Biodiversity Net Gain

What are the opportunities for insect pollinator conservation?

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Executive summary

- This document is a personal appraisal of the opportunities presented by the implementation of Biodiversity Net Gain (BNG) to support and increase populations of wild pollinators such as bees, hoverflies, moths and butterflies. This in turn will impact the prospects for future Environmental Net Gain (ENG).
- The requirement of developers to compensate biodiversity losses by at least 10% over and above what has been lost, and to guarantee that compensated land for at least 30 years, could have profound positive effects for pollinators.
- To take advantage of these opportunities, stakeholders such as developers, planners, ecological consultants, and those involved in habitat banking, need to understand the requirements of pollinators.
- When designing, restoring, or managing habitats with pollinators in mind, including new urban developments, these factors are especially important:
    - Realisation that pollinators need more than flowers
    - Understanding that different types of habitat can support equally diverse, but often distinctive, assemblages of pollinators, with some rare species having very particular requirements
    - Supporting pollinators within a landscape requires seasonal continuity of resources, especially pollen and nectar
    - Insect pollinators vary in their mobility, so connectivity between habitat patches is important
    - Appropriate monitoring needs to be put in place to understand if and how BNG has improved pollinator populations
    - An expansion of beekeeping is not a solution to pollinator decline and in fact may worsen the current situation
- Organisations interested in focusing their BNG on pollinators would benefit from taking advice from subject experts and involving their staff in training events focused specifically on pollinators and pollination
- This document will evolve as BNG becomes more established within the UK planning system and knowledge gained can be fed back into guidance
- More detailed information on pollinator ecology and conservation can be found in my recent book *Pollinators & Pollination: Nature and Society* (Pelagic Publishing 2021)

Disclaimer: this document represents the personal opinions of the author and should not be considered the final word on the topic nor a statement of the legal position or planning requirements relating to BNG. Please address any comments or corrections to: jeff.ollerton@gmail.com

Background to Biodiversity Net Gain

In January 2024, the most important and potentially impactful development in wildlife conservation for a generation will come into effect[1]. Biodiversity Net Gain (or BNG) will become a mandatory requirement for all large developments, for smaller developments from April 2024, and Nationally Significant Infrastructure Projects at some point in 2025.

The UK Government describes BNG as:

> *an approach to development, and/or land management, that aims to leave the natural environment in a measurably better state than it was beforehand*[2]

The expectation is that after BNG is initially rolled out in England, then Wales, Scotland and Northern Ireland will follow in the future. Other countries, in the European Union and beyond, are also looking with interest to see how successful the UK's approach to BNG is at conserving wildlife.

Much has been written about BNG mechanics and developer obligations, but at the time of writing, in summary:

- Any planned development or change in land management must be accompanied by a *minimum* 10% gain in biodiversity relative to what has been destroyed
- The gain can be delivered on-site, off-site or via a newly developed statutory biodiversity credits scheme
- This gain must be calculated using Defra's Biodiversity Metric[3] and the biodiversity gain plan approved
- The resulting habitat must be protected and secured for at least 30 years
- There will be a national register of BNG delivery sites
- Appropriate design, restoration and management of habitats is critical to the success of BNG, whether the aim is to support a wide range of wildlife or to boost the numbers of a specific set of species, such as pollinating insects

[1] Timetable as of 27th September 2023 – see: https://www.gov.uk/government/news/biodiversity-net-gain-moves-step-closer-with-timetable-set-out
[2] https://www.local.gov.uk/pas/topics/environment/biodiversity-net-gain-local-authorities/biodiversity-net-gain-faqs
[3] https://publications.naturalengland.org.uk/publication/6049804846366720

Why pollinators?

Quite rightly, BNG centres on habitats as the main unit of conservation. There is, however, a growing demand to also consider the needs of particular groups of species, e.g. birds, reptiles and amphibians, and whether the habitats that are created under BNG can support these species and the ecological functions that a site is meant to provide.

The focus on pollinators in this report is due to concerns about the loss of pollinating insect diversity and abundance. Pollinators are a vital component of agricultural and natural habitats. As well as pollinating crops such as orchard fruit, oilseed rape, and field beans, in the UK insects ensure the reproduction of three quarters of our native trees, shrubs and herbaceous plants[4].

