



Arable Farmland *Flora and Invertebrates* Habitat Action Plan

1. Introduction

There has been a severe decline in the number and distribution of many native wildlife species associated with arable land since 1945, particularly in the latter half of this period. Many of the biodiversity-rich features associated with farmland have their own Action Plans within this BAP, for example hedgerows, veteran trees and ponds. There is also a separate Farmland Birds Species Action Plan. For this reason the primary focus of this Action Plan will be the invertebrates and the rare arable plants found within the arable farmland habitat.

Worcestershire is an important county for plants associated with arable land: records suggest that the county has suffered a little less than other parts of the country from the negative effects of intensification following the Second World War and the introduction of the Common Agricultural Policy.

Arable Field Margins were identified as a priority UK BAP Habitat and subsequently included within the Section 41 list of the Natural Environment and Rural Communities (NERC) Act 2006. A number of species associated with arable field margins are also included on the Section 41 list, examples being large garden bumblebee (*Bombus ruderatus*), brush-thighed seed-eater beetle (*Harpalus froelichii*), cornflower (*Centaurea cyanus*), corn buttercup (*Ranunculus arvensis*) and shepherd's-needle (*Scandix pecten-veneris*).

2. Current Status

2.1 Description of habitat

An arable field has the potential to contain a range of habitat features that will benefit wildlife, however with increased intensification and changes in the timing of cropping, many of these habitats become less hospitable to wildlife or are lost altogether. Different features within the arable landscape support different species and the restoration and management of a wide range of these associated habitats needs to be encouraged. These features may include:

Nectar/pollen-rich margins and plots

Areas deliberately sown with flower-rich species mixes and managed without the use of any agro-chemicals will provide pollen and nectar resources for insects and a subsequent food source for insectivorous birds and small mammals.

Stubbles and fallow land

Areas left completely fallow, with no crop production or grazing, or areas of stubble where there is a gap between harvest and ground preparation for the next crop, can provide space for the growth of wildflowers or seed-rich plants.

Cultivated margins or headlands

Areas that are cultivated but uncropped and have no application of agro-chemicals are important for rare arable flora that thrive in areas of disturbed ground as well as providing bare ground for invertebrates that require it.

Grass buffer strips

Areas comprising wide grass strips or blocks will themselves support wildlife as well as buffering other habitat features, such as a watercourse, pond, woodland or hedgerow, from the impact of operations in the productive part of the field.

Ditches and wet flushes

Areas with standing water at or above the soil surface that cannot be cultivated will be valuable for wild plants and invertebrates.

2.2 Ecology and habitat requirements of priority species groups

2.2.1 Invertebrates

Invertebrates are of critical importance to the health of our countryside and arable land is a significant habitat for many invertebrate species. Research by Winspear and Davies in 2005 suggested that some 2000 species of invertebrate (excluding soil microorganisms) are commonly found in cereal fields, providing a rich food supply for birds and small mammals. The vast majority of our declining farmland bird species feed their chicks on insects such as grasshoppers, spiders, leaf beetles, weevils, aphids, craneflies and sawfly larvae. Farmland birds are therefore severely affected by the removal of invertebrates by insecticides and the removal of insect food plants by herbicides. The 66% decline in house sparrow (*Passer domesticus*) populations between 1970 and 2015 has been attributed to a decline in summer invertebrate prey.

Research by Boatman *et al* (2014) demonstrated that the shift from spring to autumn cultivation and the subsequent change from summer to autumn-applied insecticides in many arable fields had an effect on invertebrate groups such as ground beetles, favouring smaller species at the expense of some larger species. Seed eating ground beetles appear to have declined more than other groups of ground beetles and this probably reflects the reduction in weed species in arable fields. There is good evidence that insecticides applied during the breeding season also affect breeding performance of corn bunting (*Emberiza calandra*) and yellowhammer (*Emberiza citrinella*). In the case of the grey partridge (*Perdix perdix*), experiments have shown that a reduction in the use of herbicides and insecticides boosted insect food available to the chicks, and in turn improved breeding productivity.

Rare or very scarce species that can be found within the arable environment include the nomad bee (*Nomada fulvicornis*). This species is a cleptoparasite of the rare mining bee *Andrena nigrospina* that has recently been discovered in the conservation headlands at Devils Spittleful and Blackstone Farm nature reserves near Kidderminster foraging on wild radish (*Raphanus raphanistrum* subsp. *Raphanistrum*) growing in the unsprayed spring barley headland.

Buglife have published a list of the numbers of Nationally Notable or Red Data Book invertebrate species associated with arable field margins (Table 1). Many of these species feed on arable weeds.

