

Nature Based Solutions:

A guide to the management and benefits of farmland habitats





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Introduction

Sixty years ago, agricultural researchers noticed that a population of aphids on a crop were better controlled when a half-dose of insecticide was applied compared to a full dose. Closer examination revealed that at the lower dose the principal aphid predators were able to survive and they then helped to control the remaining aphids. The researchers coined a new phrase for this – Integrated Pest Management or IPM. Since then researchers, agronomists and farmers have increasingly looked at ways in which to foster and harness the natural regulation of crop pests, becoming proactive in the creation of habitat and alternative food supplies to boost beneficial insect numbers. All this contributes to minimising the impact of food production on the environment.

This practical field guide aims to help farmers and agronomists with establishment, habitat and management advice, helping to achieve a balanced landscape, making the most of some Nature Based Solutions.

Kellogg's Origins provided resources for studies in 2019 & 2020 into beneficial farmland invertebrates, on farms in Norfolk, Bedfordshire & Leicestershire. Kellogg's Origins have supported this guide on 'Nature Based Solutions to Habitat & Crop Management'.



This guide has been compiled by The Game & Wildlife Conservation Trust's Farmland Ecology Department and The Allerton Project who between them have over 80 years experience of trials, research and demonstration. The team combines the expertise of scientists with the practical knowledge of farm managers and agronomists.

This publication was prepared in conjunction with the BEESPOKE project which is developing new approaches to increase insect pollinators and thereby crop yields. BEESPOKE brings together 16 partners from six north sea region countries.



Interreg
North Sea Region
BEESPOKE
European Regional Development Fund



EUROPEAN UNION

The Kellogg's Origins Programme



Through the Origins Programme, Kellogg's invest in sustainable agriculture projects at farm level. This supports Kellogg's commitment to reach 1m farmers and workers globally by 2030. The projects focus on sustainable farming aspects such as climate change, biodiversity and productivity.

Origins UK Project

Kellogg's work with UK wheat farmers supplying wheat for some of our popular breakfast cereals including Special K and All-Bran. This includes initiatives to improve biodiversity and support Integrated Pest Management techniques.



The UK Kellogg's Origins Growers manage their farms to be both wildlife and climate friendly.

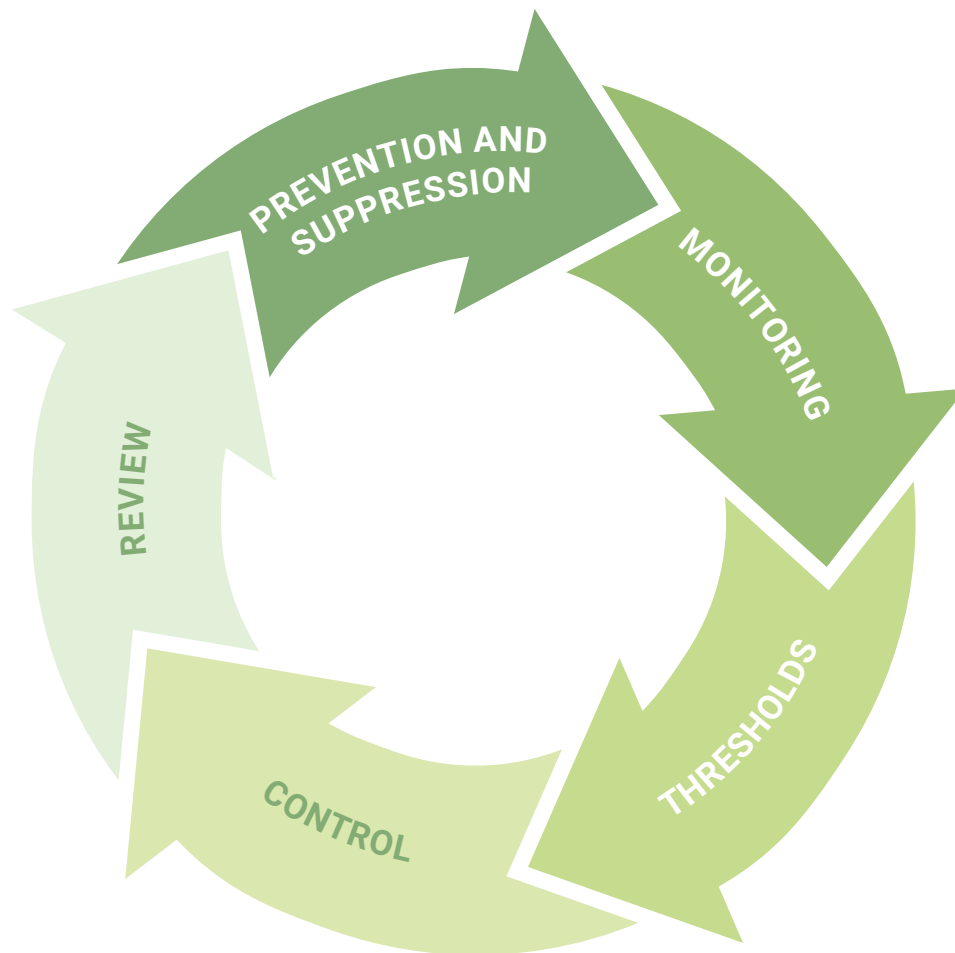


Kellogg's Origins, GWCT Farmland Ecology Unit, The Allerton Project & The Interreg BEESPOKE Project have studied the role of nature based solutions for crop pollination and encouraging natural pest enemies.

Available at www.allertontrust.org.uk/resources/

Integrated Pest Management (IPM)

Integrated Pest Management is defined as combined use of all available control methods, including targeted use of pesticides when alternatives are ineffective or unavailable. IPM emphasises crop health and minimal disruption to the agro-ecological system. IPM also includes measures to optimise pesticide application, with the aim of reducing non-target effects and unnecessary environmental exposure. IPM follows a step-by-step approach and in practice, should be individually tailored to the crop or pest.





a. Prevention and Suppression

The first line of pest control is the use of preventative cultural methods to reduce the risk of pest damage occurring, such as crop rotation, growing pest-resistant varieties, selecting appropriate sites and sowing dates, sanitation and reduced tillage practices. These measures provide prophylactic pest management with little or no environmental risk.



b. Monitoring

IPM is founded upon effective monitoring including inspection, identification, forecasting and assessing levels of pest populations. Not all potentially damaging insects, weeds, and other living organisms require control, and organisms classified as pests may be important to the structure and function of local ecosystems. As such, regular observation is crucial. Accurate identification of the pest allows the right control to be decided upon. Effective monitoring ensures that plant protection is only used when necessary, but also that suitable products are selected and applied in the right way at the right time.




