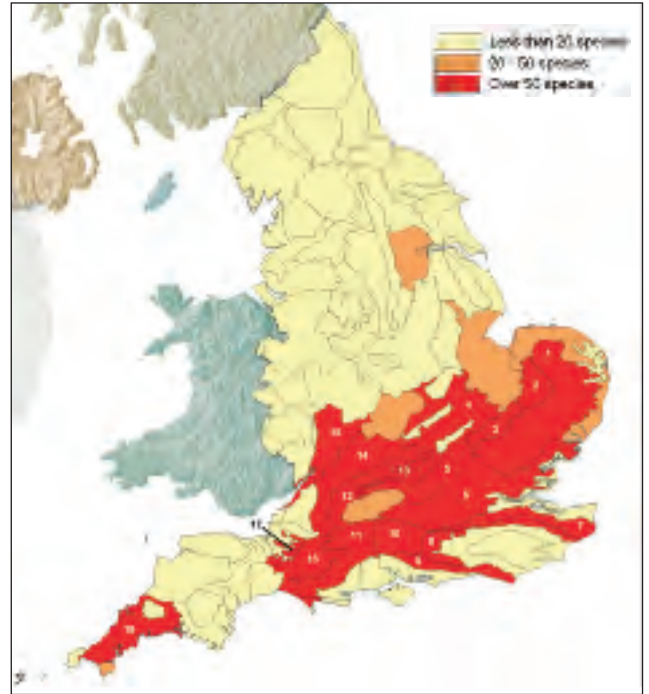
| Welsh Vice Counties | Accumulative species score for VC |
|---------------------|-----------------------------------|
| 50. Denbighshire | 193 |
| 35. Monmouthshire | 190 |
| 45. Pembrokeshire | 155 |
| 44. Carmarthenshire | 153 |
| 41. Glamorganshire | 151 |
| 49. Caernarvonshire | 131 |
| 46. Cardiganshire | 125 |
| 42. Breconshire | 121 |
| 47. Montgomeryshire | 120 |
| 51. Flintshire | 113 |
| 52. Anglesey | 86 |
| 43. Radnorshire | 81 |
| 48. Merionethshire | 65 |

Fig 5 – Richness of English Joint Character Areas based on cumulative weighted scores for 120 rare and/or declining species. Top 10 ranked areas detailed.



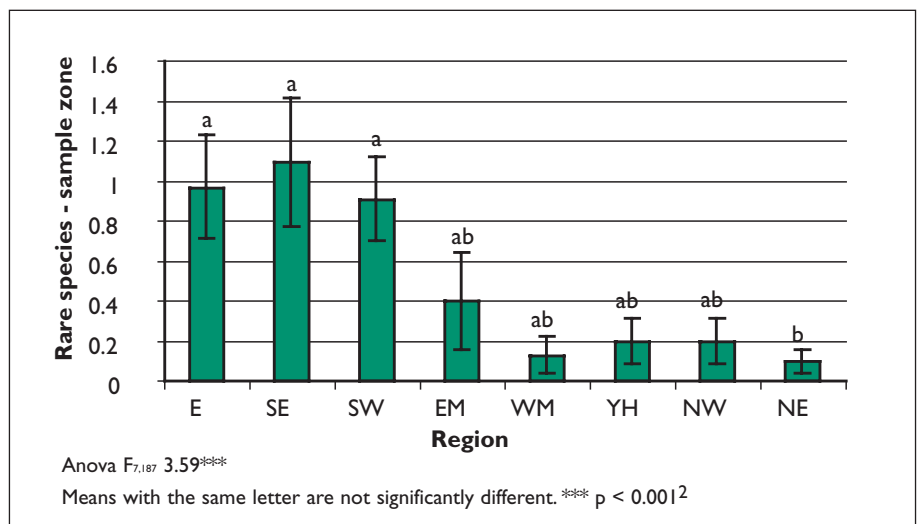
1. South Suffolk and North Essex Clayland
2. Chilterns
3. Thames Basin Heaths
4. Severn and Avon Vales
5. Hampshire Downs
6. East Anglian Chalk
7. Bedfordshire and Cambridgeshire Claylands
8. South Norfolk and High Suffolk Claylands
9. Northern Thames Basin
10. Thames Valley

Fig 6 – Richest Natural Areas for arable plant diversity in England, based on total number of arable species present (scores not weighted), identified by English Nature (now Natural England) (Porley, 1997)



- | | |
|-----------------------|---------------------------------|
| 1. East Anglian Plain | 10. Hampshire Downs |
| 2. Breckland | 11. South Wessex Downs |
| 3. East Anglian Chalk | 12. Thames and Avon Vales |
| 4. West Anglian Plain | 13. Mid Vale Ridge |
| 5. Chilterns | 14. Cotswolds |
| 6. London Basin | 15. Severn and Avon Vales |
| 7. North Downs | 16. Wessex Vales |
| 8. Wealden Greensand | 17. Mid Somerset Hills |
| 9. South Downs | 18. Cornish Killas and Granites |

Fig 7. Regional differences in rare species mean per sample (mean ± 1SE) (Walker et al. 2006).



Sites in the south-east, south-west and eastern England have the greatest diversity of rare species, whilst those in the north-east were the most species-poor.

2. Means with the same letter (a, ab or b) are not significantly different however a, ab and b are significantly different from one another with the probability (p) of the difference happening by chance being < 0.001.