Table 1. Invertebrate species associated with arable field margins (Buglife).

Group	Number of Species
Spiders and allies	6
True bugs – heteroptera	3
True bugs – leafhoppers, planthoppers, froghoppers, treehoppers and cicadas	2
Ground beetles	7
Leaf beetles	12
Weevils	14
Rove beetles	11
Ants, bees and wasps	7

2.2.2 Arable Flora

Arable flora are the most critically threatened group of plants in Britain and are of conservation concern because of enormous national declines in their distribution and abundance. Overall, some 300 species of plant can occur in arable fields, of which 54 are considered to be at high risk of extinction, including cornflower, corn buttercup, shepherd's-needle and narrow-fruited cornsalad (*Valerianella dentate*) (Plantlife, 2008). Once common, these species are now virtually extinct in Worcestershire.

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 rare 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 carefully targeted management.

2.3 Distribution and extent

2.3.1 Distribution and trends in invertebrates

Pollinators such as butterflies, moths and bumblebees are some of the best-studied groups of insects but our overall understanding of the health of the UK's invertebrate populations is limited. Data show that numbers of butterflies in the wider countryside have declined by 46% since 1976 (Defra, 2018). The 2016 annual report from the UK Butterfly Monitoring Scheme show that composite measures of abundance for 21 'farmland specialist' butterfly species were at 33% of 1990 baseline figures and for wider countryside butterflies at 64% of the 1990 baseline. These figures include both some significant long-term population declines (in 18 of the species surveyed) but also long-term increases (5 species).

2.3.2 Distribution and trends in Arable Flora

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 in supporting insect and bird populations in their position at the base of the food chain. Although the total area of arable cropping has increased in the post war period, the expansion of winter wheat cropping at the expense of winter and spring oats and barley has reduced the diversity of crop habitats. This, coupled with the earlier sowing and more intensive husbandry of cereals, has been the cause of the severe decline in arable flora.

Table 2. Worcestershire records for 10 rare arable flora species. Table shows number of tetrads in which plant was recorded during the Worcestershire Flora Project surveys which took place between 1987 and 2005. Source: The Flora of Worcestershire (Maskew, 2014).

Species	Status	Number of tetrads	Comments
Cornflower <i>Centaurea cyanus</i>	Least Concern, IUCN Red List	36	First recorded in Worcestershire in 1823 and formally a widespread and locally common plant of cereal fields. Very few 20 th century records prior to 1985. Now increasingly being introduced in planted wildflower seed mixes.
Corn Buttercup <i>Ranunculus arvensis</i>	Critically Endangered, IUCN Red List	56	First recorded in Worcestershire in 1823 and at one time locally common. Now a scare plant found mainly in the south-east on cultivated land, disturbed road verges, set-aside and waste ground.
Red Hemp Nettle <i>Galeopsis angustifolia</i>	Critically Endangered, IUCN Red List	2	First recorded in Worcestershire in 1824. In serious decline, last sighting in 1992 at Fish Hill Quarry, Broadway.
Shepherds Needle <i>Scandix pecten-veneris</i>	Critically Endangered, IUCN Red List	12	First recorded in Worcestershire in 1834. Formally so widespread and abundant in Britain that it would impede mechanical harvesters. Once thought to be extinct in the county it was re-confirmed in 1990. Now found largely in the south-east of the county.
Spreading Hedge Parsley <i>Torilis arvensis</i>	Endangered, IUCN Red List	25	First recorded in Worcestershire in 1830. All records are from the southern half of the county where it is restricted to the margins of cereal and bean fields.
Narrow-fruited cornsalad <i>Valerianella dentate</i>	Endangered, IUCN Red List	3	First recorded in Worcestershire in 1835. Now confined to a few arable field margins and headlands on Bredon Hill above Westmancote.
Small-flowered buttercup <i>Ranunculus parviflorus</i>	Least Concern, IUCN Red List	67	First recorded in Worcestershire in 1904. A plant that appears to be increasing and extending its range, colonising a wide variety of disturbed, cultivated and grassy habitats.
Mousetail <i>Myosurus minimus</i>	Vulnerable, IUCN Red List	27	First recorded in Worcestershire in 1787. Now mainly confined to the lower Severn and Avon valleys on disturbed ground in seasonally flooded riverside meadows.
Cotswold (Perfoliate) pennycress <i>Microthlaspi perfoliatum</i>	Vulnerable, IUCN Red List	1	Recorded in Worcestershire in 1999 on a single site near Strensham. This colony is now one of the largest in Britain.
Blue pimpernel <i>Anagallis arvensis</i> subsp. <i>Foemina</i>	Least Concern, IUCN Red List	14	First recorded in Worcestershire in 1954. Mostly recorded in very small numbers from the margins of cereal fields.

