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BRE National Solar Centre Biodiversity Guidance for Solar Developments

Image: G Parker, 2013

Bumblebee Conservation Trust

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eden project

National Trust

rspb giving nature a home

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SOLAR TRADE ASSOCIATION

Wiltshire Wildlife Trust

Wychwood BIODIVERSITY

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BRE NATIONAL SOLAR CENTRE

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1. Context

This document provides guidance to planners and the solar industry on how they can support biodiversity on solar farms. The guidance provided herein has been developed with, and endorsed by, a number of leading UK conservation organisations.

Biodiversity is in decline in the UK. The ground-breaking 'State of Nature Report' illustrates the severity of the threat facing British wildlife, with 60% of the 3,146 species monitored being recorded as declining over the past 50 years. A 60% decline is recorded for 1,064 farmland species, with agricultural intensification being identified as one of the primary causes.

However, recent studies of agri-environment schemes indicate that appropriate land management can bring about significant increases in wildlife populations on agricultural land. In the same way, with appropriate land management, solar farms have the potential to support wildlife and contribute to national biodiversity targets. Indeed, solar farms may have several additional advantages in that they are secure sites with little disturbance from humans and machinery once construction is complete. Recent research suggests biodiversity gains on solar farms can be significant.

The approach to managing biodiversity will be different for every solar farm, and it is recommended that a site-specific plan be devised in each case. The purpose of this document is to support the development of a plan by presenting a broad range of options for biodiversity enhancement and management, and illustrating best practice through a series of case studies. The guidance provided here draws upon good practice from a number of sources, as detailed in the bibliography at the end of this document.

Best practice in solar farm development seeks to optimise biodiversity enhancements, but it is recognised that a number of wider constraints exist, including legal or lease conditions, or planning considerations such as visual or heritage issues. Alternatively, solar farms may seek to support agricultural production, guidance for which goes beyond the scope of this document. Nevertheless, opportunities for biodiversity enhancement exist in most cases and solar farms should seek to maximise benefits for wildlife wherever possible.

2. Introduction

Solar farms present an excellent opportunity for biodiversity. In most solar farms panels are set on piles and there is minimal disturbance to the ground. The panels generally have no moving parts and the infrastructure typically disturbs less than 5% of the ground. The posts upon which the panels are mounted take up less than 1% of the land area. Normally only 25-40% of the surface is over-sailed by panels. Because panels are raised above the ground on posts greater than 95% of a field utilised for solar farm development is still accessible for plant growth and potentially for wildlife enhancements and complementary agricultural activities such as conservation grazing. Following construction, there is little human activity apart from occasional maintenance visits. Most sites have a lifespan of at least 20 years which is sufficient time for appropriate land management to yield real wildlife benefits.

A number of options exist for enhancing biodiversity on solar farms, from hedgerows to field margins to wild flower meadows to bird boxes and ponds. Each site is unique and there is no 'one size fits all' solution. Ultimately the best plans will be those developed through engagement with the local community, the landowner and local and national conservation organisations.

Biodiversity enhancements should be selected to fit the physical attributes of the site and should tie in with existing habitats and species of value on and around the site. Furthermore they should be compatible with the primary purpose of the site – to generate solar power. If agricultural production is also planned for the site, biodiversity enhancements should aim to dovetail with these goals.

The following document provides high level guidance on solar farms and biodiversity, with specific reference to the planning process. The guidance centres on the development of a biodiversity management plan for each site which identifies appropriate biodiversity objectives and defines the establishment, management and monitoring activities required to achieve them. A number of biodiversity enhancements are presented in this document as examples but it should be noted that a much wider range of options exists.

In the following sections, several general points in relation to site selection are initially considered, before moving on to consider specific habitat enhancements.