2. Arable plants: the need for conservation

2.1 Reasons for decline

Developments within arable farming techniques over the last 60 years have caused great changes to arable farmland flora, with many species unable to adapt or survive the revolution in farming methods. Advanced seed cleaning, increased use of fertiliser, new high-yielding crop varieties and the introduction of herbicides, have all resulted in a more efficient control of 'weeds'. In addition, the change in cropping patterns, including the shift from spring to autumn cultivation and a reduced diversity of crop type within the rotation, have further contributed to their decline. Corncockle *Agrostemma githago* a locally common plant until the early 20th century is now virtually extinct in Britain, in good part due to more efficient seed cleaning technology. Other species, such as Cornflower *Centaurea cyanus*, Corn Buttercup *Ranunculus arvensis* and Shepherd's Needle *Scandix pecten-veneris* were all abundant until the early 1950s and rigorously controlled as pernicious weeds. However, the development of herbicides in the 1940s led to their rapid and successful 'control' almost 'overnight' (Wilson & King, 2003). Paradoxically, two of these are now conserved as priority species through the UK Biodiversity Action Plan with targets for their long-term recovery and conservation. Corn Buttercup is currently under consideration for similar conservation measures. The widespread use of broad-spectrum herbicides has meant that overall weed abundance and field margin diversity, as well as in the seed bank, is greatly reduced (Walker *et al.*, 2006). The shift from spring to autumn sown cropping has also favoured autumn germinating species, such as Sterile Brome *Anisantha sterilis*, Cleavers *Galium aparine* and Black-grass *Alopecurus myosuroides* (Chancellor, 1985; Hald, 1999), which have adapted to the increased use of nitrogen and thrive alongside the crop, to the extent that they out compete the diverse range of less common species (Wilson & King, 2003).

2.2 Threatened arable species

The impact of modern farming developments has been severe: of the 30 vascular plant species that have shown the greatest relative decline across Britain between the 1930-69 and 1987-99 recording periods, no fewer than 60% are characteristic of arable and other cultivated land (Preston *et al.*, 2002). These levels of decline are reflected in the new assessment of the threat status of Britain's vascular plant flora (Cheffings & Farrell, 2005), and supplementary surveys. It details that no fewer than seven species are regarded as extinct as arable plants in Britain, whilst a further 54 species are considered threatened (Fig 8). In short, arable plants represent the most threatened group of British plant species according to habitat.



BOB GIBBONS / NATURAL IMAGE

Shepherd's Needle a once abundant species until the 1950's and rigorously controlled as a pernicious weed, it is now conserved as a priority species through the UK Biodiversity Action Plan.

There are now seven species regarded as extinct as arable plants in Britain, with a further 54 species considered threatened.



Arable plants training event in Wiltshire

Fig 8 - Britain's most threatened arable plants (Cheffings & Farrell 2005)

Extinct (EX)

Lamb's-succory (*Arnoseria minima*)
 Interrupted Brome (*Bromus interruptus*)
 Thorowax (*Bupleurum rotundifolium*)
 Small Bur-parsley (*Caucalis platycarpos*)
 Downy Hemp-nettle (*Galeopsis segetum*)

Extinct in arable habitats (Listed as Critically Endangered by Cheffings & Farrell, 2005)

Narrow-leaved Cudweed (*Filago gallica*)
 Darnel (*Lolium temulentum*)

Critically Endangered (CR)

Upright Goosefoot (*Chenopodium urbicum*)
Red Hemp-nettle (*Galeopsis angustifolia*)
Corn Cleavers (*Galium tricornerutum*)
 Corn Buttercup (*Ranunculus arvensis*)
Shepherd's-needle (*Scandix pecten-veneris*)

Endangered (EN)

Pheasant's-eye (*Adonis annua*)
 Ground-pine (*Ajuga chamaepitys*)
 Corn Chamomile (*Anthemis arvensis*)
Red-tipped Cudweed (*Filago lutescens*)
Broad-leaved Cudweed (*Filago pyramidata*)
 Corn Gromwell (*Lithospermum arvense*)
 Grasspoly (*Lythrum hyssopifolium*)
 Annual Knawel (*Scleranthus annuus*)
Small-flowered Catchfly (*Silene gallica*)
Spreading Hedge-parsley (*Torilis arvensis*)
 Narrow-fruited Cornsalad (*Valerianella dentata*)
Broad-fruited Cornsalad (*Valerianella rimosa*)
 Fingered Speedwell (*Veronica triphyllos*)
 Spring Speedwell (*Veronica verna*)

Note: Species highlighted in bold are UK BAP priority species

Vulnerable (VU)

Stinking Chamomile (*Anthemis cotula*)
 Rye Brome (*Bromus secalinus*)
 Nettle-leaved Goosefoot (*Chenopodium murale*)
 Corn Marigold (*Chrysanthemum segetum*)
 Common Ramping-fumitory (*Fumaria muralis* ssp. *neglecta*)
 Fine-leaved Fumitory (*Fumaria parviflora*)
 Few-flowered Fumitory (*Fumaria vaillantii*)
 Large-flowered Hemp-nettle (*Galeopsis speciosa*)
 Henbane (*Hyoscyamus niger*)
 Smooth Cat's-ear (*Hypochoeris glabra*)
 Wild Candytuft (*Iberis amara*)
 Yellow Vetchling (*Lathyrus aphaca*)
 Weasel's-snout (*Misopates orontium*)
 Mousetail (*Myosurus minimus*)
 Cat-mint (*Nepeta cataria*)
 Prickly Poppy (*Papaver argemone*)
 Night-flowered Catchfly (*Silene noctiflora*)
 Corn Spurrey (*Spergula arvensis*)
Perfoliate Pennycress (*Thlaspi perfoliatum*)
 Slender Tare (*Vicia parviflora*)

Additional rare arable species (including neophyte species not assessed by Cheffings & Farrell (2005), plus two archaeophyte species now regarded as being of Least Concern, though still listed as Priority Species in the UK Biodiversity Action Plan)

Corncockle (*Agrostemma githago*)
 Hairy Mallow (*Althaea hirsuta*)
 Small Alison (*Alyssum alyssoides*)
 Annual Vernal-grass (*Anthoxanthum aristatum*)
Cornflower (*Centaurea cyanus*)
 Purple Bugloss (*Echium plantagineum*)
Western Fumitory (*Fumaria occidentalis*)
Purple Ramping-fumitory (*Fumaria purpurea*)
 Martin's Ramping-fumitory (*Fumaria reuteri*)
 False Cleavers (*Galium spurium*)
 Smaller Tree-mallow (*Lavatera cretica*)
 Field Cow-wheat (*Melampyrum arvense*)
 Greater Yellow-rattle (*Rhinanthus angustifolius*)
 Cut-leaved Germander (*Teucrium botrys*)
 Breckland Speedwell (*Veronica praecox*)

3. Current action for arable plants (in England)

3.1. Agri-environment Schemes, the delivery mechanism for farmland biodiversity

For the first time in fifty years, arable plants are at the centre of conservation efforts in the farmland environment, with significant resources being actively directed towards their conservation. The key mechanisms to delivery of this conservation are agri-environment schemes.

