

# Ground Beetle Habitat Management Guide

This is a guide to managing arable farmland with nature in mind. Ground beetles are an important component of farm wildlife that can also provide effective natural pest control. Read on to find out about this fascinating group of insects, and how simple changes to farming practices can provide a real boost to farm wildlife.

The family Carabidae, commonly called ground beetles, contains some of our most familiar and frequently encountered beetles. With over 370 different species in Britain and Ireland, there is huge diversity amongst ground beetles in terms of body size, colour, and ecology. Despite this, their long thread-like antennae, large eyes, long legs, strong jaws, and characteristic body shape make them distinctive. They can be found under rocks, stones, and logs, or amongst tussocks of grass<sup>1</sup>.

Ground beetles are an essential component of arable fields. They are effective predators and abundant populations can be an indicator that your farm is healthy and rich in wildlife. For example, ground beetles can reduce Cabbage Root Fly *Delia radicum* density by as much as 90% through predation of eggs and larvae<sup>2</sup>. Seed-eating ground beetles can also reduce the germination of unwanted plants. In fact, without ground beetles, arable plants, particularly problem species, can increase by up to 30%!<sup>3</sup>



## The role of ground beetles on arable farmland

By predateding many invertebrates that feed on farm crops, as well as consuming the seeds of many annual plants, ground beetles have many beneficial roles within arable fields. This is termed **integrated pest management**. On the ground they predate other invertebrates like slugs, and the eggs and larvae of flies and moths. Some species also have the ability to climb plants, enabling them to eat aphids, small caterpillars and other less favourable invertebrates directly off crop plants. The diet of some ground beetles changes over each season depending on the availability of invertebrate prey or plant food. Many can exploit both insect and seed resources throughout the year.

Several ground beetles such as *Demetrias atricapillus*, which is regarded as a vital cereal aphid predator, and *Trechus quadristriatus* that feeds on Cabbage Stem Flea Beetle *Psylliodes chrysocephala* eggs and larvae before they affect Oilseed Rape plants.

Annual plants can be naturally controlled by species like the Strawberry Seed Beetle *Harpalus rufipes*, which is a widespread and locally common ground beetle. Despite its' name, the Strawberry Seed Beetle has larvae that feed on a range of seeds, while the adults are omnivores predateding various insects including aphids and weevils.

Other species that you are likely to have in your fields are:



*Harpalus affinis* © Roger Key

*Harpalus* sp. including *Harpalus affinis*, a common ground beetle which is most often found at night and feeds on the eggs of Cabbage Root Fly<sup>4</sup>.



*Agonum muelleri* | CC BY-NC-SA

*Agonum muelleri* a beautiful metallic ground beetle that predated a variety of invertebrate species.



*Ophonus ardosiacus* © Jamie Robins

*Ophonus* sp. seed eating beetles including Carrot Ground Beetle *Ophonus ardosiacus* which is relatively common and widespread, and Set Aside Downy-back *Ophonus laticollis* which is much scarcer and more restricted in distribution. These beetles tend to overwinter in margin habitats and move into crops in the spring.



*Pterostichus niger* © Vlad Proklov CC BY-NC 2.0

Great Black Clock *Pterostichus niger* and Rain-beetle *Pterostichus melanarius* are common generalist predators that overwinter in fields as larvae.

Copper Green Clock Beetle *Poecilus cupreus* is a generalist predator of aphids, fly eggs and larvae, moth/butterfly eggs and larvae, slugs and weed seeds. With a ferocious appetite they consume other invertebrates that drop to the ground from the crop as they try to escape other predators or parasitoids.



*Pterostichus melanarius* © Ouwesok CC BY-NC

Some ground beetles are excellent detritivores that help to break down organic matter, aerate soil and maintain healthy soils. Additionally, ground beetles form an important part of the food chain as they themselves are the prey of amphibians, birds, and mammals.



*Poecilus cupreus* © Gail Hampshire CC BY 2.02.0



*Harpalus froelichii* © John Walters

## Management for ground beetles

Maximising the availability of suitable habitats to encourage a diversity of wildlife across an arable farm, can be relatively simple to achieve.

A mosaic of habitats containing bare ground, wildflowers and tussock grasses can support diverse ground beetle communities and other invertebrates.

There are a wide range of opportunities to create the conditions for ground beetles to thrive on your farm, including: beetle banks, hedgerows and boundary features, areas with bare earth and disturbed soil, and uncropped cultivated margins. Ensuring that these features are connected by pockets of suitable habitat, which act like stepping-stones, will connect populations of these invertebrates across a landscape.