3. Site considerations

Solar farms can enhance local biodiversity, particularly when located within an intensive agricultural landscape, yet it is important that developments avoid ecologically sensitive sites. Sites within or functionally linked to Special Protected Areas (SPA), for example, are very unlikely to be appropriate, depending on the designated feature(s). Other designated areas that are unlikely to be suitable include Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Natura 2000, Ramsar sites and other sites international recognised as having ecological importance such as Key Biodiversity Areas including Important Plant Areas (IPAs) and Important Bird Areas and Important Biodiversity Areas (both IBA). The compatibility of all proposed solar farms with sites of local nature importance and important areas of semi-natural grassland (which are often undesignated areas of wet grassland or scrub) should be assessed by an ecologist to avoid damage to such sites. The Natural Environment and Rural Communities Act 2006[1] provides a list of priority habitats and species of principle importance for conservation in England, which should guide the appropriateness of potential solar sites, to avoid harm to these interests.

Reversion to original land use

Where a solar farm is developed on agricultural land there is usually a condition that it should be reverted to its original land use at the end of the project. Reversion of land use should be considered when planning habitat enhancements and care should be taken to ensure they do not alter the land use, for example by planting woodland in the middle of a field.

Good Agricultural and Environmental Condition

The land should be maintained in Good Agricultural and Environmental Condition, where soils, water, habitats and landscape features are properly maintained. Soil health is essential for the sustainability of farming in the longer-term and solar farms could play an important role by resting soils through the life of the solar farm. Resting would especially benefit soils that have been exhausted of their nutrients and compacted by farm machinery. Thus, solar farms can provide a means for soil to improve while maintaining production from solar harvesting, and possibly grazing.

Carbon storage

It should be recognised that good land management complements the sustainability objectives of solar power and can lead to additional benefits including enhanced carbon storage. For example, establishing permanent grasslands with few or no agricultural inputs on post-arable land should lead to a significant reduction in carbon release from the land. On degraded peat soils, solar farms may provide an opportunity for peatland restoration, conserving the soil and its carbon store.

Community engagement

Biodiversity enhancements are likely to increase community interest in solar farm developments. It is vital to engage communities throughout the life of a solar project. Engaging the local community, including local conservation groups, will increase awareness of both solar technology and the local environment. On-going community engagement, for example, through open days, local school trips, or the provision of nature trails is recommended.

4. Biodiversity Management Plan

Each solar farm requires a biodiversity management plan (BMP). The purpose of the BMP is to lay out the specific objectives for biodiversity and the means by which these objectives will be achieved, including the protection of existing species and habitats, the establishment of specific enhancements, their maintenance and monitoring. The BMP should also cover the decommissioning of the site. Developers should include all elements of the BMP in their consideration of project finance for the life of the scheme, from planning to site closure. This should include all aspects of land and species management, including the appropriate control of injurious weeds[2]. Where legally practical in terms of the options of the lease, a whole-field approach should be taken to the land-management plan, including the boundary features of the site.

The BMP should:

- identify key elements of biodiversity on site, including legally protected species, species and habitats of high conservation value such as those listed on Section 41 of NERC Act 2006, and designated areas in close proximity to the proposed site;
- identify any potential impacts arising from the site's development, and outline mitigations to address these;
- detail specific objectives for the site to benefit key elements of biodiversity and the habitat enhancements that are planned to achieve these;
- contribute to biodiversity in the wider landscape and local ecological network by improving connectivity between existing habitats;
- identify species for planting and suitable sources for seed and plants;
- consider wider enhancements such as nesting and roosting boxes;
- summarise a management regime for habitats for the entire life of the site;
- provide a plan for monitoring the site; and adapting management as appropriate to the findings of this monitoring; and,
- set out how the site will be decommissioned.

The BMP should be written by a qualified ecologist and should incorporate recommendations from the Phase 1 Habitat Survey/ Extended Phase 1, Environmental Impact Assessment, tree survey or other ecological study, as appropriate. Where specific impacts have been identified and mitigations proposed, these should be detailed in the BMP.

Advice should be sought from conservation stakeholders on how the site could contribute to local and national targets for biodiversity conservation. Landowners should be consulted for their views on the BMP. In addition, biodiversity objectives should be presented to the community for their comment as part of the public consultation process.