3.1.1 The management techniques available

The weed control methods of today's modern farming has confined the majority of arable plants, including rare species, to the outer edge of the field where competition from the crop is less intensive (due to soil compaction, poor cultivation and less efficient application of fertilisers and herbicides (Wilson & Aebischer, 1995). As a result, the arable conservation management prescriptions developed over the last 10 years focus on the outer field margin and aim to maximise the botanical diversity of that limited outer strip, leaving the majority of the field to be managed conventionally.

Under agri-environment schemes, cultivated margins can be managed in three ways, namely as:

- a 6 - 24 metre conventional *conservation headland* sown with the rest of the crop, usually with a full fertiliser programme but with greatly reduced herbicide, insecticide and fungicide inputs;
- a minimal input *conservation headland*, sown with a crop but with no fertiliser or manure applied; or
- an *uncropped cultivated margin or plot*, a 6 metre strip or area that is cultivated with the crop but not sown and has no fertiliser applied and minimal herbicide application with only spot treatment permitted.

3.1.2 How effective are these techniques?

Recent work by the Centre for Ecology and Hydrology (CEH) and ADAS (Walker *et al.*, 2006) on the effectiveness of agri-environment schemes to conserve arable plants, found that species richness within conventional conservation headlands was not significantly different from the conventionally managed control margins. This is due to the application of fertiliser still resulting in a competitive crop that shades out the slow growing arable plants. The minimal input conservation headlands (with fertiliser and manure omitted) were significantly more species rich: the more open crop canopy allowing less competitive species to thrive, and the less fertile soils favouring uncommon species over more vigorous, nitrophilous weeds. However, the uncropped cultivated margins have proven to be the most suitable for arable plants, exhibiting the widest diversity of annuals, perennials, grasses, forbs (non-woody, broad-leaved plants other than grass) and spring and autumn germinating species (Walker *et al.*, 2006).

Agri-environment Schemes: The Environmentally Sensitive Areas (ESA) scheme was the first agri-environment scheme to be launched in the UK, in 1987, focusing on a limited number of key landscape areas (e.g. the Brecklands, Test Valley). Since then a large number of other schemes have been developed across England, Scotland, Northern Ireland and Wales, all providing financial support to farmers in return for conservation management.

In England the ESA scheme was supplemented by the Countryside Stewardship Scheme (CSS) in 1991, aimed at both maintaining and /or improving the conservation, landscape and historical value of the key environmental features of an area. Although existing agreements are still being 'honoured', in March 2005 these two schemes were superseded by Entry Level (ELS) and Higher Level (HLS) Stewardship. Both are 'whole farm' schemes aimed at improving the condition of the overall farmland environment.

Entry Level Stewardship is open to all landowners and acceptance is guaranteed providing the scheme's conditions are met. The scheme aims to deliver simple, yet effective, environmental management that goes beyond the cross compliance requirements of the Single Payment Scheme. The scheme operates on a cumulative points system where an average of 30 points per hectare must be gained in order to gain the payment of £30 per hectare. Implementing different management options accumulates points and the same payment of £30 per hectare will be received irrespective of how the points total is achieved.

The Higher Level Scheme is combined with ELS to provide far more complex management, with the scheme targeted to provide significant environmental benefits in high priority situations. This payment scheme operates on a pro rata basis if farmers adopt specific management practices with high value outcomes. The payments can include annual management and one off capital works. Thus, for example, farmers can receive £440 per hectare for cultivating fallow plots or margins for arable flora.

All of the UK schemes provide some management options that will help to conserve arable plants, including cultivated margins, over-winter stubbles and low input cereals. Schemes in England and Wales provide the most appropriate management options.

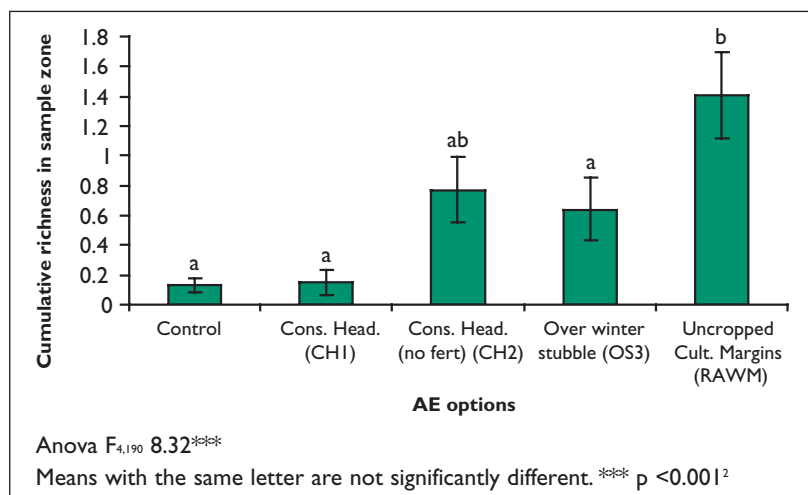


BOB GIBBONS/PLANTLIFE

Ranscombe Farm an IAPA of European importance now has 3km of uncropped cultivated margin.

Uncropped cultivated margins have proven to be the most suitable management option for rare arable plants.