The importance of pollinators cannot be over-emphasised. A recent EU policy brief stresses how pollinators are key players within the United Nations' Sustainable Development Goals (SDGs)[5] whilst an opinion piece in New Scientist by the author has highlighted their under-appreciated role in combatting climate change[6]. Increasingly, the SDGs form the basis for corporate responsibility and sustainability strategies for many companies and organisations. BNG strategies that incorporate promotion of habitats for pollinators thus can be legitimately linked to the United Nations' SDGs.

The conservation picture for pollinators in the UK is mixed. Some species are doing very well and have stable or increasing populations. Others are doing less well and have declined significantly or even gone extinct in this country[7].

The most recent JNCC Biodiversity Indicator on the Status of Pollinating Insects[8] looks at hoverflies and bees and the overall conclusion is that:

> *There was an overall decrease in the pollinator indicator from 1987 onwards. In 2019, the indicator had declined by 21% compared to its value in 1980. The long-term trend was assessed as declining.*

[4] Ollerton, J., Tarrant, S. & Winfree, R. (2011) How many flowering plants are pollinated by animals? *Oikos* 120: 321–326

[5] https://cordis.europa.eu/article/id/442752-pollinators-biodiversity-and-sustainable-development-go-hand-in-hand

[6] Ollerton, J. (2021) Protect the pollinators: pollinators have a critical, but largely unappreciated, role to play when it comes to climate change. New Scientist 3326: 23

[7] Ollerton, J., Erenler, H., Edwards, M. & Crockett, R. (2014) Extinctions of aculeate pollinators in Britain and the role of large-scale agricultural changes. *Science* 346: 1360-1362

[8] https://jncc.gov.uk/our-work/ukbi-d1c-pollinating-insects/

Much of this decline is driven by changes in hoverfly populations rather than bees, but for the majority of the flies, wasps, beetles and other groups that make up the bulk of the UK's pollinators, we have little information on their long-term trends. This is why the UK Pollinator Monitoring Scheme (PoMS) was introduced in 2017[9].

The exception to this lack of longer-term data is for butterflies. These have their own JNCC Biodiversity Indicator[10], which shows that:

> *[since 1976] populations of habitat specialist butterflies have declined significantly though species of the wider countryside show no significant change. Since 2016, both short-term trends show no significant change.*

This mixed picture – with optimism for some types of pollinators and pessimism for others – gives us no room for complacency. Appropriate design, restoration and management of BNG habitats can play an important role in allowing pollinators to thrive.

Note that the situation regarding honey bees is complex, but in summary, the current number of managed hives in the UK is as high now as it was in the mid-1950s[11]. Wild colonies of honey bees are also frequently encountered during ecological surveys and whilst we don't have a clear picture of what is happening in the UK, in Ireland wild colonies are abundant and successful[12].

The purpose of this report is to give an initial appraisal, based on my own research and experiences, as well as collaborations and recent projects, and discussions with ecological consultancies, of the opportunities presented by the implementation of Biodiversity Net Gain (BNG) to support and increase pollinator populations.

[9] https://ukpoms.org.uk/
[10] https://jncc.gov.uk/our-work/ukbi-c6-insects-of-the-wider-countryside/
[11] https://jeffollerton.co.uk/2022/07/13/have-honey-bees-declined-in-britain-an-update-of-the-numbers/
[12] Browne, K.A. et al. (2021) Investigation of free-living honey bee colonies in Ireland. *Journal of Apicultural Research* 60: 229-240

Pollinators need more than just flowers

In the UK, at least 6,000 species[13] belonging to several different orders of insects regularly or occasionally visit flowers to feed on nectar or pollen, hunt for prey, to find mates or egg laying sites, or to warm up prior to flight. These bees, wasps, butterflies, moths, flies and beetles have diverse life histories, live in a wide range of habitats, and often require very different resources (Figure 1).