The BMP should be concise and well written such that land managers, community members, developers and conservation professionals alike can make use of it. The BMP, at least in a preliminary form, should be prepared and submitted as part of the planning application for the proposed solar farm. A final version should then be agreed with all stakeholders and the local planning authority prior to consent or alternatively afterwards as part of a planning condition. The BMP should be readily accessible to the public.

[1] Natural Environment and Rural Communities Act 2006, Section 41 NB this legislation has competency in England only.

[2] The Weeds Act 1959 The legislation specifies five injurious weeds: Common Ragwort, Spear Thistle, Creeping or Field Thistle, Broad Leaved Dock and Curled Dock. Under this Act the Secretary of State may serve a notice on the occupier of land on which injurious weeds are growing, requiring the occupier to take action to prevent their spread.

5. Site construction best practice

Construction of a solar farm usually takes 6-15 weeks. The construction should take account of sensitive times for protected species which have been identified through the Phase 1 Habitat Survey or EIA. Activities likely to result in disturbance or removal of habitat should be avoided during key periods for protected species, e.g. the bird breeding season (March 1st-July 31st). Good tidy site practice is recommended to avoid negative impacts on wildlife such as covering excavations, keeping tools locked up and reducing soil compaction by minimising vehicle movements and using low ground pressure vehicles, particularly during wet weather. Lighting needed during construction should be directional wherever possible to minimise light pollution to the wider environment. It should be noted that during the operational phase there should be no need for visible lighting of any kind on a solar farm.

Image: G Parker, 2013

6. Habitat enhancement options

Various options exist to enhance the biodiversity value of a site and it should be noted that while some enhancements may have broad suitability, there is no 'one size fits all' approach. Value for biodiversity can be gained through creating different habitats within a solar farm, including hedgerows, field margins, wild flower meadows, nectar-rich areas, winter bird crops and many others. In many cases comprehensive enhancements across wide areas are possible, if properly maintained through the lifetime of the project. Opportunities are likely to be more limited where the land is also being used for agricultural production.

Whatever habitat enhancement is selected it is generally desirable that the species used are native to the UK. Where possible, species selected should tie in with local and national biodiversity targets. Seed and plants should be sought from a supplier who can guarantee appropriate provenance. Ground disturbance may be an option for encouraging naturally occurring species in the soil's seed bank. Consideration may need to be given to future climate conditions in the provenance and choice for establishing longer lived species.

Each site is unique in terms of environment, location, existing biodiversity and land use, and these factors all influence which habitat enhancements will be most appropriate. Several of the more common options are presented as examples below. Some guidance documents for the establishment and maintenance of these habitats are included in the bibliography at the end of this document.

Boundary features

These are key features for biodiversity, not only as nesting and foraging areas but also as a means for wildlife to move between habitats. Boundary features include hedgerows, ditches, stone walls, hedgebanks, field margins and scrub. Usually boundary features can be enhanced with little or no impact upon the solar array. The greatest value is gained when boundary features contribute to a network of connecting features in the wider landscape.

Hedgerows

Hedgerows can support a wide variety of wildlife, including plants, invertebrates, birds, reptiles and mammals. In solar farms existing hedges can be strengthened by planting gaps, and sections of new hedge may be planted. It's important that only suitable species are selected for the planting (e.g. native, found within hedgerows locally). Existing hedges should remain intact where possible and good practice should be observed to protect hedges during construction, e.g. with root protection zones.

If removal of a section of hedge is essential, e.g. for improving access, permission may be required from the Local Authority, and this work should be conducted outside the bird breeding season (March 1st -31st July). Any loss of hedges should be mitigated elsewhere on the site, wherever possible through new planting or strengthening of existing hedges. Hedge maintenance should be carried out to favour birds and other wildlife in accordance with Natural England guidance.

Field margins

Field margins, or buffer strips, are ideal locations for biodiversity enhancements which might benefit plants, invertebrates and ground nesting birds as well as reptiles and small mammals. Solar farms often have an access route between the security fencing and the site boundary which presents an ideal opportunity for establishing habitat within the field margins. Margins should aim to be around 7-10 metres wide.

