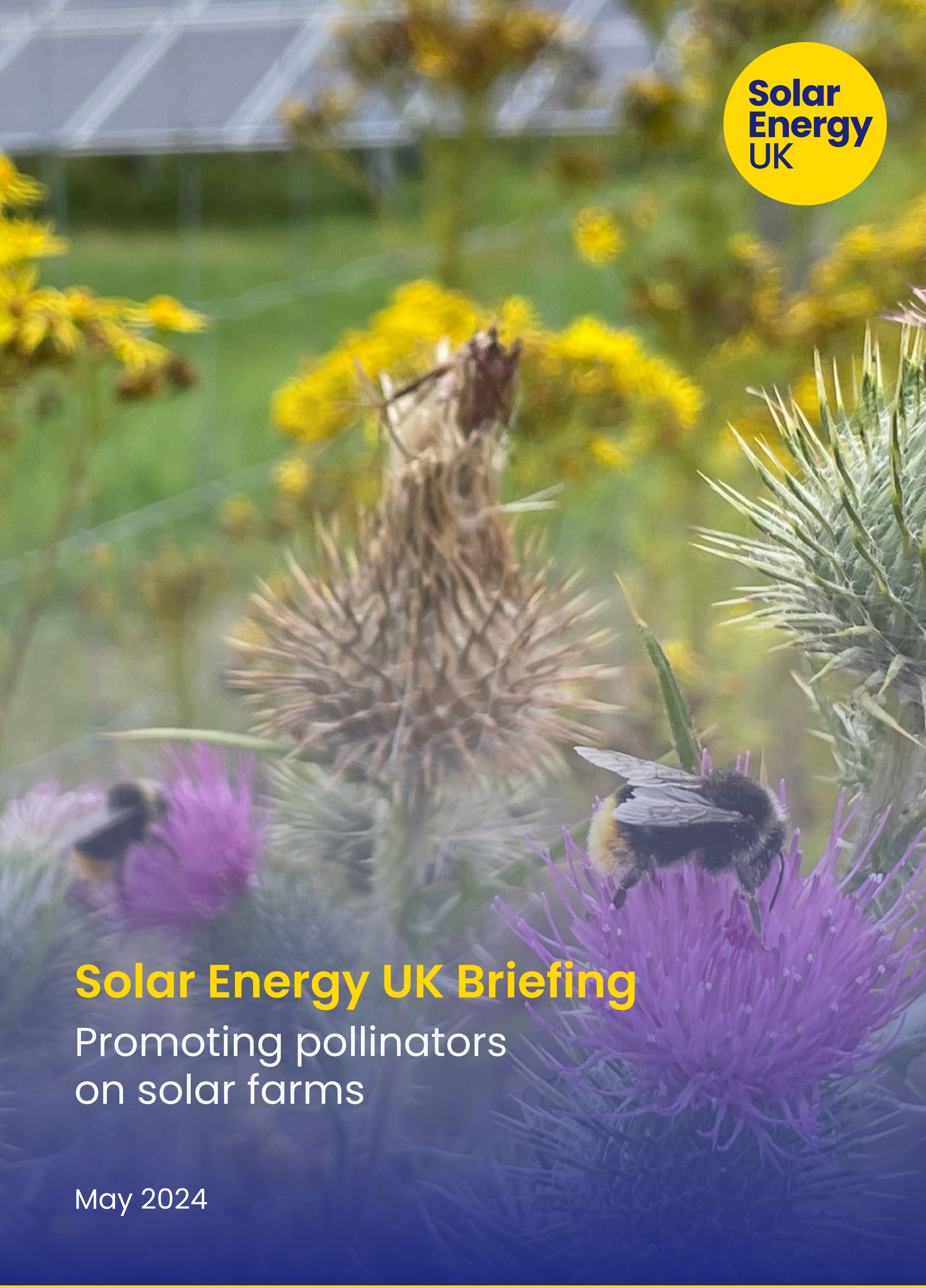

Solar Energy UK Briefing

Promoting pollinators on solar farms

May 2024

About Us

As an established trade association working for and representing the entire solar and energy storage value chain, Solar Energy UK represents a thriving member-led community of over 400 businesses and associates, including installers, manufacturers, distributors, large-scale developers, investors, and law firms.