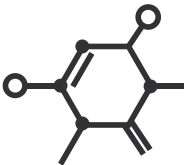
c. Thresholds

Some pests have control thresholds. Thresholds are set above which pest damage or pest population levels become economically or environmentally unsustainable. Once a threshold has been exceeded, actions are taken to control the pest. The emphasis is on control rather than eradication, as allowing a pest population to survive at reasonable levels may not only provide food for natural predators, but by reducing pest exposure to plant protection products, can also help prevent resistance developing.



d. Control

The methods of pest control should be selected on both effectiveness and risk, with a view to reduce dependency on pesticides. Control methods can be selected through the following hierarchy:

<p>Mechanical</p>	<p>Including hand weeding/rogueing, mechanical weeding and physical barriers.</p>
<p>Biological</p> 	<p>Natural biological processes and materials can provide control, often with less risk to the environment. This includes enhancing predatory and parasitic species through provision of appropriate habitats and resources and to reduce use of harmful pesticides. Biopesticides may also be available, but it is important to recognise that biopesticides do not inherently pose less risk to the environment and, as such, should be also used in a targeted and responsible way.</p>
<p>Chemical</p> 	<p>Plant protection products should be used when alternatives are ineffective or unavailable. The economic justification should mean application in the most effective and targeted way, using selective products whenever possible and modifying doses according to antagonistic pressure with the aim of optimising to reduce negative environmental impacts. Use of precision technology, spot treatments, weed wipers, drift reduction and other similar tools and techniques will aid with this. Anti-resistance strategies should also be utilised.</p>



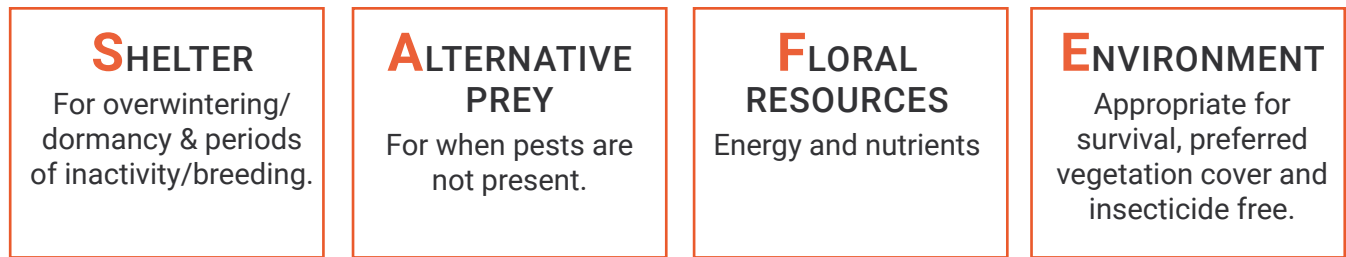
e. Review

It is important that all plant protection and pest control measures are reviewed regularly so that effectiveness can be assessed, adjusted and tailored for continued effective management.

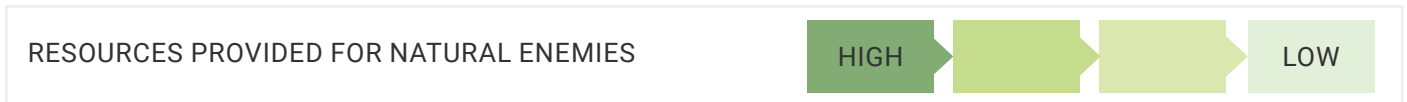
Conservation Biological Control – Making the most of pest natural enemies

Pest natural enemies can reduce the chance of pests establishing and proliferating in crops and consequently causing economic damage. Indeed, the absence of pests is testament that biological control is successfully occurring. However, it is not a quick fix solution like an insecticide, but instead relies on building up a diverse range and abundance of natural enemies. This ensures that when pests do arrive there are sufficient natural enemies of the type that can control the pest in question. This can be delivered by providing a range of habitats and adhering to IPM principles.





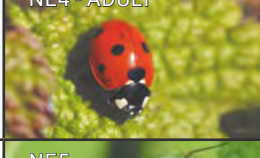
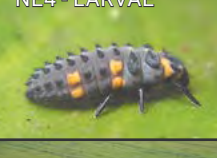
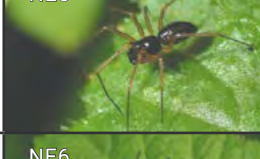

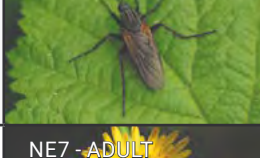


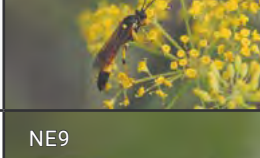





Overall, the aim is to deliver right types of natural enemies, at the right time and in the right place. This can be achieved by providing all of the resources that they need following the **SAFE** approach.



HABITAT TYPE	OVERWINTER SHELTER	ALTERNATIVE PREY	FLORAL RESOURCES	ENVIRONMENT
SHRUBBY VEGETATION (HEDGES)	High	High	High	High
UNCULTIVATED AREA (GRASSY)	High	High	Medium	Medium
WILD BIRD SEED MIXTURE	Medium	High	Medium	Medium
FLOWER-RICH HABITATS	Medium	High	High	High
OVERWINTERED STUBBLES	Medium	Medium	Low	Medium
UNCUT, TUSSOCKY GRASS MARGINS AND BEETLE BANKS	High	High	Low	Medium
UNHARVESTED CEREAL HEADLAND	Low	High	Medium	High
UNDERSOWN SPRING CEREALS	High	Medium	Low	Medium
UNCROPPED, ANNUALLY CULTIVATED	Low	Medium	Medium	High
NON-INVERSION TILLAGE	High	Medium	Low	Low
LOW INPUT GRASSLANDS	Medium	High	Medium	Medium