Uncropped tussocky grassland can be established as habitat for nesting bumblebees and ground nesting birds through the summer and invertebrate habitat through the winter. Such habitat is usually left uncut for 2-3 years to allow tussocks and tufts to develop.

A mix of perennial fine grasses and wildflowers such as knapweed, yarrow, scabious and bird's-foot trefoil can be established within the tussocky grassland to create habitat for pollen- and nectar-feeding insects. On light chalky or sandy soils, the seed bank of field margins can include a wide array of broad-leaved arable plants, some of which are threatened in the UK. For these species, annual cultivation to allow germination and then lack of disturbance to allow flowering and seeding is the most beneficial management. This approach requires careful management to prevent colonisation by injurious weeds.

Security fencing

Security fencing at the perimeter of the solar array provides an ideal surface for growing climbers such as honeysuckle or clematis, both of which are good nectar sources as well as providing additional screening for the site. A 20-30cm gap between the base of the fence and the ground enables movement of badgers and other wildlife without compromising the security of the site. A native hedge could be planted on the outer side of the security fencing which would add to the security value in future years and provide a visual shield as well as increasing the area of valuable habitat. However, a site-specific approach is required. For example allowing large mammal access may not be appropriate on a site designed to protect ground-nesting birds. In areas where species vulnerable to collision, e.g. grouse can be found, attention should be paid to fence design to ensure it is visible.

Grassland habitat

This can be established at the boundary of the site, under part or all of the solar arrays or some combination of both. It's important to establish some form of grassland cover quite quickly after construction, as bare soil will be prone to colonisation by non-desirable plants such as injurious weeds. There are a number of different grassland options to consider.

Usually the greatest biodiversity value is gained from a variety of grassland habitats. The best results will come from sites that contain both wild flower meadows and areas of tussocky uncropped grassland..

Wild flower meadows

A wild flower meadow is species-rich grassland composed of wild flowers and fine grasses which can support a wide range of invertebrates, small mammals, reptiles and birds. A broad spectrum of wild flower meadows exist, from a few species of fine grasses and wild flowers in their simplest form, through to complex, species rich habitats such as lowland chalk grassland, a BAP priority habitat.

The seed mix selected must be suitable for the soil type and should be composed of species that are both sun and shade tolerant, and native to the UK. A qualified ecologist should recommend a suitable seed mix, including provenance. Conditions within the site must be considered: ex-arable sites may not be suitable for immediate conversion to wild flower meadow where higher nutrient values still exist. A soil test to evaluate the nutrient levels is essential, as wildflower meadow establishment is rarely successful on land with a Phosphate index above 1. Advice should be sought from an experienced ecologist during the establishment phase.

A wild flower meadow could be sown beneath the array (successfully implemented at a number of solar farms) or in strips around the edge of the site. Where a meadow is established beneath the array, care should be taken to ensure the vegetation will not over-grow and shade the panels.

Establishing a wild flower meadow can take several years and its important good practice is followed. Once established, meadows tend to be quite stable and with suitable management can remain in perpetuity without the need for fertilizers or herbicides. A meadow requires only cutting or grazing at intervals through the year, with the timing of these activities being dependent upon management goals. As a general rule a hay cut in July or August followed by grazing until Christmas is recommended. It is advisable to stop or reduce grazing through the summer to allow wild flowers to flower and set seed. A maintenance plan should be specified in the BMP, including the timing of cutting or grazing.

Pasture

Pasture is grassland established primarily for grazing by livestock which can be established beneath the solar array or around the margins of the site. Greater benefits for wildlife can be gained from sowing a mix of fine grasses. Native wildflower species can be added to the mix to provide nectar over a longer period each year if the soil is not too nutrient-rich. Native red clover should be included in the mix as this species is particularly attractive to bumblebees.