Fig 9. Cumulative species richness of sample zone for different management options for rare arable plants (Walker et al., 2006)



3.1.3 Best practice for arable plants

Arable plants can react positively to management more quickly than plants of most other habitats. Two sites that Plantlife has recently been involved in highlight two key issues within arable plant conservation. In the first instance, the reason species respond so quickly is that the majority of rarer arable plants are highly susceptible to herbicides; so simply turning off the sprayer will allow previously 'wiped out' populations to flourish. Secondly, in order to successfully manage for rare arable plants the issue of pernicious weed species needs to be addressed.

1. Stopping herbicide application

Upper Strensham in Worcestershire is the only remaining arable site for Cotswold Pennycress *Thlaspi perfoliatum*. Following two spraying incidents over two separate years, the species was almost wiped out. With the support of FWAG and Natural England, Plantlife-led negotiations have been successful: in 2005 a 6m uncropped cultivated margin was created by the landowner under Entry Level Stewardship, that received no herbicides or fertiliser applications. In the following spring (2006) the area supported the largest population of robust flowering Pennycress plants that has ever been seen at the site (between 9,000 and 11,000 individuals).

At Ranscombe Farm, Plantlife's nature reserve in Kent, 3km of the same no input, cultivated uncropped margins have been established over the last two years. Since 2004, they have yielded two new populations of Hairy Mallow *Althaea hirsuta* and a number of large, healthy populations of Broad-leaved Cudweed *Filago pyramidata*. Encouraging the neighbouring farmer to carry out similar practice has resulted in a new healthy population of Ground-pine *Ajuga chamaepitys*. This success is the result of stopping herbicide applications and removing the competition of the highly nitrified crop.

2. Controlling the pernicious weeds

The four hectare Kitchen Field (SSSI) at Ranscombe Farm has been long famed amongst botanists as one of the richest sites for arable plants in the UK, and is considered of European importance (Byfield & Wilson, 2005). The flora includes Blue Pimpernel *Anagallis arvensis* ssp. *foemina*, Night-flowering Catchfly *Silene noctiflora*, Narrow-fruited Cornsalad *Valerianella dentata* and Dense-flowered Fumitory *Fumaria densiflora*.

The Kitchen Field has been subject to a management agreement for a number of years, but has increasingly been suffering from a proliferation of perennial weeds such as Colt's-foot *Tussilago farfara*, Docks *Rumex* spp. and Couch-grass *Elytrigia repens*. It is thought the problem was created in the 1990s following the introduction of an autumnal, minimal till regime with repeated management over the years permitting certain pernicious species to flourish. The decision was taken to spray the field with glyphosate in an attempt to control the perennial weeds: the work was carried out in September (2005) once the annuals had largely seeded

(and thus not susceptible to the effects of the herbicide), but the perennials were still in active growth. Additionally, the field was cultivated (part ploughed, part disced) the following February (i.e. not autumn). The combined introduction of judicious spraying and reinstatement of ploughing resulted in the reappearance in 2006 of two rare species; Ground-pine and Blue Pimpernel.

4. Outstanding issues for arable plants

The conservation of rare arable plants may be beginning to get the recognition, management tools and funding it requires but, when reviewing the existing state of arable plant conservation in Britain, Plantlife has identified a number of outstanding issues that still merit attention if our rarer arable plants are to have a long-term future in Britain.

4.1 Uneven uptake of Stewardship options

Through agri-environment schemes, the delivery mechanisms are in place to conserve existing assemblages of arable species and also to recover 'lost' populations from the seed bank. However, there is a lack of awareness or concern of the plight of arable plants, and this low profile means that many farmers are unaware of the value of the arable plant communities on their land. This is demonstrated by a generally low uptake of options providing suitable conditions for arable plants.

As England is richer for arable plants than Scotland and Wales, it has been the focus of a comparative study identifying which species-rich areas are failing to benefit from the new Stewardship schemes with the potential they offer arable plants.

A lack of awareness or concern of the plight of arable plants means that many farmers are unaware of the value of the arable plant communities on their land.

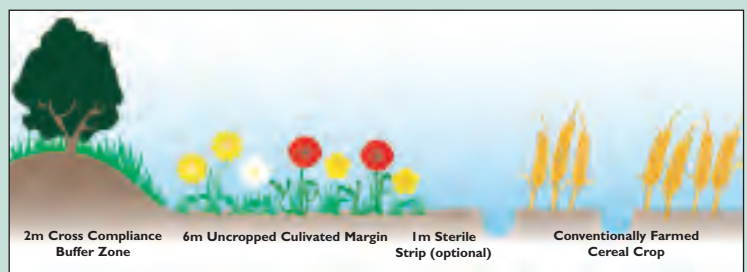
4.1.1 Delivering arable plant conservation in England:

Methodology

Using the methodology described in section 1.2 the Joint Character Areas (JCAs) for England were ranked for species richness. The highest scoring areas were then compared with Environmental Stewardship (ES) uptake of options suitable for arable plants. Using Natural England ES option uptake figures (as at 8 August 2006), a total area of cultivated margin habitat suitable for arable plant conservation was compiled for each JCA (both for Entry and Higher Level Stewardship). The suitable Entry (EF) and Higher (HF) level options selected were as follows:

- EF9/HF9 Conservation headlands in cereal fields
- EF10/HF10 Conservation headlands in cereal fields (with no fertiliser or manure applied)
- EF11/HF11 6m uncropped cultivated margins on arable land
- HF14 Unharvested fertiliser free conservation headlands
- HF19 Unharvested fertiliser free conservation headlands preceding enhanced set-aside
- HF20 Cultivated fallow plots or margins for arable flora

It should be noted that the RDS option uptake figures used in this analysis do include both Organic Entry Level (OELS) and Higher Level Schemes (OHLS) though, as of 8 August 2006, there had been no uptake of suitable cultivated margin options under the organic schemes.