2.4 Legislation affecting biodiversity within the arable habitat

Basic Payment Scheme (BPS) and 'Greening'

The BPS is a European Union-funded rural grant support programme for farmers and land managers. Arable farmers who want to claim BPS and who meet certain land holding size and land use criteria must meet 'greening' rules. Part of this requires them to establish Ecological Focus Areas whereby a minimum of 5% of eligible land is set aside to benefit wildlife. Farmers/land managers must also meet relevant Cross Compliance regulations to receive support under the BPS.

Cross Compliance

The Cross Compliance regulations involve demonstrating that land is being kept in Good Agricultural and Environmental Condition (GAEC), including soil management and protection measures and the maintenance of habitats and landscape features, and complying with a number of specific Statutory Management Requirements (SMR's) relating to the environment, public and plant health and welfare, and livestock identification and tracing.

Legal protection for specific species

Twelve species of arable plants receive full protection under Schedule 8 of the Wildlife and Countryside Act 1981 (as amended). Cornflower, red hemp-nettle, corn buttercup, shepherd's needle, Cotswold pennycress and spreading hedge-parsley are all included within Section 41 of the NERC Act.

Legislation relating to the water environment

The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 brought together a number of rules that farmers and land managers must comply with for the management of manure, fertiliser and soil in order to prevent runoff, erosion and leaching.

2.5 Summary of important sites for arable flora

There are two sites within the county where the conservation of arable flora is a particular priority for site management:

- The **Kemerton Estate** is situated on the south-facing slopes of Bredon Hill. During the 1980s the Estate began to leave wide, unsprayed margins around a number of its arable fields and to monitor the arable flora that grew: this pioneering work contributed to the adoption of the arable field margin options within the first agri-environment schemes offered to farmers. The Estate, in partnership with the Kemerton Conservation Trust, has continued to focus on the conservation of rare arable flora and around 70 different species have now been recorded in the arable margins on the Estate. Almost 30 years of monitoring has gathered a wealth of data about the management of arable field margins and the propagation of arable wildflowers from seed.
- **Lower Smite Farm**, the headquarters of Worcestershire Wildlife Trust, is a small mixed farm (65 ha) that seeks to maximise education and biodiversity value whilst at the same time retaining a viable farming unit. The farm is in Countryside Stewardship (CSS) and maintains an arable rotation of winter wheat, spring barley, winter beans and temporary grass. The farm is of national importance for arable flora and is part of Plantlife's

Important Arable Plant Areas (IAPA) Project (see section 4.3). Four 0.5 ha research plots have been managed to evaluate the effectiveness of different management strategies, including different cultivation dates, cultivated margins, fallow plots and conservation headlands, in conserving and encouraging rare arable flora. Key species present include corn buttercup, small flowered buttercup, mousetail and spreading hedge parsley. WWT also manages areas of fallow outside of the CSS scheme.

Analysis of the distribution of records of the ten arable flora species listed in Table 2 collected during the Worcestershire Flora Project surveys between 1987 and 2005 shows clusters of records within the following broad locations:

- Southern Forest of Feckenham from Cowsden to Bishampton (including Naunton Court Fields)
- Around Madresfield from north-east Malvern across to Callow End and Clevelode
- The area around Coombegreen Common and across to Upton-upon-Severn
- The very south-west of the county around Gadfield Elm
- North of Pebworth
- Around Defford and Birlingham
- Western slopes of Bredon Hill across to Bredon's Norton (including the Kemerton Estate)

3. Current factors affecting biodiversity within the arable habitat

- Lack of knowledge and awareness of rare arable flora and its conservation amongst agronomists and land agents/advisors.
- Widespread adoption of broad-spectrum herbicides to remove weeds from within crops.
- Lack of selective herbicide trials work and an overall lack of selective herbicides available.
- Use of insecticides, applied either as seed dressings (e.g. Neonicotinoids) or sprayed directly onto the crop.
- Use of molluscides (slug pellets).
- Lack of adoption of Integrated Pest Management.
- Predominance of winter cropping over spring cropping resulting in crops that allow increasingly less light through the canopy from early spring.
- Planting of high nitrogen requirement crops.
- Autumn ploughing of stubbles.
- Field drainage (e.g. a reduction in wet areas).
- Whole field applications of lime/base fertiliser altering soil/habitats.