Pasture is a common agricultural option so is a less expensive option to establish, but it does require re-sowing at regular (3-4 year) intervals and does require some agricultural inputs. This option is lower in biodiversity value than the above grassland options but can still provide a nectar source through mid-summer. Reducing or stopping livestock grazing through the summer will maximise flowering to the benefit of bees.

Pollen and nectar strips

Pollen and nectar strips are designed to provide food for pollinating insects through the summer period. Such mixes are relatively cheap, being composed of more common and agricultural species such as sainfoin, red clover and bird's foot trefoil. Pollen and nectar seeds can be sown in strips, either along rows within the solar farm, or at its edge. Such mixes usually require re-sowing every 3-4 years.

Wild bird seed mixes

Wild bird seed mixes are established to provide food for wild birds. These mixes are sown in the spring and left standing as a seed crop for birds through the winter. These mixes are usually grown in strips and are ideal for boundaries or wayleaves. Such crops usually contain a mix of cereal and oil-rich crop such as quinoa or oilseed rape and need to be re-sown annually. Allowing arable wild flowers to grow, or including additional species such as flax, will add further value.

Bare uncultivated strips

Strips of bare ground could be left uncultivated for the maintenance and propagation of rare arable plants, where appropriate. Small areas of bare ground with undulating profile may also benefit ground active and warmth loving invertebrates. The location of bare strips should be advised by an ecologist and such interventions should be monitored periodically for injurious weeds.

Woodland habitat

Woodland may not be suitable within the solar array due to shading, but can provide screening on the northern boundary or in areas bordering the solar park. Any planting should be composed of native species and where possible should tie in with local and national biodiversity targets. The planting pattern should include open glades and rides to provide a variety of structure within the woodland. Alternatively, wood pasture or parkland may be appropriate.

Ponds and water courses

All wet areas on a solar farm, be they ponds or ditches, will be beneficial to invertebrates, amphibians, birds and reptiles as long as high water quality is maintained. New ponds should be created on habitat of low wildlife value and an ecologist should advise on their siting, design and management. Ditches will usually attract the most wildlife if a variety of conditions are provided, including shady and sunlit areas, shallow water and deeper sections. It will be necessary to get a license from the Environment Agency if substantial changes are planned to an existing water course. All ponds and water courses will benefit from a wide buffer of uncropped grassland along their edge.

Artificial structures

A variety of structures can be built to provide suitable habitat for nesting, roosting and hibernation.

Hibernacula

Hibernacula are log, rock and stone piles designed to create suitable conditions for reptiles and amphibians to hibernate. Advice on design should be sought from an ecologist.

Habitat for invertebrates

Log piles should consist of a mixture of hard wood and soft wood and left undisturbed to rot down. Log piles should be placed in both sunny and shady habitats to benefit the widest variety of invertebrates. Butterflies and solitary bees prefer sunny areas while stag beetles prefer shade. Log piles can also provide suitable conditions for reptiles, amphibians, lichens and fungi.

Roosting and nesting

Birds, bats and small mammals can benefit from the provision of artificial nesting and roosting structures. The type of box and its location should be specified by an ecologist to increase the chances of success. Usually nesting and roosting boxes would be located within hedgerows and woodland but suitable habitat can also be created within the solar array itself: planks have been affixed to frames as nesting habitats for blackbirds and other farmland birds. Built structures such as control buildings can be designed or adapted to promote and enhance access for roosting, nesting and/or hibernating. A number of more specialist structures can be built for invertebrates including 'bug hotels' with small holes for solitary bees and wasps, and beetle buckets for stag beetles to lay their eggs.In some cases small areas of bare ground may benefit certain invertebrates.

It should be noted the habitat enhancements listed here are a selection of the more common options known to be successful within solar farms. Many other options exist (e.g. scrub, heath, wetland, coppice...) and well-conceived new approaches, endorsed by conservation organisations, should be encouraged on solar farms.