EF11 – uncropped cultivated margin



EF9/10 – Conservation Headland

ANDREW EVANS

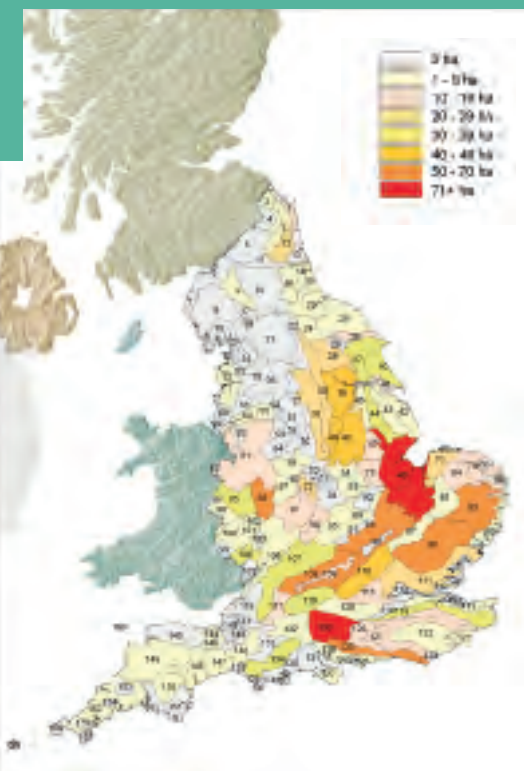


Fig 11 – The distribution of cultivated margin option uptake across England.

Results

Fig 10 – The level of cultivated margin option uptake within the richest Joint Character Areas

| JCA Name | Total accumulative species score | Area of cultivated margin under ES (Hectares) |
|---|----------------------------------|---|
| South Suffolk and North Essex Clayland | 362 | 50 |
| Chilterns | 353 | 44 |
| Thames Basin Heaths | 335 | 6 |
| Severn and Avon Vales | 331 | 5 |
| Hampshire Downs | 330 | 123 |
| East Anglian Chalk | 328 | 7 |
| Bedfordshire and Cambridgeshire Claylands | 326 | 57 |
| South Norfolk and High Suffolk Claylands | 323 | 57 |
| Northern Thames Basin | 321 | 20 |
| Thames Valley | 321 | 10 |
| Upper Thames Clay Vales | 308 | 57 |
| The Fens | 305 | 119 |
| Midvale Ridge | 305 | 12 |
| Cotswolds | 298 | 32 |
| Wealden Greensand | 294 | 13 |

The two areas with the highest cumulative species scores, South Suffolk and North Essex Claylands, and the Chilterns have a total of 94 hectares, over 8.5 times that of the 3rd and 4th ranking areas (Fig 10). However, the needs of the arable plant populations in the Thames Basin Heaths and Severn and Avon Vales are not currently being met, with a total of just 11 hectares across the two JCAs of Stewardship options that would provide suitable conditions for rare arable species.

The Hampshire Downs and the Fens have the greatest area of cultivated margins under the Stewardship schemes. These two areas have 15% of the total 1,621 hectares of suitable cultivated margin options to date.

Although this analysis does not take account of cultivated margin options put in place under the classic Countryside Stewardship or Environmentally Sensitive Areas schemes, the analysis provides an overview of new scheme uptake and clearly identifies the areas that would benefit from more targeted advice to farmers (Fig 11), ensuring good biodiversity is delivered by the schemes. It is noted that the level of uptake will reflect the amount of arable land available in a certain area. It is likely that the reason the uptake figures in the Thames Basin Heaths and Severn and Avon Vales is low is due to what was once arable land being reverted to grassland.

Of the 1,621 hectares of cultivated margin under management agreements with farmers through Environmental Stewardship, 83.5% of the area is managed under the Entry Level scheme. This will be partly due to the rather slow uptake of Higher Level Stewardship, with currently only 52,816 hectares³ of farmed area under agreement (both HLS & OHLS), just 26.4% of the target agreement area of 200,000 hectares by December 2007. However, with the majority of ELS agreements being completed by farmers with very little influence from conservation advisors, it is reassuring that many have chosen the cultivated margin options. Closer analysis of the different types of options taken up shows that 25% of the total area are options EF11 (under ELS) and HF20 (under HLS) which provide the most suitable conditions of uncropped, cultivated margins or plots with no inputs permitted. It is unfortunate that 38% of the area is options EF9, conservation headlands (with fertiliser), which have been proven not to provide significantly better conditions for arable plants than a conventionally managed crop (Walker et al., 2006).

The South Suffolk and North Essex Claylands, and the Chilterns have the highest cumulative species scores and combined have 5.8% of the total 1,621 ha of suitable cultivated margin option to date.

3. Figures taken from Environmental Stewardship Update September 2006, within which figures are taken from GENESIS as of 12 September 2006 (RDS)

4.1.2 Solving the uptake problem: Plantlife’s arable plants project – targeted action for arable plants

The Plantlife arable plants project has identified some of the best sites for arable plants using the Important Arable Plants Areas criteria, and is currently implementing a programme to conserve them. The project targets farms identified as IAPAs and then advises owners/managers to take up appropriate options within the Entry and Higher Level Stewardship Schemes (or make changes to their existing agri-environment schemes as appropriate). The project is run in partnership with the Farming and Wildlife Advisory Group (FWAG) and currently focuses in five counties, Wiltshire, Hampshire, Cambridgeshire/Hertfordshire (all within the top 10 species rich VCs using the IAPA criteria), Worcestershire and Cornwall. This advisory role is undertaken by FWAG, and their interim report details great success to date with at least twelve farmers within four of the five counties applying for the Higher Level HF20 options (uncropped, cultivated plots or margins for arable flora), to conserve and regenerate a range of species including the Vulnerable Prickly Poppy *Papaver argemone* and Endangered Grass-poly *Lythrum hyssopifolium* in Cambridgeshire, and both Endangered Narrow-fruited Cornsalad *Valerianella dentata* and Corn Gromwell *Lithospermum arvense* in Wiltshire.

The comparison of uptake of cultivated margin options under Environmental Stewardship compared with key JCAs for arable plants, identifies clear gaps where this new agri-environment scheme is failing to deliver essential arable plant conservation.