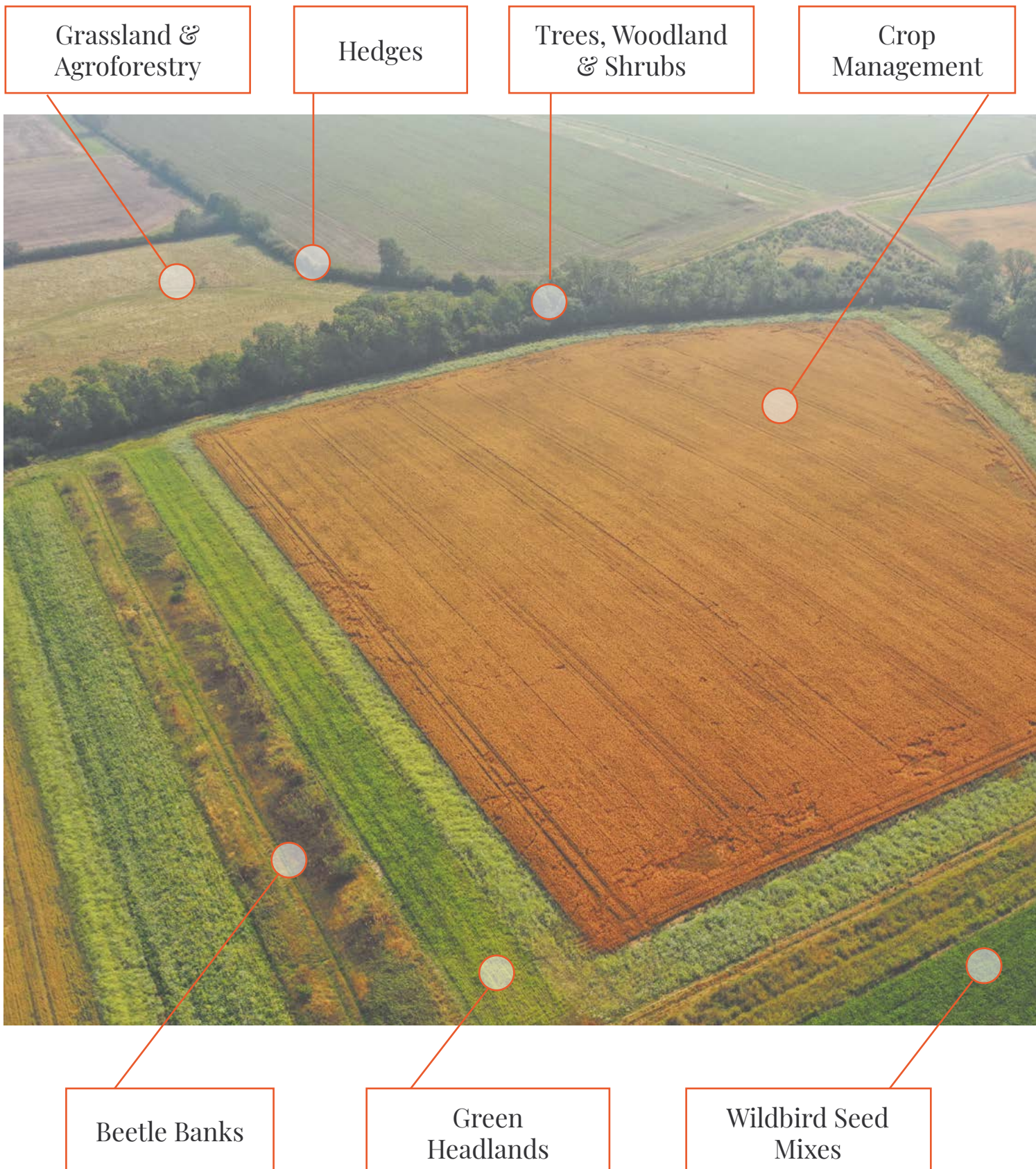


How to recognise and support key groups of pest natural enemies

NATURAL ENEMY	PESTS ATTACKED	HABITATS/MANAGEMENT	PHOTO	
GROUND BEETLES	MOST INSECT PESTS, SLUGS AND WEED SEEDS	GRASSY/BETTER BANKS/ LOW TILLAGE/WEED COVER	NE1 	NE1 - LARVAE 
ROVE BEETLES	APHIDS, FLIES, MOTHS, FUNGAL DISEASES	GRASSY/BETTER BANKS/ LOW TILLAGE	NE2 	
SOLDIER BEETLES	FLIES, CATERPILLARS	SIMPLE OPEN FLOWERS (UMBELLIFERS)	NE3 	
LADYBIRDS	APHIDS, SCALE INSECTS AND FUNGAL DISEASES	SIMPLE OPEN FLOWERS, TREES, SHRUBS AND HEDGES	NE4 - ADULT 	NE4 - LARVAE 
SPIDERS	ALL INSECT PESTS	MOST HABITATS, LOW TILLAGE, VERY VULNERABLE TO INSECTICIDES	NE5 	
PREDATORY FLIES	MOST INSECT PESTS	FLOWER-RICH, GRASSY, SHRUBS, DITCHES AND PONDS	NE6 	
HOVERFLIES	APHIDS AND BUGS	SIMPLE OPEN FLOWERS, DITCHES AND PONDS	NE7 - ADULT 	NE7 - LARVAE 
PARASITIC WASPS	ALL PESTS	SIMPLE OPEN FLOWERS (UMBELLIFERS)/PREY HOST	NE8 	NE8 - MUMMIFIED APHID 
LACEWINGS	APHIDS AND BUGS (PREDATED PRIMARILY BY LACEWING LARVAE)	FLOWER-RICH, TREES, SHRUBS AND HEDGES	NE9 	NE9 - LARVAE 
PREDATORY MITES	MITES	FLORAL RESOURCES	NE10 	
PREDATORY BUGS	APHIDS, THRIPS, WHITEFLY, BEETLES, CATERPILLARS AND MITES	FLOWER-RICH	NE11 	

For further details see AHDB Encyclopaedia of pests and natural enemies <https://ahdb.org.uk/pests>

Habitats covered in this Guide



Habitats to deliver nature-based solutions

Pond & Wetlands

Existing farm habitats and new ones can deliver many on-farm benefits, including enhancement of beneficial insects such as pollinators and pest natural enemies, support other farm wildlife, build soil fertility and structure, prevent soil erosion and run-off, store carbon and improve the aesthetic value of farmed landscapes. Most of these habitats are eligible for financial support through UK agri-environment scheme funding.

To ensure that these habitats deliver the maximum benefits it is important that they are established and managed appropriately. In the following pages, a brief synopsis of the main farm habitats is provided. This includes some of the most important plant species, however seed mixes should be tailored to local conditions (soil type, pH, degree of shade) and if needed can be selected to encourage a particular groups of organisms (bumblebees, solitary bees, butterflies, natural enemies, bird chick food etc). Advice is available from seed companies, NGOs and many online sources. <https://www.gwct.org.uk/research/habitats/farmland/integrated-pest-management/>

For new habitats, creating the right conditions for establishment is critical, just like any crop. Typically, this involves creating weed free, fine seedbed with drilling or broadcasting when soil conditions are best for rapid germination. Some may require further management to ensure the sown species have the best chance of survival, such as mowing/cutting at appropriate times or weed control.

The types of beneficial insects and other wildlife these areas can support are also listed in the following habitat pages. For effective IPM it is important to supply a broad range of natural enemies and ensure they have resources throughout the year.

The contribution of weeds

Many natural enemies and pollinators also make use of the resources provided by weeds. They typically have simple open flowers and consequently the pollen and nectar is easily available. The seeds are eaten by ground beetles, birds and small mammals. The vegetation supports plant feeding insects that are in turn prey for natural enemies, while also providing cover and structure, which web-spinning spiders can use. Provided the weeds do not become too dominant, they can be left as an additional resource in the habitats and even in crops. Rare arable plants may also be present in annually cultivated habitats, which are now among the rarest plants in Britain.

Flowers & Grass Margins

Cover, Catch & Companion Crops

These are all crops that can help with providing habitat and food resources for natural pest enemies. Please be aware they can harbour pests as well.



PLANT SPECIES

Cover crops	Usually preceding a spring crop – typically oats, oil radish (fodder radish), Phacelia, mustard.
Catch crops	Usually sown in July and terminated in October – buckwheat, oil radish (fodder radish), berseem clover, crimson clover, phacelia, buckwheat, vetch, oil & tillage radish.
Companion crops	Usually grown with the main cash crop and terminated in late autumn/ early spring or taken through to harvest as two cash crops such as oats and beans – buckwheat, linseed & undersown clovers, legumes and grasses.

SOIL TYPE AND DRAINAGE

Mixes will grow on most soil types with a pH above 5.6. Species composition can be tailored to soil type and desired outcome.

ESTABLISHMENT

When to sow: July - August or undersown in spring.
 How to sow: cover crops & catch crops can be sown behind subsoiler, broadcast or drilled. Companion crops can be mixed with cash crop or undersown into standing cash crop.

LONGEVITY

Up to 1 year

MANAGEMENT

Catch and cover crops can be destroyed by rolling in frosty weather, which breaks stems. Some crops can be left if not frost tolerant i.e. mustard. Spray off using herbicides, grazed with sheep or the following crop can be drilled directly into cover crop canopy.

PEST NATURAL ENEMIES

Ground beetles, spiders

OTHER BENEFITS

 NATURAL ENEMIES	 POLLINATORS	 BUTTERFLIES	 FARMLAND BIRDS	 NESTING SITES	 GROUND BEETLES
 SMALL MAMMALS	 AMPHIBIANS	 SOIL HEALTH & BIODIVERSITY	 WIDER FARM BIODIVERSITY - EARTHWORMS	 WATER QUALITY & PROTECTION	 CARBON SEQUESTERING HABITAT



PLANT SPECIES

Uncropped, cultivated arable field margins aim to encourage rare arable plants such as red hemp nettle, round-headed prickly poppy, fine-leaved fumitory, flixweed and night-scented catchfly. The more common arable plants such as speedwells, field pansies and forget-me-knot will also be encouraged.



SOIL TYPE AND DRAINAGE

Light chalky or sandy soils, especially brows of slopes and corners that receive less herbicide.



ESTABLISHMENT

Select a location where arable plants have proliferated in the past or where rare species have been found. Locations should be free from pernicious weeds and have less competitive arable plants and grass weeds. Annually cultivate at least a 3m wide margin to a fine tilth to 10-15cm. The area should be left undrilled and undisturbed to allow for natural regeneration. The time of cultivation should be suited to germination time of any rare arable species present.



LONGEVITY

Cultivate annually and seasonally rotate around the farm.