Our underlying ethos has remained the same since our foundation in 1978 – to be a powerful voice for our members by catalysing their collective strengths to build a clean energy system for everyone's benefit.

Our mission is to empower the UK solar transformation. Together with our members, we are paving the way for solar to deliver 70GW by 2035 by enabling a bigger and better solar industry.

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Overview

Solar farms can promote pollinator biodiversity, including bumblebees and butterflies, through creating a range of microclimates and pollinator-friendly habitats [1]. Creating pollinator-friendly habitats can be simple and fully compatible with solar farm operation. Habitat creation can be undertaken between the rows of panels or in margin areas, avoiding interference with electricity production. Five key facets of promoting pollinator biodiversity on solar farms are:

- Employing **management practices** that promote pollinator friendly habitats.
- Enhancing **food resources** (such as pollen and nectar) for pollinators.
- Providing **reproductive resources (i.e. places to nest or lay eggs)** for a suite of pollinators.
- Designing and managing solar farms, where possible, to provide pollinators with a range of **microclimates**, essential for regulating body temperature.
- Taking a **landscape** approach to pollinator conservation is key and solar farms can help to connect habitats.

Pollinator population declines

Pollinators are insects that visit flowers and include wild bees (such as bumblebees and ground nesting bees), hoverflies, butterflies, moths, some beetles and other flies. Whilst honey bees are important pollinators too, they are entirely dependent on beekeeping practices and differ greatly from wild bees.

Many pollinator groups have experienced population declines in recent decades, with studies reporting widespread losses of bee and hoverflies species across the UK since the 1980s [2]. Similarly, 80% of butterflies have declined across the UK since the 1970s and species have vanished from nearly half of the places they once flew [3]. Populations of larger moth species have also decreased by more than 30% since 1968 [4]. Declines are attributed to a range of interacting factors affecting pollinators, including environmental pollution, invasive species and climate change but the main drivers are land use change, intensive agricultural management and pesticide use [5]. Such factors threaten pollinator abundance, diversity and health, affecting the services they provide to agriculture and wider ecosystems. It is therefore imperative to address pollinator decline to minimise risks to societies and ecosystems that rely on pollination services.

What do pollinators need?

Pollinators need a range of resources and microclimatic conditions to survive and reproduce and if managed appropriately, solar farms can provide many of these. Food, comprising pollen and nectar provided by flowering plants, is one of the most important resources and some pollinator species can be specific in the plants they feed from.

Pollinators also need resources to reproduce and complete their lifecycles. Reproductive resource requirements vary across groups, depending on whether they nest or lay eggs and where they do this. For instance, many bee species nest in the ground, but trees, vegetation and cavities are also used. A few species of bee can also nest in artificial structures (e.g. cardboard tubes or reed stems in a bee hotel) but natural nest sites (e.g. brambles) are thought to be more effective. Other pollinators, such as butterflies, rely on plant species (i.e. host plants), on which they lay eggs and their preferences range in specificity. For example, the meadow brown butterfly can use a range of agricultural grasses as host plants but the brown argus butterfly is typically limited to a single plant species (common rock-rose). In contrast, hoverflies rely on a range of features such as wooded or wet areas. The number of nest sites and host plants available in a landscape is important as it can help determine the size of the pollinator population.

A range of microclimates are needed for pollinators to survive as many are sensitive to climate and some are poor at regulating their own body temperature. Variation in microclimate in pollinator habitats is therefore critical to enable pollinators to warm up or cool down as needed. Warm microclimates are used for basking, which enables the storage of heat for when temperatures are lower. Cooler microclimates act as thermal refuges when temperatures increase and reduce extreme stress. Global climate change is already affecting pollinators and some species are moving to higher latitudes or altitudes to escape warmer climates. Other negative impacts have been described and trends are set to continue, with climate warming predicted to negatively impact some pollinators in the future.