It is also apparent that these six areas fall within the sites identified by English Nature (now Natural England) to be the 18 richest Natural Areas for arable plant diversity in England (see Fig 6.).

Fig 12 – Six JCAs that have been identified with exceptional species assemblages but RDS data indicates low uptake of appropriate arable plant ES options. Fig 13 illustrates the distributions of these rich areas.

| JCA Name | Total accumulative species score | Area of cultivated margin under ES (Hectares) |
|---------------------------|----------------------------------|---|
| 129 Thames Basin Heaths | 335 | 6 |
| 106 Severn and Avon Vales | 331 | 5 |
| 87 East Anglian Chalk | 328 | 7 |
| 111 Northern Thames Basin | 321 | 20 |
| 115 Thames Valley | 321 | 10 |
| 109 Midvale Ridge | 305 | 12 |

Delivering UK Biodiversity Action Plan targets through Environmental Stewardship

The Arable Field Margin Habitat Action Plan (HAP) has targets to expand the area of cultivated unsprayed field margin in England by an additional 4,619 hectares to 10,000 hectares by 2010. This HAP target contributes to the greater Plant Diversity Challenge⁴ target of ‘at least 30 per cent of production lands managed consistent with the conservation of plant diversity by 2010’. Entry Level Stewardship (ELS) provides the key mechanism to achieve this, with the appropriate cultivated margin options available. However, the ‘hands off’ nature of ELS has meant that many farmers have opted for the minimum impact boundary and management plan options that provide limited biodiversity gain. In order for ELS to successfully deliver ‘in-field’ arable biodiversity, greater influence is required by Natural England and other interested parties to target the most beneficial options in the right locations.

⁴Plant Diversity Challenge is the UK’s response to the Global Strategy for Plant Conservation and was launched by the UK Government in 2004. It sets out the framework for plant and fungus conservation throughout the UK by identifying sixteen outcome oriented targets to be met by 2010.



PETER MARREN/PLANTLIFE

The Endangered Grass-poly *Lythrum hyssopifolium* is being conserved at a Cambridgeshire farm under the Plantlife Arable Plants Project.

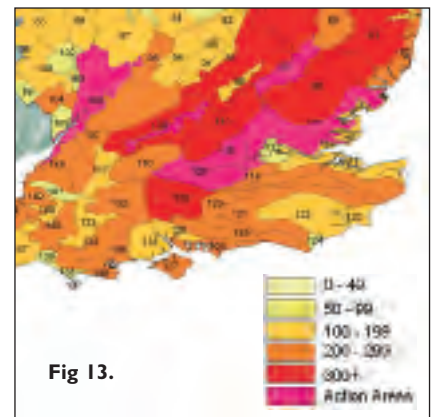


Fig 13.

The Arable Field Margin Habitat Action Plan (HAP) has targets to expand the area of cultivated unsprayed field margin in England by an additional 4,619 hectares to 10,000 hectares by 2010.



Cleavers *Galium aparine*

KATE STILL/PLANTLIFE

Recommendations and actions:

- Key arable plant areas with very rare species or exceptional assemblages should be targeted for appropriate management across a range of different soil types, to ensure that Stewardship resources are used effectively.
- The GENESIS database requires regular updating with Important Arable Plant Area (IAPA) data to ensure accurate targeting of agri-environment scheme options at key arable plant sites.

4.2 Pernicious weeds & farmer perception

Pernicious weeds represent the biggest problem when managing land sustainably for arable plants. The difficulty of controlling pest species whilst maintaining desirable species, combined with the limited options for control under agri-environment scheme prescriptions, is a key factor behind the low uptake of cultivated margin options.

A number of effective management techniques can be used to control grass and perennial weed species, and these need to be permitted and encouraged within the Stewardship option prescriptions. These include: (a) very careful site selection to avoid a problem occurring; (b) changing the timing and depth of cultivations (including spring sown crops in the rotation) to control grass weeds; and (c) the targeted use of herbicides where absolutely necessary. Spot spraying represents the low risk option, but needs to be done in the early stages of weed growth. If a perennial weed burden impacts on the growth of the arable plants in the margin or the crop as a whole, the use of glyphosate in September will control the perennial species with minimum damage to the rare annual plants (most of which have largely seeded and died by autumn). At present this is not permitted under the Stewardship prescriptions.

The weed risks associated with unsprayed cultivated margins, along with the increased management that is required annually, discourages farmers from taking up these options. More work is still required to improve their perception of arable plants, particularly the conservation of natural populations.

Recommendations and actions:

- Agri-environment scheme prescriptions need to allow more flexible weed control practice and give better guidance on the use and timing of cultural methods to discourage a build-up of pernicious weed species.
- More advice and detail on where to site and how to manage for rare arable plants should be provided to land managers.

4.3 Low payment incentives for cultivated margin options.

The management risks and issue of poor perception is not helped by the relatively low payment rates and points allocation, particularly when compared to the low risk option of grass buffer strips (Fig 14).

The ‘weed’ risk associated with unsprayed cultivated margins is the main issue that discourages farmers.

Fig 14 – Comparing the ‘value’ per hectare of cultivated margins compared with grass buffer strips under the two tiers of the Environmental Stewardship scheme.

| Agri-environment scheme options | £/ha or points/ha |
|--|--------------------------------|
| Entry Level Stewardship: 6m uncropped cultivated margin on arable land (i.e. high botanical interest) 6m grass buffer on cultivated land (i.e. negligible botanical interest) | 400 points/ha 400 points/ha |
| Higher Level Stewardship: Cultivated fallow plots or margins for arable flora (i.e. high botanical interest) Floristically enhanced grass margins (i.e. negligible botanical interest) | £440/ha £485/ha |

As arable plant conservation can be delivered by Entry Level Stewardship (a scheme open to all), increasing the point allocation to the EFl I option, and therefore encouraging uptake, would have a far greater impact than relying on highly targeted HLS. There is also the risk that, as the competition amongst farmers for funds for Higher Level Scheme increases, predominantly arable farms may not be able to provide sufficient gains across a range of habitats or resources to successfully reach the target threshold for entry into the scheme.