- Deep cultivations/subsoiling affecting individual species requirements.
- Expansion of the biofuel sector and the potential loss of arable land to crop production for biomass.
- Drive away from leaving bare ground due to Flood Risk Management concerns.
- The general poor and declining state of soil health.

4. Current Action

4.1 Local protection

One arable flora site, the Cotswold pennycress site near Strensham, was listed as a Local Wildlife Site (LWS) in 2018.

4.2 Habitat management and programmes of action

- The **National Pollinator Strategy** was published by Defra in 2014. The 10-year strategy aims to address the decline in pollinator populations by working across five theme areas, including supporting pollinators on farmland through the Common Agricultural Policy and by promoting the uptake of voluntary initiatives and Integrated Pest Management.
- Farmers and land managers claiming support under the Basic Payment Scheme, an agri-environment scheme or the English Woodland Grant Scheme must meet **Cross Compliance and Greening** rules.
- **Agri-environment schemes** were first introduced in the 1980's with the current scheme launched in 2015 and administered by Natural England. Between 2013 and 2017 UK farmers claimed £2.35bn in agri-environment payments. The current scheme, Countryside Stewardship, covers around 4000 ha of land within Worcestershire (Defra, 2018), whilst a number of other agreements set up within the previous scheme (Environmental Stewardship) are still live with varying amounts of time to run.
- The adoption of an **Integrated Pest Management** system should aim to reduce or eliminate the use of pesticides by replacing chemicals with cultural, biological or structural control strategies.
- Plantlife's **Important Plant Areas** (IPA) programme was designed to identify key botanical sites across Europe significant for the presence of particular threatened species, exceptional plant assemblages or priority habitats of particular importance to botanical science. In 2005 Plantlife adapted the IPA concept to launch the UK Important Arable Plant Area criteria to highlight sites of European, UK or county significance. The 'outstanding assemblages' criterion assesses sites based on a scoring system linked to 120 indicator species, weighted according to their rarity and decline across Britain

4.3 Survey, research and monitoring

- The Centre for Ecology & Hydrology is leading the recently established Pollinator Monitoring and Research Partnership in developing a **UK Pollinator Monitoring Scheme**, which will combine improved analysis of

long-term datasets with new systematic survey activity. New survey activity will include engaging volunteers to carry out Flower-Insect Timed (FIT) Counts and 1km square survey transects. <https://www.ceh.ac.uk/our-science/projects/pollinator-monitoring>

- The **Worcestershire Flora Project** was initiated by a group of botanists including R. Maskew, J. Day and A.W Reid in 1987 with the aim of developing a clear understanding of vascular plant distribution in Greater Worcestershire (the current county plus all of VC 37) and publishing a new County Flora. Survey work continued until 2005 and the Flora was published in 2014 by Roger Maskew. Worcestershire is now one of the better recorded counties in the UK for plant distribution, with over 700,000 individual records on the Worcestershire Flora database.
- The **Game and Wildlife Conservation Trust** runs a study designed to measure the impacts of changes in farming practice on the fauna and flora of arable land. Begun in 1968 with the aim of investigating the causes of the decline in numbers of the grey partridge, it is the longest-running study of its kind in the world. <https://www.gwct.org.uk/research/long-term-monitoring/sussex-study/>.
- Researchers at the **Wildlife Conservation Research Unit** carried out a series of experiments which showed how the ways in which arable field margins are established and managed had profound effects on the invertebrate assemblages able to survive within them (Feber *et al*, 2015).

5. Associated Plans

Farmland Birds, Hedgerows, Brown Hairstreak, Ancient and Veteran Trees.

6. Conservation Aim

Levels of awareness of arable flora ecology and conservation are high and key sites within the county are managed to maintain a diverse seed bank that safeguards populations of rare species.

7. Conservation Objectives

- Promote and support the adoption of Integrated Pest Management systems on farms
- Engage with Natural England and Defra to ensure that future farm support/agri-environment payment structures will benefit arable flora and are compatible with Integrated Pest Management systems
- Promote appropriate management of arable field margins that will allow the germination of the 'forgotten' seed bank
- Promote the conservation of rare arable flora through the collection and germination or spreading elsewhere of seed from high-value species-rich margins such as those on the Kemerton Estate

- Support compulsory training for agronomists, farm advisors and farmers on the ecology and conservation of arable flora and link this to CPD requirements where relevant
- Be involved in the development, trialling and promotion of agri-technology that supports the Integrated Pest Management approach

References and further information

Brereton, T. M., Botham, M. S., Middlebrook, I., Randle, Z., Noble, D and Roy, D.B (2017). *United Kingdom Butterfly Monitoring Scheme report for 2016*. Centre for Ecology & Hydrology and Butterfly Conservation.