A significant amount of the present focus on habitat creation for pollinators emphasises the need to plant or encourage the growth of flowers that contain nectar and/or pollen. This is fine as a first step, but if these populations are to be sustained, as well as flowers on which to feed, pollinators require places in which to reproduce. A few examples include:

- Nesting sites for bees – almost half of the 270 or so native bee species nest in soil or underground cavities. Relatively few use holes in wood or stone as nesting sites, which means that "bee hotels" are of value for only about 10 species.
- Host plants for the caterpillars of butterflies and moths can be very specific, for example various ragworts in the case of Cinnabar moth and nettles (occasionally hops) in the case of Peacock and Small Tortoiseshell butterflies. Other species are more generalist, such as the Silver-Y moth that feeds on at least 200 different plants.
- Longhorn beetles, which regularly visit flowers as short-lived adults, feed on dead and decaying wood during their larval stage, which can last several years.
- Hoverflies lay their eggs in a wide range of different microhabitats, for example on leaves close to aphids (on which the larvae feed), in freshwater, on dead wood, or in dung.

[13] Steven Falk, unpublished data cited in this study: https://www.britishecologicalsociety.org/applied-ecology-resources/document/20210100953

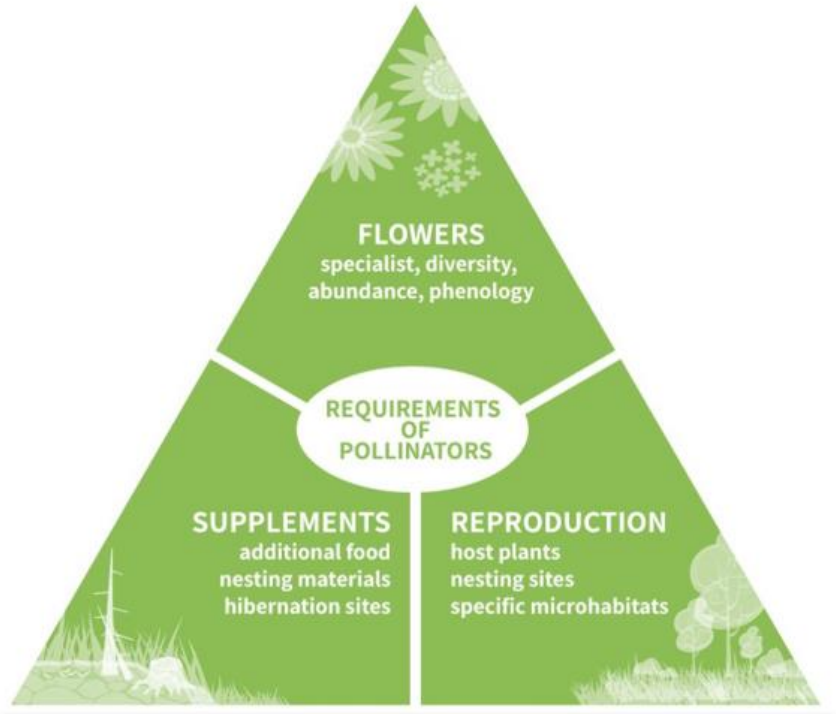

Figure 1: The "requirements of pollinators triangle". Each of the three vertices of the triangle represents one of the sets of factors that allow pollinators to survive and produce offspring. Design by Sari Kaija of advertising agency Kuke (https://kuke.fi) based on the original in Pollinators & Pollination: Nature and Society *(Pelagic Publishing).*

The third vertex of the "requirements of pollinators triangle" (Figure 1), which I refer to as "supplements", includes a diverse range of resources and habit requirements. These include hibernation sites, materials for nest building, and presence of prey to feed to larvae in the case of carnivorous wasps. The only way to ensure that these three sets of requirements are met for as wide a range of pollinators as possible, is to ensure that habitats are plant species rich, structurally diverse and with a heterogenous topology. In the UK this often means a mosaic approach to habitat creation in which a landscape is comprised of smaller, mixed patches of distinctive vegetation types, such as woodland, scrub, grassland, and wetland.