Providing a range of habitats that are suitable for ground beetles to feed, breed, and shelter is essential. These will also benefit other invertebrates, including pollinators like bees and hoverflies, parasitic species such as ichneumon wasps, and soil conditioners such as woodlice and earthworms.

Management around an arable farm that encourages ground beetles provides ideal opportunities for other taxa to thrive. Increasing the range of habitats available can benefit plants, invertebrates, mammals, and birds. This encourages natural control of aphids and other species.

Incorporating different habitat features across the arable landscape requires careful planning<sup>5</sup>:

**Appropriate** – Which habitat features fit with your farm and its existing habitats?

**Location** - Where can you deliver the greatest benefit for ground beetles and other invertebrates? Consider links to existing habitats.

**Size** – Do you have fields large enough for cultivated margins, flower-rich plots and beetle banks?

**Timing** – When is the most appropriate time to create these habitat features?

**How** – Do you have the right equipment?

**Maintenance** – Can you include management of these habitat features into your cropping rotation?

### Key habitat features for ground beetles

- Beetle banks ★★★★★
- Boundary features ★★★★★
- Conservation headlands and annually cultivated plots ★★★★★
- Wildflower margins and plots ★★★★★



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**Beetle banks** are 2 m in width or wider strips that run across cultivated fields. They are often sown with native grasses, including tussock forming species like Cock's-foot *Dactylus glomerata*. Beetle banks provide permanent vegetation cover for ground beetles and other beneficial invertebrates like spiders. Many ground beetles typically travel less than 200 m and creating these features within fields can increase the abundance and diversity of ground beetles. By locating beetle banks within a crop, beneficial invertebrates can spread into the centre of arable fields more readily.

Beetle banks provide insulated habitat for overwintering invertebrates and can support alternative food sources when ground beetles' preferred prey, like aphids, are not active. They can be created by ploughing furrows toward each other from either side constructing a raised bank of earth.

To maximise the benefit of beetle banks on your farm:

- Divide up large fields over 15 ha with beetle banks to ensure a more even coverage. Fields larger than 30 ha could contain more than one bank.

- Headlands could be cultivated at each end creating two banks, so that the field is not entirely divided in half.
- Whenever you cultivate your field is the ideal time to create a beetle bank. During autumn, this has the benefit of developing a tussocky grass bank with some open space. Spring constructed banks are also useful for beneficial invertebrates and provide more bare ground which may be used by ground beetles and solitary bees.
- Generally, beetle banks are 2-5 m wide and mounded to less than 0.5 m high.
- Mow banks in autumn every 2 to 3 years to encourage the growth of tussock grasses. Every now and then, over autumn and winter, rough-up the ground in different areas along the beetle bank to retain bare ground and early successional areas for flowering plants, particularly annual plants, but ensure this is not carried out across the whole bank in any given year.
- Encourage native flora to establish on a bank by leaving the bank unsown. This will provide habitat for cornfield flowers, many of which are in decline, as well as many invertebrates. Where native flora is suppressed, and plant diversity is low, sowing seed onto a newly created bank may be required. In such instances, select a native seed mix containing tussock forming grasses and finer grasses like fescues.
- The first year of establishment may require a few summer cuts to encourage grass tillage and suppress problem plants. Banks can be managed in sections on an annual

rotation, creating patches of bare ground to ensure that arable plants have the opportunity to grow from the soil seed bank. This diversifies the flora and supports a greater number of invertebrates.

- Ideally create a buffer strip on one or both sides of a beetle bank, encouraging native flora to establish. This will boost the value of a beetle bank for invertebrates and other wildlife, as well as acting as a buffer from infield herbicide spraying and fertiliser drift. Beetle banks should not be sprayed with pesticides, herbicides or fertiliser.

**Conservation headlands and annually cultivated plots** are areas sown in or around the edge of a crop for cornfield flowers, small mammals and farmland birds. They are also very beneficial for ground beetles and other invertebrates providing seeds, nectar, and pollen. Uncropped arable margins and plots containing cornfield flowers and grasses have benefits for generalist as well as many specialist ground beetles. When choosing where to site such margins, priority should be given to margins adjacent to patches of existing semi-natural grassland. Create cultivated, unsprayed and unsown margins at least 6 m wide to encourage abundant annual arable plants communities and they should be cultivated each year either in the autumn or spring depending on the cropping rotation.