PEST NATURAL ENEMIES

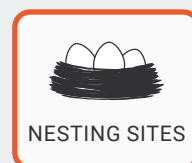
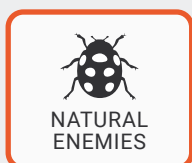
Parasitic wasps, beetles, hoverflies & spiders.



MANAGEMENT

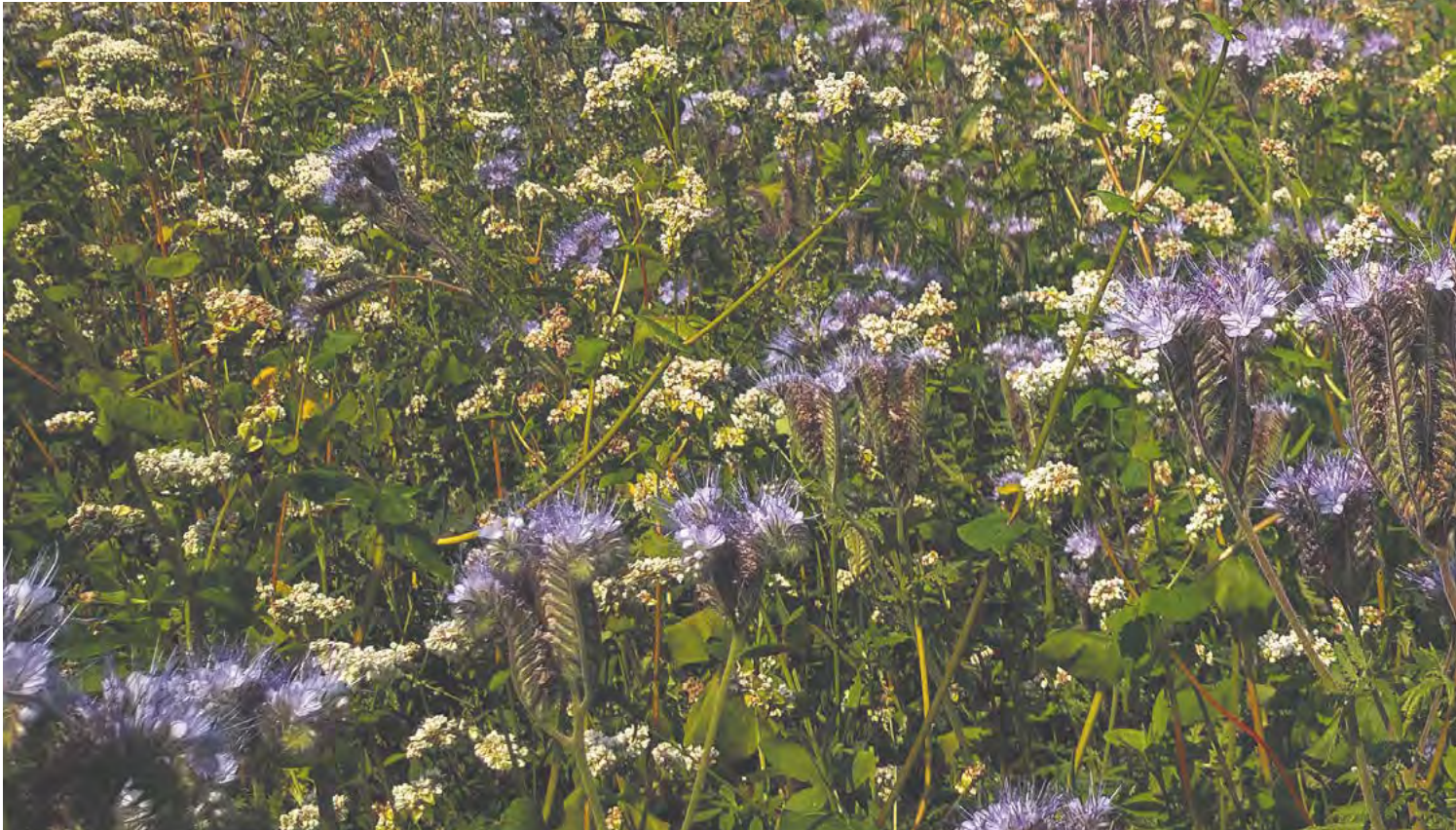
Fertiliser should not be applied, and pesticide drift onto the uncropped areas should be prevented. Rotation of plots may be necessary to control competitive weeds, such as docks, bromes, cleavers and blackgrass.

OTHER BENEFITS



Green Headlands

Green headlands are annual flower and legume mixes used to attract pollinators and fix soil nitrogen.



PLANT SPECIES

Fast growing annual mixes can be established on turning headlands in late spring when soils warm up. They can include berseem clover, crimson clover, phacelia, buckwheat, vetch, oil & tillage radish.



SOIL TYPE & DRAINAGE

Mixes will grow on most soil types, with a pH above 5.6. Species composition can be tailored to soil type.



LONGEVITY

Seasonal.



PEST NATURAL ENEMIES

Hoverflies, ladybirds, predatory bugs, parasitic wasps.

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



FARMLAND BIRDS



NESTING SITES



GROUND BEETLES



ESTABLISHMENT

When to sow: May – August.

How to sow: best drilled shallow into a fine, firm seedbed or alternatively mixes can be broadcast or direct drilled into stubble at a maximum of 1cm, ideally into warm soils (especially if containing legumes) and when rain is imminent.



MANAGEMENT

Once established, leave as long as feasible into autumn. Investigate whether margins can be incorporated into UK agri-environment schemes and deliver both pollinator, carbon and seed benefits.



SMALL MAMMALS



AMPHIBIANS



SOIL HEALTH & BIODIVERSITY



WIDER FARM BIODIVERSITY - EARTHWORMS



WATER QUALITY & PROTECTION



CARBON SEQUESTERING HABITAT

Pollen & Nectar Mixes



PLANT SPECIES

Pollen and nectar habitats are an easy way to boost 'on farm' flower-rich habitats and are often targeted at supporting bumblebees. They usually include a range of clovers, bird's-foot trefoil, sainfoin, lucerne and vetches.



SOIL TYPE AND DRAINAGE

These mixes are best on light to medium soils that are free draining.



LONGEVITY

3-4 years. Grass free mixes will last longer, but clovers will diminish.



PEST NATURAL ENEMIES

Ladybirds, parasitic wasps, hoverflies, predatory bugs and mites.