The value of different habitats for pollinators

Species-rich grasslands are often considered to support the highest diversity of pollinators, but in fact scrub, woodlands, and heath can support equally diverse, but often distinctive, assemblages of pollinators. The value of ancient woodlands for pollinators, in particular, has been under-estimated. In a recent Woodland Trust report by entomologist Steven Falk[14], for instance, it was found that:

- 320 native insect species that are saproxylic (associated with dead wood, old trees and tree wounds) also visit flowers, including 130 species of beetles, 85 flies, 35 bees and 75 wasps
- This represents 16% of the c. 2,000 species of saproxylic insects in the UK and is considered a conservative estimate as some groups were not included in the review

The high canopy of woodlands, where most native trees flower, can also support a diverse and abundant assemblage of bees that is often not apparent from ground-based surveys[15].

Some habitats support rare species that have very particular requirements, for example lowland heath which is the only place in which to find species such as the Heath Bee-fly[16] and saltmarsh and other coastal habitats which supports the Sea Aster Mining Bee[17].

Habitat quality, especially the age of a site, is crucial. One of the concerns of BNG is the possibility that old sites that have accumulated significant insect pollinator diversity may be sacrificed for more recently developed areas of similar habitat which, although larger, may not have the same diversity. Size, however, is not the only consideration: type of management is also important. In a survey of woodlands it was found that, although the ground flora of larger woodlands tended to support more pollinating insects, there was a lot of variation between woodlands. The number of plants and pollinators depended on how on how the wood was managed as well as the size. In Figure 2, the woodlands marked with arrows are similar in size, but the more diverse of the two is actively coppiced whilst the less diverse woodland is completely unmanaged. The active management allows more light to reach the woodland floor, stimulating the growth and flowering of the ground flora, and so supporting more pollinators.

[14]https://www.britishecologicalsociety.org/applied-ecology-resources/document/20210100953
[15] https://jeffollerton.co.uk/2022/11/14/the-hidden-potential-value-of-woodland-trees-for-wild-bee-assemblages-lead-author-guthrie-allen-introduces-his-recently-published-study/
[16] https://naturebftb.co.uk/wp-content/uploads/2020/05/Heath-Bee-fly.pdf
[17] https://cdn.buglife.org.uk/2019/07/Sea-aster-mining-bee-management-guidance-sheet.pdf