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**Wildflower margins and plots** come in a variety of shapes, sizes, and types. They are best achieved by encouraging native flora to naturally regenerate. If annual problem plants, such as thistles, are particularly abundant, these should be controlled prior to cultivation. Where native flora is suppressed, and plant diversity is low, sowing seed may be required. If sowing is necessary, always use a native seed mix, preferably of local provenance as these are better for local invertebrate populations, often flowering for longer and better adapted to local conditions. Sowing is more likely to be successful if undertaken in the autumn. Sow the seed through broadcast or shallow casting, followed by rolling the ground to press the seed into the soil. In the first year of establishing a wildflower margin or strip, whether seed has been sown or naturally regenerated, managing annual problem plants is a priority. From the second year onwards, the wildflower margins and plots should have a late summer / autumn annual cut and removal regime to control vigorous grasses and weed species, and to retain low fertility levels. Mowing may not be necessary if there are sufficient levels of grazing by rabbits and occasional deer to keep vegetation succession in check, or if the margins and plots are treated like wildflower meadows and grazed with livestock.

**Hedgerows, fence lines and boundary features** contain a variety of native plant species and offer a greater range of invertebrate food sources. Flowering plants, such as blackthorn, honeysuckle, and bramble not only provide nectar and pollen essential for adult insects, but also berries later in the year. Ivy flowers in late autumn are also an important source of nectar for insects, such as hoverflies. These hedge habitats are of high importance to ground beetles as they provide foraging opportunities, shelter, refuge and can be used as dispersal corridors between different habitat patches. Thick grass tussocks and litter layers provide further habitat that is also needed in their lifecycle, while supporting other important predators, such as spiders. Retaining fallen branches from trees and hedges in a shady location will provide dead wood for beetles that lay their eggs in dead/decaying wood and under bark. Maintaining an uncultivated margin on one or both sides of hedges, banks, or other boundary features, is extremely beneficial to enable ground beetles to move freely and explore different habitat patches.



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## Other farm operations

**Soil disturbance/rotovation** - habitat management or creation by mechanical soil disturbance creates early successional conditions favourable to generalist as well as specialist ground beetles. The scale of disturbance or rotovation can be either small or large, ideally aiming to create a mosaic of bare ground with different topological aspects and a diverse range of microhabitats. Disturbance can be conducted manually or mechanically. For example, an excavator could scrape off a larger area of material and easily overturn soil. To ensure the continuity of suitable habitat across the years, small patches should be managed on an annual rotation. This management is particularly suited to the nationally rare Brush-thighed Seed-eater *Harpalus froelichii* and other seed-eating *Ophonus* and *Harpalus* species that feed on the plants of disturbed, ruderal environments.

**Insecticide applications** – Pesticides and herbicides should never be sprayed on cereal field margins, as they will kill ground beetles and other beneficial invertebrates and the native plant species such as Charlock *Sinapis arvensis* and Fat-hen *Chenopodium album* upon which they depend. An unsprayed margin of 6 m should be retained around the field and care should be taken to protect the field margins from pesticide drift<sup>6</sup>.

Support to create and manage many of these habitat features is available under agri-environment schemes.

## References

- <sup>1</sup> Jones *et al.* 2020 An Introduction to Ground Beetles: Beneficial Predators on Your Farm eOrganic website <https://eorganic.org/node/33936> (Blubaugh and Kaplan, 2016) accessed 17.08.2020
- <sup>2</sup> Kelly Jowett, Farm Wildlife website <https://farmwildlife.info/category/farmed-area/arable-farmed-area/beetle-banks/> accessed 17.08.2020
- <sup>3</sup> <https://www.coleoptera.org.uk/carabidae/home> accessed 12.08.2020
- <sup>4</sup> <https://www.ukbeetles.co.uk/harpalus-affinis> accessed 12.08.2020
- <sup>5</sup> <https://farmwildlife.info/how-to-do-it/farmed-area/integrated-pest-management/>
- <sup>6</sup> <https://voluntaryinitiative.org.uk/schemes/integrated-pest-management/> accessed 17.08.2020

## Further guidance

<https://cdn.buglife.org.uk/2019/08/Hedgerows-and-cereal-field-margins.pdf>

[https://cdn.buglife.org.uk/2019/08/Cereal-field-margins\\_0-1.pdf](https://cdn.buglife.org.uk/2019/08/Cereal-field-margins_0-1.pdf)

<https://farmwildlife.info/how-to-do-it/farmed-area/beetle-banks/>

<http://adlib.eversysite.co.uk/adlib/defra/content.aspx?doc=91387&id=102817>

[Encyclopaedia of pests and natural enemies in field crops](#)

<https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/farming/advice/managing-habitats/conservation-headlands/>