Boatman, N. D., Brickle, N. W., Hart, J. D., Milsom, T. P., Morris, A. J., Murray, A. W. A., Murray, K. A and Robertson, P. A (2004). *Evidence for the indirect effect of pesticides on farmland birds*. *Ibis* **146** (Suppl.2), 131–143.

Buglife advice on farmland management for pollinators and other insects:

- <https://www.buglife.org.uk/sites/default/files/Farmland%20Pollinator%20Sheet%20Final.pdf>
- https://www.buglife.org.uk/sites/default/files/Hedgerows_web.pdf

Butler, S., Vickery, J and Norris, K. (2007). *A risk assessment framework for evaluating progress towards sustainability targets*. Aspects of Applied Biology 81, Delivering Arable Biodiversity Conference (Association of Applied Biologists) 23-25 January 2007.

Byfield, A.J and Wilson, P.J (2005). *Important Arable Plant Areas: identifying priority sites for arable plant conservation in the United Kingdom*. Plantlife International, Salisbury, UK.

Comont, R. F and Dickinson, H (2018). *BeeWalk Annual Report 2018*. Bumblebee Conservation Trust, Stirling, Scotland UK.

Defra (2007). *Wild bird indicators for the English regions 1994-2005*. Department for Environment, Food and Rural Affairs.

<http://www.defra.gov.uk/environment/statistics/wildlife/research/download/wdbrds200703.pdf>

Defra (2014). *The National Pollinator Strategy: for bees and other pollinators in England*. Department for Environment, Food and Rural Affairs.

Defra (2018). *UK Biodiversity Indicators 2018*. Department for Environment, Food and Rural Affairs.

Feber, R. E., Johnson, P. J., Tattersall, F., Manley, W., Hart, B. Smith, H and Macdonald, D. W (2015). *How can field margin management contribute to invertebrate biodiversity?* Oxford University Press.

Feber, R. E and Macdonald, D. W (2013). *Wildlife & Farming: Conservation on Lowland Farms*. Wildlife Conservation Research Unit, University of Oxford.

Hayhow, D. B., Burns, F., Eaton, M. A., Al-Fulaij, N., August, T. A., Babey, L., Bacon, L., Bingham, C., Boswell, J., Boughey, K. L., Brereton, T., Brookman, E., Brooks, D. R., Bullock, D. J., Burke, O., Collis, M., Corbet, L., Cornish, N., De Massimi, S., Densham, J., Dunn, E., Elliott, S., Gent, T., Godber, J., Hamilton, S., Havery, S., Hawkins, S., Henney, J., Holmes, K., Hutchinson, N., Isaac, N. J. B., Johns, D., Macadam, C. R., Mathews, F., Nicolet, P., Noble, D. G., Outhwaite, C. L., Powney, G. D., Richardson, P., Roy, D. B., Sims, D., Smart, S., Stevenson, K., Stroud, R. A., Walker, K. J., Webb, J. R., Webb, T. J., Wynde, R and Gregory, R. D (2016). *State of Nature 2016*. The State of Nature partnership.

Marshall, E. J. P., Brown, V. K., Boatman N. D., Lutman P. J. W., Squire G. R and Ward L. K (2003). *The role of weeds in supporting biological diversity within crop fields*. Weed Research Vol 43, Issue 2, pg 77-89.

Maskew, R (2014). *The Flora of Worcestershire*. Worcestershire Flora Project.

Nowakowski, M and Pywell, R. F (2016). *Habitat Creation and Management for Pollinators*. Centre for Ecology & Hydrology, Wallingford, UK.

Plantlife (2008). *Threatened Arable Plants Identification Guide*. Plantlife, Salisbury.

Plantlife (2013). *England Farmland Report: And on that farm...* Plantlife, Salisbury.

Still, K and Byfield, A.J (2007). *New Priorities for Arable Plant Conservation*. Plantlife, Salisbury.

Vickery, J. A., Feber, R. E and Fuller R. J (2009). *Arable field margins managed for biodiversity conservation: A review of food resource provision for farmland birds*. Agriculture, Ecosystems Environment, Vol 3 Issues 1-2 pg 1-13.

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 and Fowbert, J. A (2006). *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.

Winspear, R and Davies, G (2005). *A management guide to the birds of lowland farmland*. The RSPB, Sandy.