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



FARMLAND BIRDS

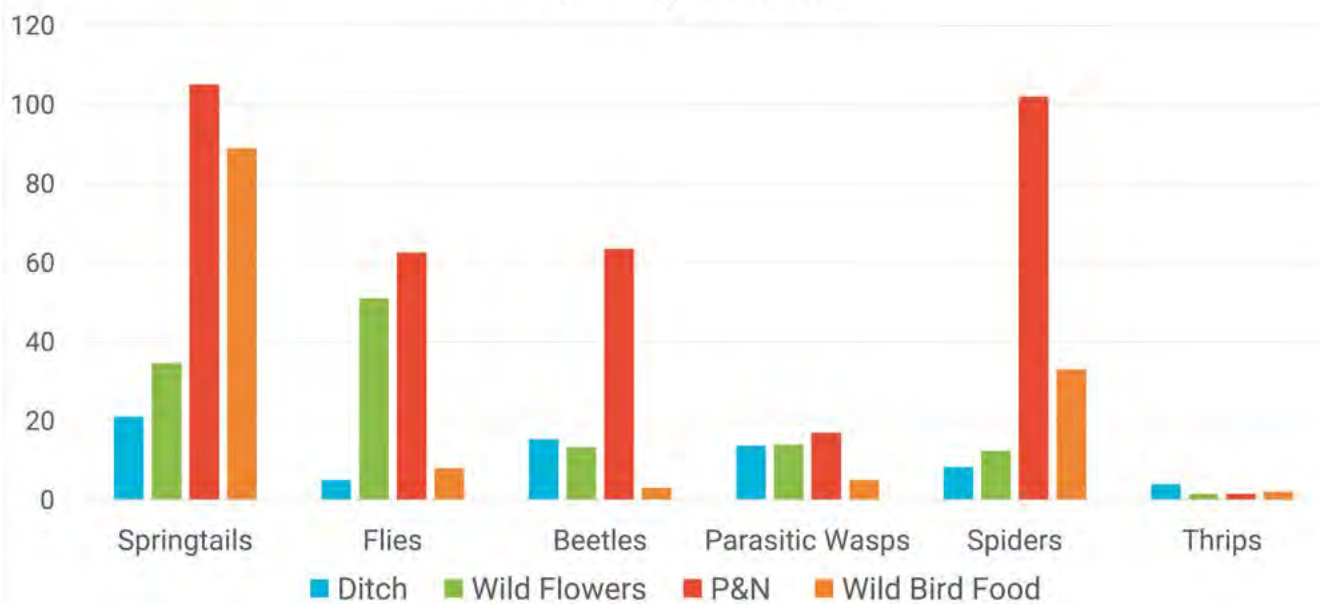


NESTING SITES



GROUND BEETLES

Pitfalls by Habitat



The graph above is taken from The Kellogg's Report of 2020 (left) and shows Springtails, Flies, Beetles, Parasitic Wasps & Spiders were more prevalent in pollen and nectar habitats in the Norfolk, Northamptonshire and Leicestershire study farms.

You can view the full report at www.allertontrust.org.uk/resources



ESTABLISHMENT

When to sow: March - May or August - mid-September. Sow when soil is warm.

How to sow: sow into a fine and firm seedbed.



MANAGEMENT

In the first year, mow several times to control weeds.

After establishment pollen and nectar mixes are best mown after flowering. Ideally remove cuttings to encourage further flowering. To extend the flowering period, half of the plot can be cut between mid-May and mid-June and then the whole plot is cut from mid-September up to mid-March.



Wildflower Margins



PLANT SPECIES

Wildflower margins are usually comprised of at least 10 perennial wildflower species such as oxeye daisies, knapweed, plantains, umbellifers, musk mallow, tufted vetch and self-heal and three fine-leaved grass species. Cornfield annual species can be added to provide flowers in the first year.



SOIL TYPE AND DRAINAGE

Mixtures are available for different soil types, e.g., clay, loamy, chalk and limestone and sandy soils.



LONGEVITY

Can last many years. Removing cuttings increases longevity by decreasing competition from grasses.



PEST NATURAL ENEMIES

Soldier beetles, ladybirds, predatory flies, mites & bugs, parasitic wasps, lacewings, hoverflies, spiders

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



FARMLAND BIRDS



NESTING SITES



GROUND BEETLES



ESTABLISHMENT

When to sow: autumn or spring, just before rain.

How to sow: eliminate pernicious weeds beforehand. Prepare a firm, fine, weed free seed bed, spread seed on the soil surface and then roll.



MANAGEMENT

In the first year mow regularly to maintain a sward height of 5-10cm. From year 2 onwards, if sward is >15cm cut in March, otherwise cut or graze annually in the autumn. Remove cuttings to reduce fertility, allow seeds to drop and prevent new flowers from being smothered. Spot treat pernicious weeds.



SMALL MAMMALS



AMPHIBIANS



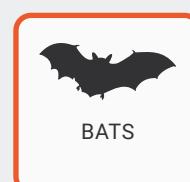
SOIL HEALTH & BIODIVERSITY



WIDER FARM BIODIVERSITY - EARTHWORMS



WATER QUALITY & PROTECTION



BATS

Bees & Seed Mixes



PLANT SPECIES

These mixes provide both pollination services and seed-bearing crops for birds. They can include cereals, vetch, linseed, sunflowers, kale, mustards, teasels, gold of pleasure and fodder radish. Bumblebird (Stewardship) mixes which need a minimum of 6 flowering and 6 seed bearing species are similar but usually include bird's-foot trefoil, oxeye daisy, knapweed, phacelia and crimson clover.

SOIL TYPE AND DRAINAGE

Mixes can be tailored to be suitable for most soil types.

ESTABLISHMENT

When to sow: mid-May – mid-July (preferably on warm moist soil) or before mid-September for Bumblebird mixes.

How to sow: drilling to a max depth of 15mm into weed free seedbed.

LONGEVITY

2 years

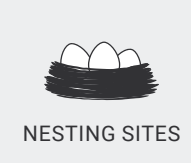
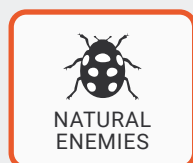
MANAGEMENT

In the spring of a bi-annual mix, the plot should be topped, cutting a few centimetres below the top of the flowering plants. It is recommended to re-sow some fresh seed mix each year, so a combination of year one and year two habitats are available.

PEST NATURAL ENEMIES

Hoverflies, lacewings, parasitic wasps, ladybirds, beetles

OTHER BENEFITS





PLANT SPECIES

Small seeds and cereals especially triticale, kale, millet, quinoa, linseed, gold of pleasure and fodder radish.



SOIL TYPE AND DRAINAGE

Wild bird seed is suitable for most soil types with a pH above 5.5.



ESTABLISHMENT

When to sow: April – May.

How to sow: prepare a seedbed and drill the crop. If not sown in spring can be sown in autumn but this will only provide food in alternate winters. If sown too late, there is a chance that seed might not reach maturity before the onset of winter.



LONGEVITY

1-2 years



MANAGEMENT

Plots with only annual crops (cereals with linseed or mustard) should be re-established every spring. Mixtures of cereals including kale as a biennial crop should be re-established every other spring.



PEST NATURAL ENEMIES

Spiders, hoverflies, ladybirds, parasitic wasps, predatory bugs and flies.

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



FARMLAND BIRDS



NESTING SITES



GROUND BEETLES



SMALL MAMMALS



AMPHIBIANS



SOIL HEALTH & BIODIVERSITY



WIDER FARM BIODIVERSITY - EARTHWORMS

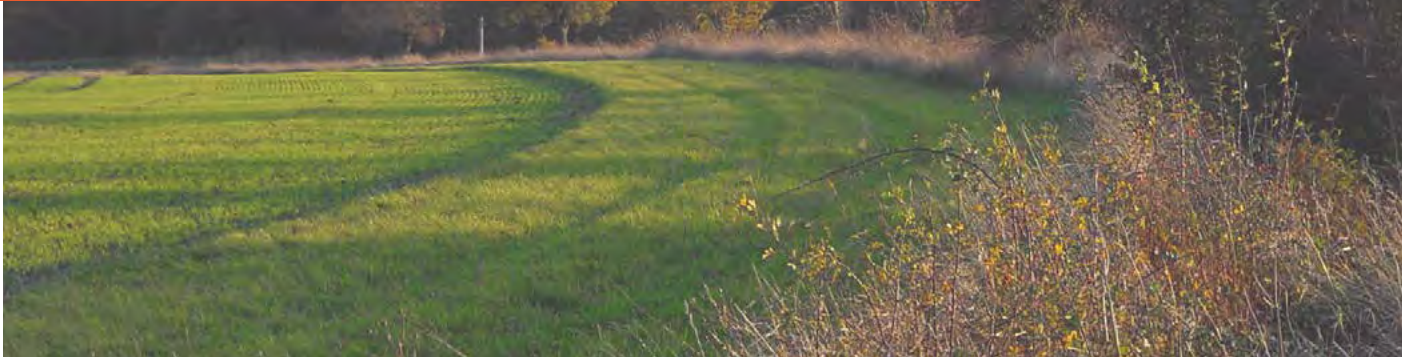


WATER QUALITY & PROTECTION



CARBON SEQUESTERING HABITAT

Grass Margins & Beetle Banks



PLANT SPECIES

Broad and fine leaved grasses can provide several different functions within beetle banks, grass margins and buffer strips. Tussock forming grasses are important as overwintering sites for invertebrates. Herbs can be added for higher floristic diversity but tussock forming grasses can become dominant.