The combined uptake of ELS and HLS 6m grass buffer strips and 6m uncropped cultivated margins was 6,930 hectares and 1,621 hectares respectively (August 2006). Under the Arable Field Margin Habitat Action Plan there is no target to increase the area of grass margins, but the target for uncropped cultivated margins is a 46% increase in area by 2010 (from a 2005 baseline). The most effective way to meet this target is if the points allocation is raised for uncropped cultivated margins under the Entry Level scheme.

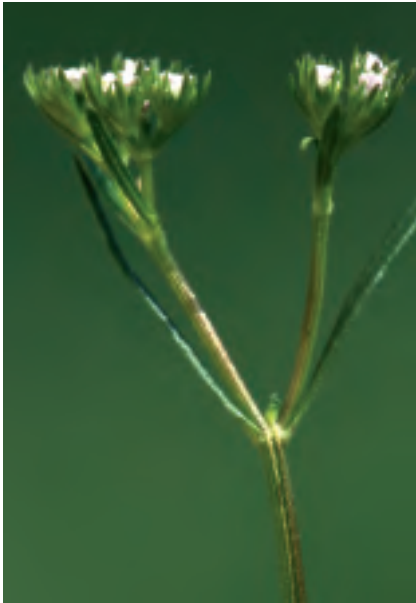
Recommendations and actions:

- Future reviews of available Stewardship schemes should require land managers to select effective in-field options in key arable plant areas.
- Stewardship payments should be reviewed and increased to encourage uptake of key cultivated margin options and reflect the increased management burden on the farmer and high value to biodiversity.

Arable plant conservation can be delivered by Entry Level Stewardship, increasing the point allocation to the EFl I option, and therefore encouraging uptake, would have a far greater impact than relying on highly targeted HLS.

Uncropped cultivated margin





Narrow-fruited Cornsalad *Valerianella dentata* has very long-lived seed (>30 years)

Two key areas have been identified that would benefit from further investigation through research: the seed longevity of many rarer arable species, and the cost effective targeting of pernicious weed species.

4.4 Research requirements within arable plant conservation

Although our knowledge is steadily increasing, there are still many gaps in our understanding of the ecology and physiology of arable plants and the best techniques by which to manage them within the modern, arable farming environment. Two key areas have been identified for further investigation: the seed longevity of many rarer arable species, and the cost effective targeting of pernicious weed species. Knowledge about seed longevity would permit better targeting of 'lost' historic populations, allowing more accurate predictions regarding possible re-emergence from seed banks. The key problem of managing pernicious weeds in rare arable plant margins needs further research, to provide farmers with more options to resolve weed infestations, whilst minimising damage to the desirable species.

4.4.1 Seed bank longevity

In order to encourage the regeneration of rare plant assemblages from the seed bank (as opposed to planting new, introduced, populations), a more accurate understanding of the ability of different species to germinate from dormant buried seed needs to be known. Farmers need to be sure that the management effort and cost they are investing is highly likely to produce desired results.

There are many arable plant species, which have long-lived seed that can lay dormant for many years until the right conditions occur, permitting germination. Two threatened arable species rank in the top 100 species ranked by their maximum recorded longevity (Thompson et al., 1997): Henbane *Hyoscyamus niger* with a record of > 90 years, and Narrow-fruited Cornsalad *Valerianella dentata* at > 30 year. Conversely, there are also many species with only very short-lived seed. Corncockle *Agrostemma githago* seed may remain viable in the soil for only 1 to 2 months. It has a longer dormancy when stored dry in the grain store, but here improvements in seed cleaning have ensured its rapid decline. In fact, with the exception of Red and Downy Hemp-nettle *Galeopsis angustifolia* and *Galeopsis segetum*, all arable plant species that are now regarded as Extinct or Critically Endangered (Fig 8) are thought to have short-lived seed, which makes the regeneration of new populations from the seed bank highly unlikely. One of the main issues with the majority of threatened arable species is the lack of accurate data on seed longevity, making it hard to judge the likelihood of regeneration.

Recommendations and actions:

- Research into seed longevity, and other ecological attributes (e.g. fecundity and competitiveness), needs to be undertaken to identify which species are more successful than others at completing their annual life cycle.

4.4.2 Controlling pernicious weeds alongside desirable arable plants

See 4.2 for details on the pernicious weed issue.

Recommendations and actions:

- Further trials should be implemented to investigate different methods of weed control. The focus should be on cultural methods, comparing the effect of cultivation technique, depth and timing on both desirable and undesirable species. The use of herbicides in managing rare arable plant margins also requires more detailed analysis, both in terms of the use of different active chemicals and timing of applications.

4.5 Awareness raising and training requirements

Despite being the most threatened group of British plants, arable species still suffer from poor awareness amongst farmers, industry professionals and policy makers. Farmers are unwilling to set aside land for 'weed' conservation and many conservation advisors and industry professionals do not have the skills to identify rare species or provide advice for correct management. Further training is required to ensure that necessary botanical skills are held or accessible to the industry. This will become increasingly important as management prescriptions are monitored to assess condition and delivery of targets. Being able to monitor species assemblages is the only way species richness, and therefore biodiversity, can be effectively assessed.

The use of farmland birds as the biodiversity indicator for arable landscapes is distorting our understanding of the impact of agri-environment schemes on biodiversity in general. It is assumed that, as birds sit near the top of the food chain, an increase in their numbers will reflect an increase in all plants and animals below them in the chain (in other words an all-round healthy farming environment). However, the use of sown wild birdseed mixes, as well as pollen and nectar mixes (for insects), is distorting the picture on the ground. Food can be provided to increase bird numbers within the arable farming environment without necessarily greatly improving the overall biodiversity of the landscape and the arable plant populations on the ground.