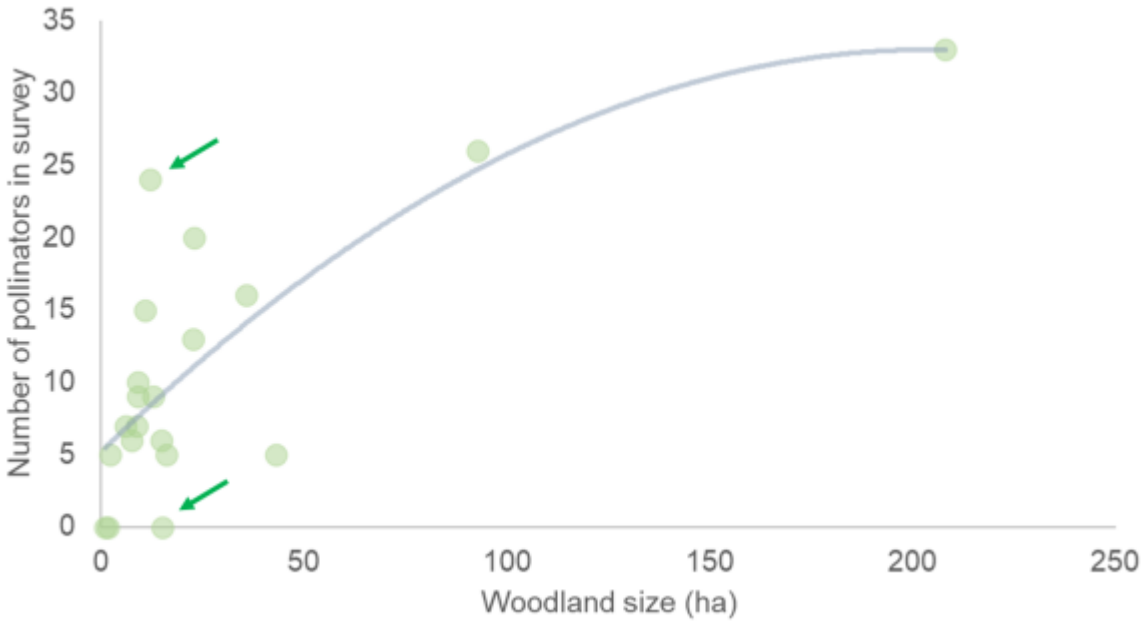

Figure 2: Pollinator diversity found in surveys of the ground flora of woodland patches across Rockingham Forest, Northamptonshire. The two woodlands marked with arrows are of similar size, but differ significantly in the diversity of pollinators that they support (Rose, McCollin & Ollerton, unpublished data)

Seasonal continuity of nectar and pollen is also important. Newly created hedgerows and woodland, for instance, can potentially flower and provide these resources for 10 months if the year if they are properly designed and appropriately planted (Figure 3). These have advantages over "wildflower meadows" or "flowering strips" in that they are easier to manage, and are permanent and predictable landscape elements.

As well as providing nectar and pollen, appropriately planned hedgerows offer other positive benefits to pollinators. For example, queen bumblebees often hibernate in the drier, more sheltered soil at the base of the hedge. Hedgerows can also link together otherwise isolated habitat patches as we know that bees, butterflies and hoverflies navigate using hedge lines and other "linear landscape features"[18]. This is especially important for central-place foragers such as bees, which return regularly to their nests to provision their larvae. Large species such as bumblebees can forage over distances of 2.5km in a single trip, so the position of any new or newly managed habitat needs to be considered in terms of landscape connectivity.

[18] Cranmer, L., McCollin, D. & Ollerton, J. (2012) Landscape structure influences pollinator movements and directly affects plant reproductive success. Oikos 121: 562-568

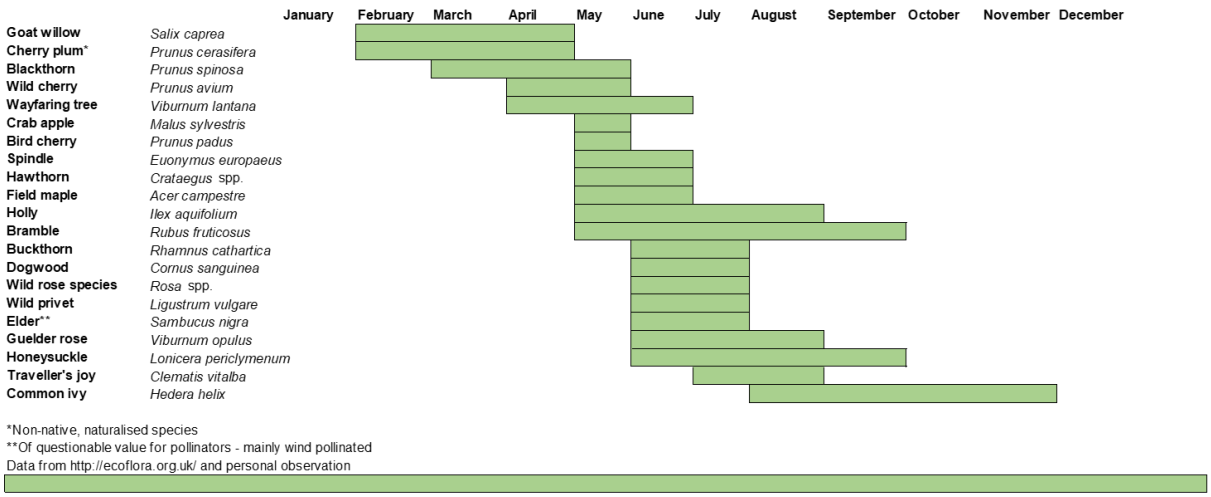

Figure 3: Flowering times of UK hedgerow & woodland edge trees, shrubs and woody climbers. With the exception of Cherry plum, all species are considered native.