SOIL TYPE AND DRAINAGE

Mixes are suitable for most soil types where the pH is 5.5 or above. Beetle Banks should be raised and free draining.



ESTABLISHMENT

When to sow: March – early May or August – late September. (Late sowings are slower to establish and can be vulnerable to slugs, but can benefit from better soil moisture)

How to sow: the mix should be sown onto a fine but firm seedbed, no more than 1cm. If broadcasting it is best to lightly harrow and roll twice after sowing.



LONGEVITY

8 years +



MANAGEMENT

Beetle banks and grass margins should be cut two or three times in the first year for annual weed control but, once established, are cut only to prevent the encroachment of woody and suckering weeds.

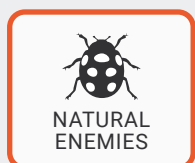
Once established, buffer strips can be cut in autumn when needed, to maintain plant diversity or to control scrub. It is important to leave some patches or strips uncut each year to provide undisturbed areas for insects and wildlife.



PEST NATURAL ENEMIES

Spiders, ground &rove beetles, predatory flies

OTHER BENEFITS



NATURAL ENEMIES



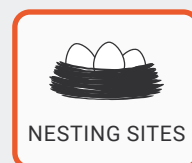
POLLINATORS



BUTTERFLIES



FARMLAND BIRDS



NESTING SITES



GROUND BEETLES



SMALL MAMMALS



AMPHIBIANS



SOIL HEALTH & BIODIVERSITY



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WATER QUALITY & PROTECTION



CARBON SEQUESTERING HABITAT



PLANT SPECIES

Less intensively managed grassland can support a diverse array of plant species and is one of the most important habitats for pollinators. The plant community will depend on the soil type and conditions. For natural enemies, yarrow, oxeye daisy, bird's-foot trefoil, bush vetch, yellow rattle, teasel and red and white clover, amongst others, are valuable along with the umbellifers which are a favourite of parasitic wasps. Campions, willowherb, forget-me-not and cuckoo flower can thrive if left ungrazed.



SOIL TYPE AND DRAINAGE

Low nutrient soil is preferable for flowers and the best results are seen when pH is higher than 6.5.



ESTABLISHMENT

Fence areas off to allow natural regeneration of grassland, or you can use grassland seed tailored to soil type in these areas.



LONGEVITY

Indefinite, though highly dependent on management.



MANAGEMENT

In the first year mow the grassland when it reaches a height of 10-15cm, down to about 5cm. The grass cuttings should be removed. You may need to repeat this a few time in the first year. Over the following years allow the sward to fill out, the grassland should be cut or grazed once a year after it has flowered, and the seed has dropped (late July-August). Less intensively managed grassland and mob grazing in which plants have chance to flower can also be useful.



PEST NATURAL ENEMIES

Beetles, spiders, predatory flies & hoverflies

OTHER BENEFITS

NATURAL ENEMIES

POLLINATORS

BUTTERFLIES

FARMLAND BIRDS

NESTING SITES

GROUND BEETLES

SMALL MAMMALS

SOIL HEALTH & BIODIVERSITY

WIDER FARM BIODIVERSITY - EARTHWORMS

WATER QUALITY & PROTECTION

CARBON SEQUESTERING HABITAT

BATS

Hedges



PLANT SPECIES

Hedges provide key resources for a range of wildlife. They also link habitats, allowing safe movement through the landscape. Common hedge species include blackthorn, dogwood, field maple, hawthorn, hazel, whilst wild rose and other 'climbers' can give longevity of flowering and varying structures.



SOIL TYPE AND DRAINAGE

Beech can thrive in dry soils, whereas alder can perform well in wetter soils. Waterlogged soils should be avoided for all hedges.



LONGEVITY

With appropriate management, hedgerows can last for centuries.



PEST NATURAL ENEMIES

Lacewings, ladybirds, parasitic wasps and spiders.

OTHER BENEFITS



NATURAL ENEMIES



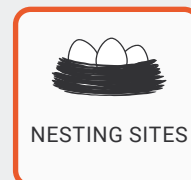
POLLINATORS



BUTTERFLIES



FARMLAND BIRDS



NESTING SITES



GROUND BEETLES



ESTABLISHMENT

Plant a diverse range of native species, include both evergreen and deciduous plants and where possible link to other hedges or habitats. Try to source plants locally. The best time to plant hedges is in winter.

Prepare site by clearing area and planting into bare soil to avoid competition. Bare root plants are the cheapest and most easily acquired, but some species such as holly are only available as container- or cell-grown plants. Plastic tubes, spirals or quills will likely be needed to protect young plants from grazing animals, such as deer and rabbits. Consider future use of biodegradable hedge guards.



MANAGEMENT

Whilst establishing, light and regular trimming can encourage dense, bushy growth.

Once established, cut hedges on rotation with a minimum of a three-year cycle to deliver more benefits for biodiversity. Alternatively leave 10cm of incremental growth each year. Trim in January or February to allow berries to be used by wintering birds. This can be done in the autumn, but delaying the hedge cut until Jan/Feb can really benefit biodiversity. Aim for a variety of hedge heights and widths. Hedges can also be coppiced or layered to provide different hedge structures.

Plant hedgerow gaps with species native to the area.



SMALL MAMMALS



AMPHIBIANS



SOIL HEALTH & BIODIVERSITY



WATER QUALITY & PROTECTION



CARBON SEQUESTERING HABITAT



BATS

Hedge Bases



PLANT SPECIES

The hedgerow base can be comprised of tussocky grasses such as cocksfoot which provide nesting sites for birds including whitethroat, yellowhammer and grey partridge. Herbaceous plants can also thrive including hedge mustard, hedge garlic, dead nettles, cranesbill, common vetch, wood forget-me-not, primrose and campions. Umbellifers such as wild carrot, wild parsnip, hogweed, yarrow and angelica can be added to a mix. A word of caution with inclusion of umbellifers, as some can support pests of carrots and parsnips and become a weed itself within the crop. Hedge base mixes are available from some seed merchants and can be adapted to local conditions.

SOIL TYPE AND DRAINAGE

The flora of a hedge base will often be determined by the soil fertility and subsequently a cover of grasses and nettle can develop if nitrogen fertiliser is inaccurately spread. Soil type will also influence the flora. Herbaceous plants will flourish if soil is not waterlogged.

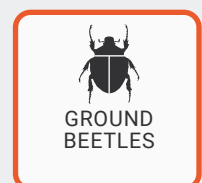
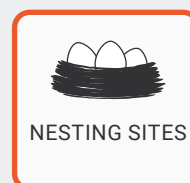
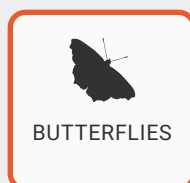
LONGEVITY

Hedge grass margins can last indefinitely if managed sensitively to allow light to the hedge base vegetation and restrict hedges (especially blackthorn) from suckering into the margin.

PEST NATURAL ENEMIES

Flowers can be chosen to encourage hoverflies, parasitic wasps, ladybirds. Ground beetles will use this habitat. Diversity will help give more control over crop pests which will inhabit these margins as well.

OTHER BENEFITS





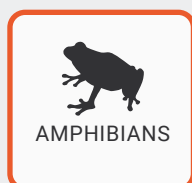
ESTABLISHMENT

A hedge base can be established by natural regeneration, but if planting a hedge in a new location then hedgerow species are unlikely to be present in the seedbank. Hedge base seed mixes can be sown in spring or autumn to compete with less desirable weeds. Seed can be broadcast and lightly covered.