7. Managing the site for biodiversity

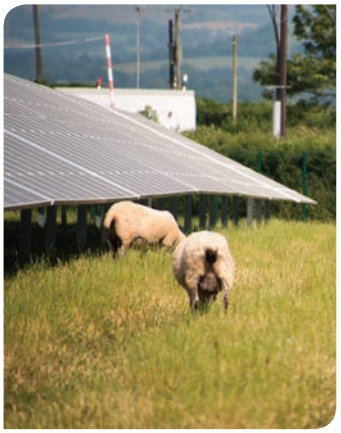
Appropriate management is vital to ensuring habitat enhancements deliver benefits to biodiversity. If management is not suitable, or is discontinuous, then any benefit may be lost. For example, if a wild flower meadow is seeded but then cut or grazed at the wrong time of year, or if fertilizer is applied, many of the wild flowers will be lost. Conversely, where management is appropriate, wildflowers may appear spontaneously from the natural seed bank.

Generally management for biodiversity is less intensive than typical agricultural land management, which means costs are also lower. For example, hedges would be cut every 3 years instead of annually; tussocky grass field margins would be cut every 2-5 years. This reduces disturbance to the habitat, enhances structure and promotes flowering and fruiting.

The greatest benefits for biodiversity will be gained on sites where fertilizer and pesticide use is minimised. Such an approach will significantly reduce management costs and enable floral and invertebrate diversity to increase over time. Consideration must be given to ecologically appropriate control of weeds, especially those injurious weeds which must be controlled by law. Seeding or planting any bare areas of site is usually the best means of preventing weed colonisation. Regular monitoring should be undertaken and if weeds become a problem rapid action should be taken. A variety of guidance exists on this topic – see bibliography for further details.

The BMP should outline management activities with prescriptions on methodology, timing and frequency. Site management and contractors should be made fully aware of the biodiversity objectives for the site and specifically any protected species that occur. Management activities should follow established good practice such as that provided by Natural England and non-Government conservation organisations – see bibliography for further details.

8. Grazing



Low intensity grazing can provide a low cost means of managing grassland as well as increasing its conservation value. Grazing also enables the land to remain agriculturally productive, although it should be noted that higher intensity grazing is unlikely to be beneficial to wildlife.

Sheep are the usual choice for solar farms, being generally small enough to pass beneath the rows of panels. They are usually available and also easy to handle. Sheep have been successfully used at multiple solar farms for several years. Hardy breeds are usually best suited to autumn and winter grazing where the grazing is less nutritious. Larger stock such as horses and cattle are not considered suitable due to their ability to damage the arrays.

A qualified ecologist should assist with the development of a conservation grazing regime that is suited to the site's characteristics and management objectives, and this regime should be incorporated into the BMP. If grazing is being conducted with biodiversity in mind, then a lower stocking density should be maintained so that the grassland retains some structural diversity. Maintaining grassland structure through the winter is good for invertebrates.

Grazing should be stopped for periods of the spring and summer. Stopping grazing in the spring (April – June) will favour early flowering plants, whereas summer (July-September) will favour summer flowering herbs. Ceasing grazing April-September will return the greatest biodiversity benefits but it is appreciated this may not always be possible. A combination of low stocking density and breaks in grazing should lead to a high diversity of wild flowers and invertebrates as well as benefiting ground nesting birds and mammals.

Where grassland is being managed for ground-nesting birds light grazing is usually acceptable but topping or mowing must be avoided through the spring and summer months.

If grazing is being conducted with agricultural production as the primary goal then the landowner may choose to graze livestock at higher stocking densities through much of the year. While the biodiversity value of the pasture would be minimal, this approach does not preclude the use of other habitat enhancements, such as hedgerows and field margins which can still provide benefits to biodiversity from the wider site.

9. Monitoring biodiversity

Monitoring is a fundamental component of biodiversity management and requires thorough planning to identify key indicators, establish baseline conditions prior to development and assess biodiversity changes through the life of the project. The monitoring section of a BMP should provide details of key elements of biodiversity to be monitored, the method of monitoring and frequency and time of year the activity should be carried out.