Similar issues occur with sowing wildflower seed mixes as a 'quick fix' for biodiversity. The sowing of wild plant seed masks the natural distribution of species and is an expensive and unnecessary replacement for natural regeneration. Standard annual wild flower mixes often contain species that wouldn't necessarily occur together naturally and are certainly not historically found the length and breadth of the UK. There needs to be greater appreciation of the natural plant communities of the arable landscape and how they reflect the soil, topography, climate and traditional management of a site.

Recommendations and action:

- Greater emphasis is required on encouraging uptake of naturally regenerated margin habitats rather than artificial food sources for birds and insects.
- An assessment of difference in bird and insect populations on naturally regenerated 'weedy' margins compared with sown margins should be completed.
- Training should be provided to ensure that necessary botanical skills are held or accessible to the industry.

The Cornflower case study:

The *New Atlas of the British and Irish Flora* (Preston *et al.*, 2002) shows Cornflower *Centaurea cyanus* to be widespread across much of Britain, and records no fewer than 412 10 km squares where the plant has been seen since 1987 (15% of the UK total). In fact, the species is apparently extant in as many 10 km squares as ones from which it has been lost so it is not surprising the recent Red List of Vascular Plants (Cheffings & Farrell, 2005) considered the plant to be relatively stable, and of 'Least Concern' in conservation terms.

However, the general consensus among botanists and farmers is that Cornflower remains one of our rarest and least seen cornfield flowers. A recent audit (2005) of the species (Wilson, 2007) supports this view, and identifies just 105 arable fields (81 10-km squares) in which the plant is thought to occur naturally today, confirming an earlier assessment of the species' status as Endangered (Wiggington, 1999). So is this UK Biodiversity Action Plan Priority Species on the verge of extinction? Or exceeding its distribution targets?

The issue here is trying to differentiate between the rare natural occurrences of the plant with the multitude of deliberate introductions. Cornflower is possibly the most obvious example of where sowing wild flower mixes either on farms or around the countryside has upset the 'natural' populations and, increasingly, conservationists see these deliberate introductions as inappropriate.



KATE STILL / PLANTLIFE

Annual wildflower seed mix at Cereals 2006

Food can be provided to increase bird numbers within the arable farming environment without necessarily greatly improving the overall biodiversity of the landscape and the arable plant populations on the ground.



ROB GIBBONS/PLANTLIFE

Narrow-fruited Cornsalad
Valerianella dentata

CONCLUSIONS

There is no doubt that arable plants have not fared well in the agricultural revolution of the last 60 years. Although a little too late for some, this group of plants is now at the centre of plant conservation activity and the new agri-environment schemes, focused by the Arable Field Margin Habitat Action Plan targets, give them a very good chance of recovery. However this will only happen if arable plant conservation is made more attractive to farmers, through raising the value of the appropriate management options, making pernicious weed management more flexible, and by raising awareness of the value of the species group to farmland biodiversity as a whole. The ability of arable plants to lie dormant in the seed bank means, with correct management in the right place, species rich assemblages can appear within the first year. With targeted action there is no reason why arable plants, the foundation of arable farmland biodiversity cannot return to the British countryside on a large scale.

REFERENCES

- Anderson, S. (2002) Identifying Important Plant Areas. Plantlife International, Salisbury.
- Byfield, A.J. & Wilson, P.J. (2005) Important Arable Plant Areas. Identifying priority sites for arable plants conservation in the United Kingdom. Plantlife, Salisbury.
- Chancellor, R.J. (1985) Changes in the weed flora of an arable cultivated field for 20 years. *Journal of Applied Ecology* 22, 491 – 501.
- Cheffings, C.M. & Farrell, L. (2005) Species Status, Report No 7: The vascular plant red data list for Great Britain. Joint Nature Conservation Committee, Peterborough
- Hald, A.B. (1999) The impact of changing the season in which cereals are sown on the diversity of the weed flora in rotational fields in Denmark. *Journal of Applied Ecology* 36, 24 – 32.
- Porley, R. (1997) Rare and scarce vascular plants and bryophytes in Natural Areas Research Report No 267, English Nature, Peterborough.
- Preston, C.D., Pearman D.A., Dines T. (Comps and Eds.) (2002) The New Atlas of the British and Irish flora. Oxford University Press, Oxford.
- RDS, Entry Level and Higher Level Stewardship Handbooks (2003).
- Rodwell, J. S. (2000) British Plant Communities Volume 5: Maritime communities and vegetation of open habitats. Cambridge University Press, Cambridge.
- Thompson, K., Bakker, J., Bekker, R. (1997) The Soil Seed banks of North West Europe: methodology, density and longevity. Cambridge University Press, Cambridge.
- Walker, K.J., Critchley, C.N.R., Sherwood, A.J., Large, R., Nuttall, P., Hulmes, S., Rose, R., Moy, I., Towers, J., Hadden, R., Larbalestier, J., Smith, A., Mountford, J.O. & Fowbert, J.A. (2006) Defra Cereal Field Margin Evaluation. Phase 3. Evaluation of Agri-environment Cultivated Options in England: Effectiveness of new agri-environment schemes in conserving arable plants in intensively farmed landscapes. ADAS, CEH and DEFRA.
- Wigginton, M.J. (1999) British Red Data Books I, Vascular Plants. JNCC, Peterborough.
- Wilson, P.J. (2007) The Status of *Centaurea cyanus* in Britain (Unpublished).
- Wilson, P.J. & Aebischer, N.J. (1995) The distribution of dicotyledonous arable weeds in relation to distance from the crop edge. *Journal of Applied ecology* 32, 295-310.
- Wilson, P.J. & King, M. (2003) Arable Plants – a field guide. English Nature & WildGuides, Old Basing, Hampshire, UK.



BOB GIBBONS/ PLANTLIFE

Red Hemp-nettle *Galeopsis angustifolia*



JAMES PEAT/ PLANTLIFE

Ground-pine *Ajuga Chamapitys*

BOB GIBBONS/PLANTLIFE



Dwarf Spurge *Euphorbia exigua*

GAVIN DULEY/PLANTLIFE



Pheasant's eye *Adonis annua*



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