MANAGEMENT

Hedge management will affect the area of grass and flowers at the hedge base, large hedges create shade leading to fewer flowering plants. South facing margins will also be better for flowers, with north facing margins better for grass. Regular topping and weed control is recommended in first few seasons to help establish base cover. The cutting should be managed rotationally to vary habitats and stop woody growth spreading from the hedge itself. Crop inputs such as fertilisers and spray should be precisely applied to crop areas to reduce their impact on the hedge base plants.



Woodland



PLANT SPECIES

Deciduous trees provide habitat, shelter and food for pest natural enemies as well as birds and bats that feed upon crop pests. Flowering trees are also a huge and valuable resource for pollinators. Little is known about the contribution that trees make to the natural enemy populations in crops. Tree species differ in the number of invertebrates associated with them; with oak, willow species and birch having the most and holly, sweet and horse chestnut, yew, walnut and plane trees the least. A diverse plant understorey in woodland can also provide resources for natural enemies. Trees should be sourced from the UK.



SOIL TYPE AND DRAINAGE

Some species prefer particular soil types. Surrounding tree populations will give a good guide as to successful species.



LONGEVITY

20-100+ years



PEST NATURAL ENEMIES

Ladybirds, lacewings, spiders, predatory mites & beetles.

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



BIRDS



NESTING SITES



GROUND BEETLES



ESTABLISHMENT

Trees can be planted as new woodlands, as part of new hedgerows or planted in existing gaps.

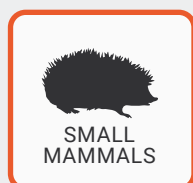
They can be planted bare-rooted between October and March. Container-grown trees can be planted at any time in the year (if in late spring or summer they should be watered during dry spells for first season).

An appropriate planting density should be chosen to allow an understorey to develop and space left for woodland rides and glades as these offer alternative habitats.



MANAGEMENT

Tree management will depend on the purpose of the woodland and any management conditions that grant schemes may stipulate. The Woodland Trust, Local Authorities and The Forestry Commission run such schemes. There are developing alternatives to plastic tree guards and the longevity of such guards should be determined before planting. Thinning or coppicing will encourage a diverse understorey.



SMALL MAMMALS



AMPHIBIANS



WIDER FARM BIODIVERSITY - EARTHWORMS



WATER QUALITY & PROTECTION



CARBON SEQUESTERING HABITAT



BATS



PLANT SPECIES

Agroforestry can be established to provide several benefits to a landscape and business. It can provide a new habitat with a diverse plant community, support game and produce harvestable fruit, nuts or wood. Agroforestry is often integrated with livestock, providing food and shelter. Check trees are not poisonous to livestock, such as some privet and yew. The choice of tree will depend on the agroforestry objective, but as the name implies it will combine agricultural output with the other benefits that a wooded landscape can provide. Benefits will vary according to the type of agroforestry and species planted.



SOIL TYPE AND DRAINAGE

Free-draining, fertile and moisture-retentive soil in the sunniest aspect will help. Heavy clay or sandy soils are not ideal for nut trees. Larch, spruce and beech may be better for lighter soil, whereas hawthorn, crab apple, alder, hornbeam, maple, apples and pears will grow on heavier soils. Cherry, oak, holly, dogwood, privet and hazel will grow on most soil types.



LONGEVITY

Nut tree 20-30 years, fruit trees 30-40 years, mixed deciduous trees 100-200 years, and coppiced stands of hazel 80 years while sweet chestnuts can last centuries!



PEST NATURAL ENEMIES

Spiders, lacewings, other predators will increase if open flowered trees are included.

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



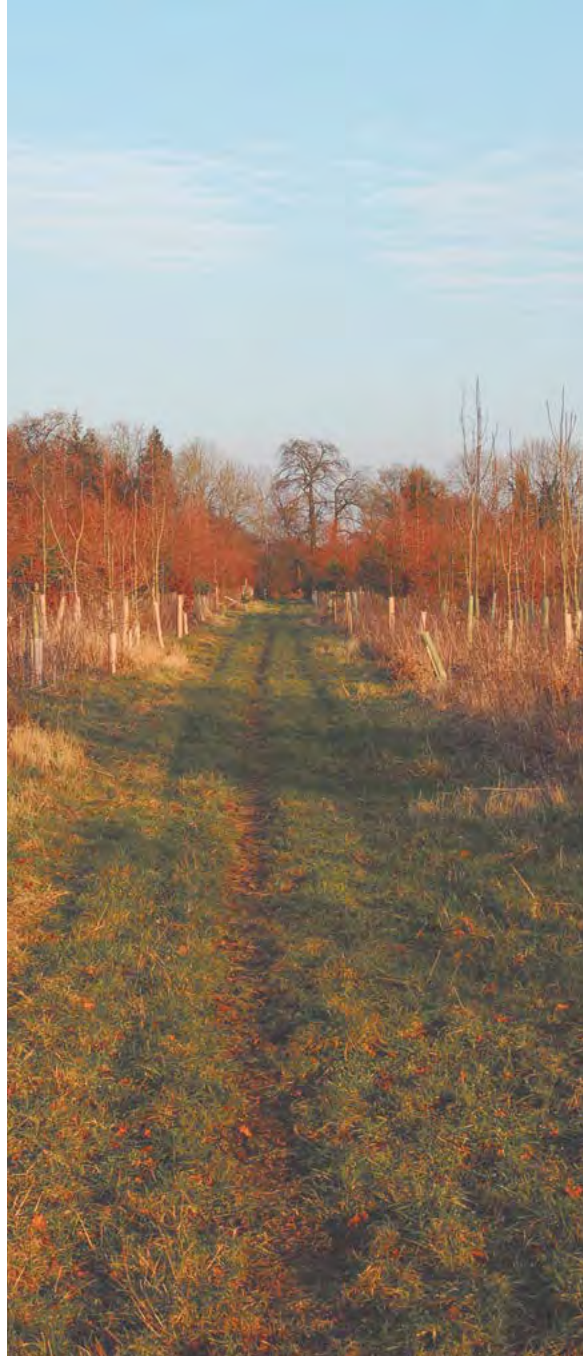
BIRDS



NESTING SITES



GROUND BEETLES



ESTABLISHMENT

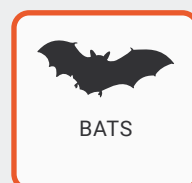
Avoid exposed sites or frost pockets where strong winds and late frosts may damage flowers on nut or fruit trees. Plant over winter, preferably before the end of March and ensure they have sufficient water to establish a good root system in first few seasons.



MANAGEMENT

Plan tree density, species grouping, harvesting, pruning, longer term thinning and felling policy from the outset. Tree guards will be needed protect against grazing livestock.

MORE INFORMATION: <https://www.soilassociation.org/farmers-growers/technicalinformation/agroforestry-handbook/>



Shrubs



PLANT SPECIES

Shrubs can give a more diverse and different structure to rural landscape. Shrubs provide food, habitat and shelter for most of the year for crop pest predators. Species such as dog rose, spindle, dogwood, privet, bramble, holly, hazel and hawthorn can be managed as a shrub habitat. If livestock are present check the toxicity of shrub mixes.



SOIL TYPE AND DRAINAGE

Some species prefer particular soil types. Surrounding tree populations will give a good guide as to successful species.



ESTABLISHMENT

Habitats made up of young trees and shrubs can develop naturally if allowed, for example, areas within or adjacent to woodland, or in field corners next to hedges. Planting is only necessary if there is no natural source of regeneration. Protecting existing areas from grazing and browsing may help allow the habitat to establish.



LONGEVITY

Matures at 15 years.



MANAGEMENT

Light grazing can help to maintain the scrub edge. Browsing from animals creates better structural diversity in the vegetation, but be mindful of the ways in which different livestock species and breeds browse.