BNG and beekeeping

In recent decades, beekeeping has been presented as an opportunity to reverse declines in pollinators, especially in urban areas, with companies offering to install hives to gain Building Research Establishment Environmental Assessment Method (BREEAM) credits[19]. Western honeybees (*Apis mellifera*) are a largely managed species with wild/feral colonies. As mentioned, available data shows that the numbers of hives in the UK are similar now to they were in the 1950s and thus honey bees are not an endangered or declining species[20].

Under the new BNG system, adding bee hives to a site does not provide credits as part of the site assessment. Hives might, however, be requested by developers for their novelty factor or to generate a good news story. This should be resisted.

It's clear that in some large conurbations, London for instance, there are not enough floral resources available for the current density of hives and that honey bees can have negative effects on other wildlife[21]. Some professional beekeepers accept that the presence of hives within urban areas and adjacent to nature reserves can have

[19] https://www.alveole.buzz/earning-green-building-certifications-with-beehives-and-alveole/
[20] https://jeffollerton.co.uk/2022/07/13/have-honey-bees-declined-in-britain-an-update-of-the-numbers/
[21] https://www.nhm.ac.uk/discover/news/2020/september/beekeeping-in-cities-harming-other-wildlife.html

detrimental effects on wild pollinator populations through competition and over-spill of honey bee diseases to wild bees[22].

In summary, placement of honeybee hives should not be encouraged in BNG compensation areas or as additions to new urban developments.

Monitoring of pollinator populations

Any habitat restoration, management or creation that is designed with pollinators in mind is only going to be as good as the long-term ability of that habitat to support those insect populations. In order to demonstrate a positive impact on pollinator populations for reporting purposes, appropriate monitoring needs to be put in place. This can adopt the approaches, and potentially feed into, existing initiative such as the UK Pollinator Monitoring Scheme (PoMS)[23] or the UK Butterfly Monitoring Scheme (UKBMS)[24].

A more rigorous assessment of pollinator populations in a BNG site would preferably go beyond simply counting numbers of adult insects. Being often highly mobile insects, pollinators may be drawn into an area from the surrounding habitat, resulting in a shift in existing insects rather than an increase in the sizes of populations. It is therefore more appropriate to monitor breeding success, e.g., numbers of butterfly and moth larvae, density of bee nests sites, and so forth.

Whichever approach is adopted, advice should be sought from experienced field entomologists who have knowledge of the insect groups concerned.

[22] https://www.apicultural.co.uk/do-managed-honey-bees-compete-with-wild-bees-for-floral-resources
[23] https://ukpoms.org.uk/
[24] https://ukbms.org/

Final comments: pollinators and Environmental Net Gain (ENG)

Biodiversity Net Gain (BNG) is one component of what is termed Environmental Net Gain or ENG, which is defined by the National Infrastructure Commission[25] as:

> *an approach to development that leaves both biodiversity and the environment in a measurably better state than prior to development – as measured by the biodiversity measures, alongside a broader range of measures of ecosystem services (e.g. recreation, flood protection) and environmental metrics (e.g. air quality)*

One of these "measures of ecosystem services" i.e., the benefits that society derives from the natural word, is of course insect pollination of agricultural crops. But wild plant pollination is also important and, indeed, many ecosystem services are directly or indirectly underpinned by pollination services to these plants, which is why they are so important for the United Nations' SDGs. For these reasons, support for pollinator populations using BNG is a vital component of the UK's strategy for nature conservation and for building sustainable, resilient communities.

Acknowledgements

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[25] https://nic.org.uk/app/uploads/Updated-Natural-Capital-Paper-Web-Version-Feb-2021.pdf

About the author

Scientist and writer Professor Jeff Ollerton has studied and written about pollinators and their interactions with flowering plants for over 30 years. As author of around 160 highly cited research papers, book chapters and articles, he is considered a world authority on the subject of pollinator biodiversity and conservation. Jeff has acted as an advisor, reviewer and consultant for local and national government departments including Defra and the USDA, for NGOs and businesses, and for organisations such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

This experience was distilled into a recent book, *Pollinators & Pollination: Nature and Society* (Pelagic Publishing, 2021). His next book, *Birds & Flowers: An Intimate 50 Million Year Relationship*, will be published in late 2023.

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