Key elements of biodiversity, including protected species and BAP priority habitats, should be measured at regular intervals. If a protected species is found on site and specific enhancements have been made, this species should be surveyed at least annually at a suitable time of year to check its status (providing this doesn't result in disturbance to the species). Likewise, a specialist habitat such as a wild flower meadow should be carefully monitored to ensure it develops to its full potential. For habitat monitoring it's usually advisable to identify a small number of indicator species. Monitoring should be undertaken by a qualified ecologist with training in the species or habitat of interest.

All habitat enhancements should be checked regularly to ensure they are working properly and nothing has gone wrong. For example, any plantings should be assessed in spring and autumn to ensure the plants have taken and remain healthy. The entire site should be checked regularly for injurious weeds. Nesting and roosting boxes should be cleaned and checked for structural integrity outside of the breeding season.

An adaptive management approach should be adopted whereby the results of monitoring feed back into the management of the site. This means that if problems are identified during monitoring, e.g. a flush of injurious weeds on part of the site, then appropriate management action should be rapidly taken. Likewise, if positive results are returned, e.g. an increase in a particular bird species nesting on site, then consideration should be given as to how to maintain and maximise this success. Such management revisions are likely to require specialist ecological knowledge and discussion with appropriate conservation organisations.

Monitoring activities should be described in full within the BMP, but can be summarised in table form, as below.

The cost of monitoring must be factored into the land management of the site and becomes a significant expense where professional ecologists are used. It may be possible to engage amateur naturalists to take on key elements of monitoring, e.g. birds, but it is the responsibility of site management to ensure such surveys are undertaken to the standards required to provide the evidence necessary to inform the BMP.

There is an opportunity for the solar industry to invite members of the conservation community to periodically audit solar farms and gauge the progress made in implementing the various elements of the BMP. Such an approach would provide an independent assessment of developments at a site level and would enable the sharing of management experience – both successful and unsuccessful – among members of the industry.

Biodiversity element	Monitoring activity	Key indicators	Target	Frequency	Time of year
Hedgerows	Walk full length of hedgerows	Check for browse damage, dead whips, weeds, gaps	Species mix and density of original planting is maintained	Annually	Summer
Woodland	Inspect all new plantings	Check for browse damage, dead whips, weeds	Species mix and density of original planting is maintained	Annually	Summer
Wild flower meadow	Walk full length of grassland habitat	Count herbs flowering – check against seed mix species list Check for injurious weeds in high density	ID indicator species for year 1 Species richness should approach seed mix by year 5	3 times during first year of establishment, then annually	3 times between March and July in 1st year, then July
Nest boxes	Inspect each box	Check boxes are intact, secured, previously used for nesting, clean	25-50% of boxes occupied by target species in year 2	Annually	Winter
Birds	Walk-through of entire site plus point surveys in early morning	Record all birds, especially arable priority species. Check against target bird species list in BMP	Bird species increase by year 5	Annually; repeat 2-3 times per session	Summer (March – August).
Reptiles	Check reptile suntraps	Record all species	Reptile species maintained or increased by year 5	Annually; repeat 2-3 times per session	Summer

10. Case Studies

Wiltshire Wildlife Trust developing Chelworth solar farm for the local community and biodiversity

Concern about the long term impact of climate change on wildlife led Wiltshire Wildlife Trust to engage with the renewable energy sector. Solar PV was identified as a the most appropriate technology that could both contribute successfully to renewable energy targets and, at the same time, provide a net biodiversity gain if implemented at the right site.

Part of the Trust's land adjacent to an industrial estate was identified as a suitable site. A new community benefit society, Wiltshire Wildlife Community Energy, was formed with the support of Bath and West Community Energy to develop the site. A share offer issued to Trust members and local people was launched in July 2013. It was hoped the share offer would contribute to the estimated cost of £1.2million, but in just 2 months the entire cost of the scheme was met, reflecting strong local support.