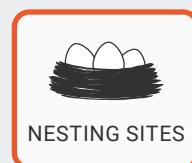
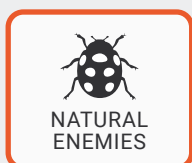
Cut areas of scrub in rotation, only cutting between September and February, to avoid breeding bird season. Try to leave berry-bearing shrubs until after Christmas.



PEST NATURAL ENEMIES

Ladybirds, predatory flies & mites, spiders & beetles.

OTHER BENEFITS





PLANT SPECIES

Natural wetland habitats provide a variety of different flowering plants including water forget-me-not, brooklime, marsh marigold, water crowfoot and marsh woundwort. Sown mixtures can include marsh-mallow, meadowsweet, yellow iris, loosestrife and meadow foxtail.



SOIL TYPE AND DRAINAGE

Soils with a low infiltration rate e.g., dense clay soils, are the most suitable for pond construction or lining can be used.



ESTABLISHMENT

Artificial ponds can be dug using machinery, try to create a variety of water depths, make sure the pond has a shallow sloping area for easy access in and out of water. Many plants will arrive naturally.



LONGEVITY

10+ years



MANAGEMENT

In the first year, annual weed growth may be cut back to encourage development of good perennial ground cover.

Aim to create variation in vegetation surrounding the pond with the minimum amount of disturbance, preferably on a rotation of 2-3 years. Vegetation should be removed like a wedge and must be carried out between September and November. On larger sites light grazing in late summer can be used.



PEST NATURAL ENEMIES

Predatory flies, spiders & ladybirds.

OTHER BENEFITS



NATURAL ENEMIES



POLLINATORS



BUTTERFLIES



BIRDS



NESTING SITES



GROUND BEETLES



SMALL MAMMALS



AMPHIBIANS



WIDER FARM BIODIVERSITY - EARTHWORMS



WATER QUALITY & PROTECTION



DRAGONFLIES/ DAMSONFLIES



BATS

Ditches & Dykes



PLANT SPECIES

Ditches and dykes tend to be predominantly grassy banks, hogweed and cow parsley, but also support wetland species including reeds, sedges, bullrushes and a range of flowering plants.



SOIL TYPE AND DRAINAGE

Wild bird seed is suitable for most soil types with a pH above 5.5.



LONGEVITY

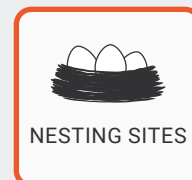
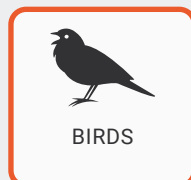
10-50+ years



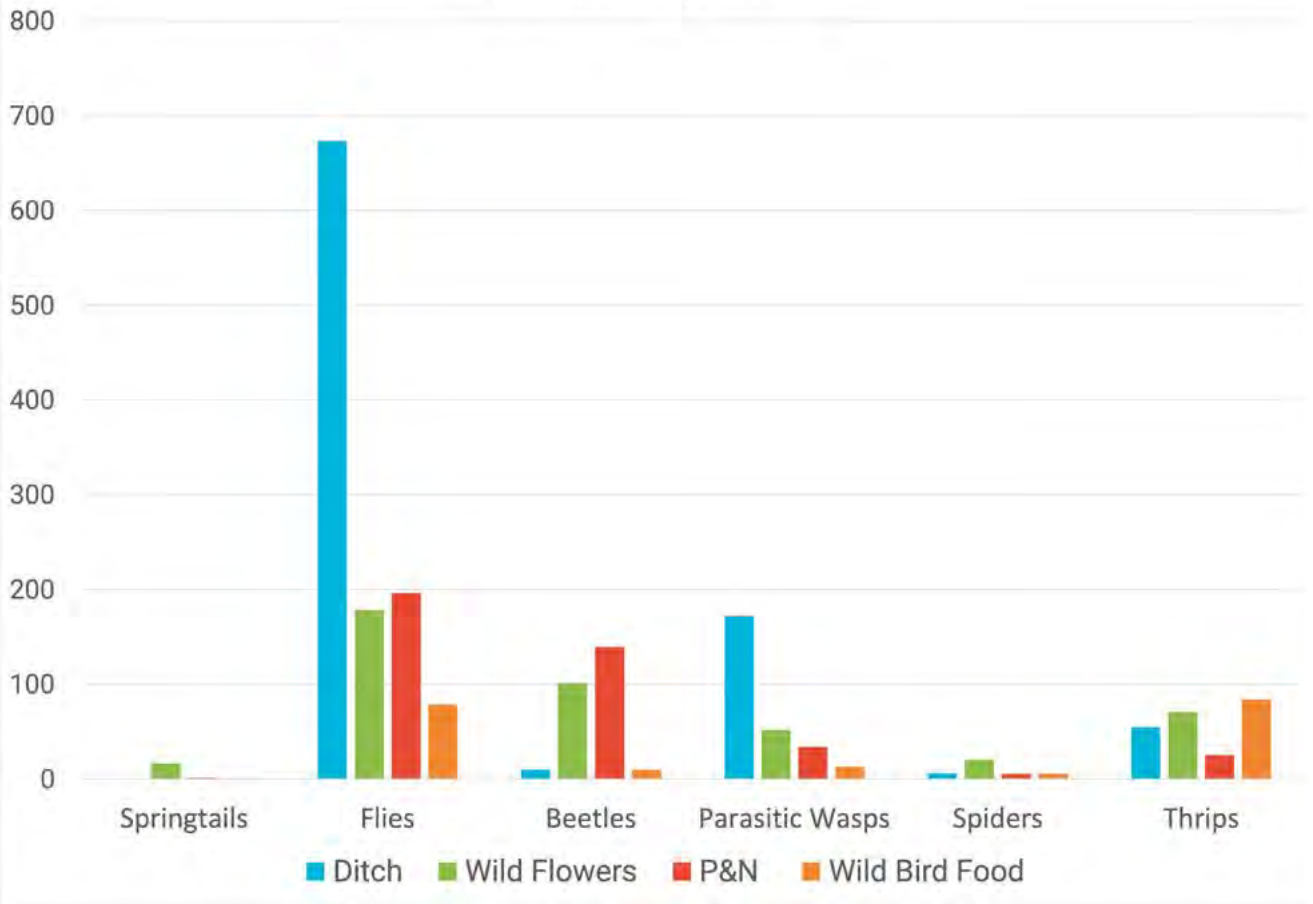
PEST NATURAL ENEMIES

Parasitic wasps, predatory flies, spiders and hoverflies.

OTHER BENEFITS



Sweep Net by Habitat



This chart shows high numbers of flies and parasitic wasps in ditch habitats (Y axis = numbers). Ref; Kellogg's 2020



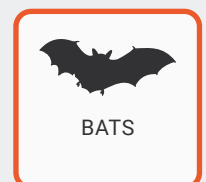
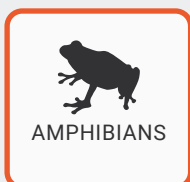
ESTABLISHMENT

Create or maintain with gently sloping sides to create a wider range of habitats from wet to dry. Locate away from sources of pollution such as silage clamps and manure heaps.



MANAGEMENT

They should be managed on a rotation of 2-5 years, with no more than half of the ditches managed in one year. Clearing and trimming is often essential to ensure water flow and land drainage and is best undertaken in autumn or winter months. Invasive non-native species should be controlled. Allow light to penetrate by cutting back overgrowing hedges and keep clear of trimmings.





The Kellogg's Origins Programme



Through the Origins Programme, Kellogg's invest in sustainable agriculture projects at farm level. This supports Kellogg's commitment to reach 1m farmers and workers globally by 2030. The projects focus on sustainable farming aspects such as climate change, biodiversity and productivity. Thanks to Kellogg's Origins for their support in producing this guide.



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