Management recommendations

This briefing presents ten evidence-based management recommendations to support and enhance pollinator populations within solar farms, based on research undertaken at Lancaster University [1]. Recommendations are based on > 400 pieces of peer-reviewed scientific evidence on how land management practices relevant to solar farms can enhance pollinator biodiversity. Moreover, recommendations are grounded in solar farm management practices, align with industry best practice guidance and consider solar farm operation and maintenance needs [6]. Expert ecological advice, including an understanding of the local context, should be sought alongside these recommendations to tailor implementation, given solar farm-specific conditions. Management recommendations are grouped into five key themes: foraging resources, reproductive resources, site management, climate and landscape.

Foraging resources

1. Provide a diverse mix of key flowering grassland species

Nectar and pollen-rich plants can be sown within solar farms to create wildflower meadows or strips, providing a food resource for pollinators. It is preferable to provide a wide variety of key plant species, ideally of local provenance and selected on a site-by-site basis so they are suited to local growing conditions and target pollinator communities. Such interventions can be applied across solar farms but may be best established in open areas at the margins of the site, where machinery can move freely and there is plenty of sunlight. Generally, less flowers are observed under the arrays and areas between the rows of panels due to the shade cast by the panels and more intensive vegetation management, which is required to prevent taller plants from shading the panels.

2. Plant or maintain hedgerows

Establishing or maintaining hedgerows within or around solar farms provides a multitude of benefits to pollinators, complimenting resources provided by grassland flowers. The mixture of woody and herbaceous species in hedgerows are an important source of food. Hedgerows are also used by breeding pollinators, act as structural elements that impact pollinator movement and provide shelter and a range of microclimates. To maximise the benefits for pollinators, hedgerows should be carefully managed. Low intensity practices, such as incremental or less frequent cutting, and winter management can benefit pollinators.

3. Ensure season-long access to food resources

Grasslands and hedgerows should be planned and managed to ensure season-long access to food resources and should include plant species that flower at different times throughout the pollinator season (March – September). Late flowering plant species are important to pollinators as two thirds of species have peak flight observations (i.e. are foraging for food) in late summer (July and August) [7]. Food resources are typically low during this period and establishing late summer resources on solar farms could therefore help to eliminate resource gaps. Early flowering plant species, such as primroses and other hedgerow-associated species, are also important and could be encouraged through careful management. Cutting hedgerows on rotation (i.e. every two to three years) and leaving one side uncut at any time could be beneficial as blossoms only tend to form on twigs that are not newly cut. As such, these practices can help to ensure early season resources are available to pollinators.

Reproductive resources

4. Provide a range of nesting, breeding and reproductive resources

Solar farms can be managed to provide a range of reproductive resources through the creation suitable natural habitat or establishment of specific plant species. Natural features include tussocky vegetation, sparse vegetation, bare ground and banks or ditches and management to provide such features should be undertaken where possible. Specific host plants could be included in seed mixes or planted, but where such species are established within the park should be considered carefully, as pollinators can be particular about the conditions in which the plant itself grows. For example, some female butterflies require specific conditions for egg-laying and rely on their host plant growing in particular microclimates. Such resources may be best established in the solar farm margins, where vegetation will be cut less frequently, so avoiding the destruction of eggs and larvae. Leaving areas of vegetation uncut in the margins also creates overwintering habitat for larvae and adults.

Site management

5. Graze, cut or mow at low intensity and late in the season

Pollinator habitat needs to be managed to ensure it remains suitable over time. However, the intensity and timing of grassland management is important and should be undertaken later in the season to make sure pollinator resources are available throughout the summer when possible. Delaying cutting provides plants the opportunity to flower and set seed. Where there is a risk of panels being shaded by tall vegetation, strips can be cut in front of the lower panel edge as required, leaving the rest of the vegetation intact. Where grasslands are grazed, livestock should be deployed late in the season or over the winter, to allow plants to flower and set seed. Well-managed grazing outside of the summer months can increase plant diversity and thus the availability of food and reproductive resources on solar farms [8]. If necessary to graze throughout the summer, rotational grazing could help to ensure pollinator resources are always available somewhere within the solar farm.