The site is a brownfield site which hosted a small population of great crested newts. It was fully surveyed and has now been temporarily cleared of newts under a European Protected Species licence from Natural England (eight newts were found in 30 days, in the grassland habitat). Construction started in February this year and, when it is completed, the newts and many other species will be free to return to an improved and economically secure nature reserve, that includes a new pond.

Grassland on-site will be restored to wildflower meadow, combining shade tolerant species with plants favouring more open sunlight. Grassland planting has been chosen to reflect the mixed shade and light conditions that will exist under the solar array, and it will subsequently be grazed by Trust-owned sheep. As well as newts, it is expected that the site will support other local populations of protected species, such as reptiles and brown hairstreak butterfly in surrounding hedgerows.

RSPB using solar farm planting to nourish farmland birds

Farmland birds require insect rich habitat in the breeding season, seed rich habitat in winter and in-field nesting habitat. Provision of these measures also benefits a range of other wildlife including insects, arachnids and small mammals. The RSPB advocates achieving meeting these three seasonal needs to support birdlife through careful zoning on the ground.

Insect rich habitat (nectar flowers) should be sown and managed every first and second row. In-field nesting habitat (fine grasses) should be sown and managed every third row for priority species such as skylark. This also provides habitat for small mammals and larvae of pollinating insects, including butterflies and moths. Seed rich habitat (wild bird seed mixture) should be sown around the installation, where access dictates, and should be managed on an annual basis. This provides vital food for farmland birds and small mammals.

The fine grasses in nesting areas should include common bent, creeping red fescue, hard fescue and smooth stalked meadow grass. Good nectar producing plants include clovers, birdsfoot trefoil, black medick, common vetch, Phacelia, sainfoin and lucerne. Seed food over the winter months can be provided through a mix of mustard, spring wheat, millet, triticale and barley.

The RSPB has applied these measures to Uphouse Farm's new solar pv installation, which powers indoor chicken production, in Fakenham. Nectar rich areas were created in autumn, which will yield food sources for a range of insects including butterflies, moths, beetles and hoverflies. Areas of fine grass areas for mammals and insects were also established. These areas are followed in spring with establishing wild bird seed mix areas, to which unharvested seed bearing plants such as wheat, barley and oats will be added, providing a huge boost for seed eating farmland birds, such as yellowhammers, in the winter.

More information on recommended mixes and sowing rates is available in the RSPB's solar farm guidance information at www.rspb.org.uk/solarfarmadvice

Solarcentury and Bumblebee Conservation Trust partner to boost bumblebees

Solarcentury and Bumblebee Conservation Trust (BBCT) have partnered to promote the use of solar farms in alleviating the plight of the bumblebee, which has declined dramatically. The partnership will promote the development of bee-friendly environments by creating biodiverse spaces in and around the solar farms Solarcentury has developed.

In the last 100 years bumblebee populations have crashed, with two species becoming extinct in the UK. Solar farms are ideal environments for bee habitats because they can support a range of attractive micro-habitats. The variety of dry and wet and shaded and sunny areas, if properly planted and managed, can encourage a much wider variety of fauna than improved grassland alone.

When Solarcentury develop a solar farm, they plant acres of wildflower meadows with native seed mixes that are specifically designed to attract a diversity of wildlife. Solarcentury farms are fenced off, and are frequently situated in remote areas, which creates a safe haven for wildlife. So in addition to generating clean, carbon-free energy, solar parks are also helping to reinvigorate the British bumblebee.

Solarcentury and BBCT plan to engage communities local to solar parks to highlight how people can grow particular plant species in their gardens and public spaces to support bees. It is hoped that this 'positive loop' between solar farms and local green spaces will further encourage the establishment of healthy bumblebee populations, as well as Britain's rarer bumblebees.

BBCT in working with Solarcentury hope to enhance the prospects of Britain's bumblebees, including the rarest Shrill carder and the Brown-banded carder species. Together, there is the prospect of improving the quantity and diversity of wildlife both within the solar farms and in nearby communities. Solar farms have the potential to breathe life into the bumblebee population and contribute to a vision of communities and countryside rich in bumblebees and colourful flowers.

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