6. Create or maintain variation in vegetation structure

Variation in habitats across the solar farm should be encouraged as structurally diverse and tall vegetation can be beneficial to pollinators. Taller vegetation benefits butterflies in particular, although species-specific preferences mean that creating patches of vegetation of different heights can support a wider range of species. Strip mowing to prevent panel shading can create areas of shorter vegetation, increasing variation in vegetation structure and height across the site.

7. Minimise the use of agrochemicals

Agrochemicals negatively impact pollinators. Solar farms tend to use less fertilisers and insecticides than farmland, but herbicides used at some sites can diminish floral resources. Ideally, herbicide use within solar farms should be avoided, as even selective use to target weeds or invasive species can eliminate non-target plants. However, where herbicide use is necessary, targeted approaches such as spot treatment or weed wiping is far less damaging to plant biodiversity (and therefore pollinators) than lance or boom spraying.

Climate

8. Generate a range of microclimates

The microclimates generated within a solar farm could help to mitigate the impacts of climate change on pollinators by providing a range of thermal conditions. Solar farm infrastructure provides microclimatic niches [9], but this can be enhanced through the creation and management of a range of semi-natural features. Many of the features already mentioned, such as bare ground, tall vegetation and hedgerows can provide microclimates and shelter that benefit pollinators.

Landscape

9. Consider the surrounding landscape

Managing solar farms for pollinators is always valuable. However, it is worth noting that the surrounding landscape will influence how rapidly and to what extent habitat established within solar farms is utilised. As pollinators are mobile and use habitats and resources outside of the solar farm, characteristics of the surrounding landscape have an impact on the pollinators inside solar farms and can influence how effective management interventions may be in boosting or supporting populations. For example, managing a solar farm for pollinators in a agriculturally-dominated landscape containing few resources, where there are few pollinators, may be less effective given the lack of insects to benefit from the interventions. A resource-rich solar farm managed for pollinators in a diverse, resource-rich landscape may also be less effective given the abundance of resources already available. Instead, targeting management at solar farms in ‘intermediate’ landscapes could be the most effective strategy to support pollinators at the landscape level, given there are pollinators present to use the resources provided and resources are likely scarce elsewhere. Moreover, targeting management for pollinators at solar farms nearby to pollinator-dependent crops could bring potential benefits to surrounding agriculture through boosted local pollination services [10, 11].

10. Promote connectivity to semi-natural habitat

Solar farms and nearby suitable habitats could be connected through the creation or maintenance of semi-natural linear features such as hedgerows or wildflower strips. Where possible, actions outside of the solar farm boundary should be also considered. For example, hedgerows could be created or margins in surrounding fields could be left uncultivated and seeded with flowering plant species used by pollinators to promote a landscape scale approach. Both features within and outside solar farm boundaries could also link to national initiatives including B-Lines (insect pathways distributed across the UK) [12] and Important Invertebrate Areas [13].

Evidence that solar farm management can enhance pollinator biodiversity

Targeted management actions can increase the abundance and diversity of important pollinator groups within solar farms. For example, solar farms managed as wildflower meadows, rather than turf grass, could boost bumblebee numbers by up to four times [14]. Greater pollinator biodiversity has also been linked to solar farms providing more foraging resources, such as a higher diversity of flowering plant species [15]. Moreover, findings from Solar Energy UK Solar Habitat reports show that more individuals and species were recorded on solar farms managed with a greater focus on biodiversity [16, 17].

To better understand the impacts of management actions on pollinators within solar farms, monitoring is crucial. Pollinators can be monitored using transect surveys, where a surveyor records bumblebees and butterflies along predetermined 100 m routes within a site [18]. Full guidance for monitoring pollinators and other biodiversity within solar farms is available in the Solar Energy UK Standardised Approach to Monitoring Biodiversity on Solar Farms [19].

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Resources

- Habitat Creation and Management for Pollinators guide: https://www.ceh.ac.uk/sites/default/files/Habitat%20Management%20and%20Creation%20For%20Pollinators.pdf
- Butterfly food plants: https://www.ukbutterflies.co.uk/foodplants.php

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Acknowledgements

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Lancaster University

University of Reading

UKRI Natural Environment Research Council

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Clarkson & Woods Ecological Consultants

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