why biodiversity net gain requires an ecological permission system

Emma Gardner, **Adam Sheppard** and **James Bullock** argue that an ecological permission system is essential if we are to genuinely achieve biodiversity net gain

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A requirement for BNG is a key moment of opportunity — but its implementation is not without challenges

Biodiversity net gain (BNG) is an approach to development that aims to leave the natural environment in a measurably better state than beforehand. In the Environment Bill of 2020, the government announced its intentions to embed BNG in the planning system by including a requirement to demonstrate net gains for biodiversity in association with securing planning permission. This intention has now been enacted through the Environment Act 2021 (applicable to England only), with implementation intended for some point in 2023 via the use of general (standard) pre-commencement planning conditions, agreements or covenants, and requiring the approval of a biodiversity net gain plan before development on site commences.

The introduction of the requirement for BNG is a seminal moment in the interface between planning and ecology. However, although presenting a moment of opportunity, BNG is not without challenges.

Although it is pending introduction as a formal requirement, early adopters of BNG have already set policy requirements; as of April 2022, property

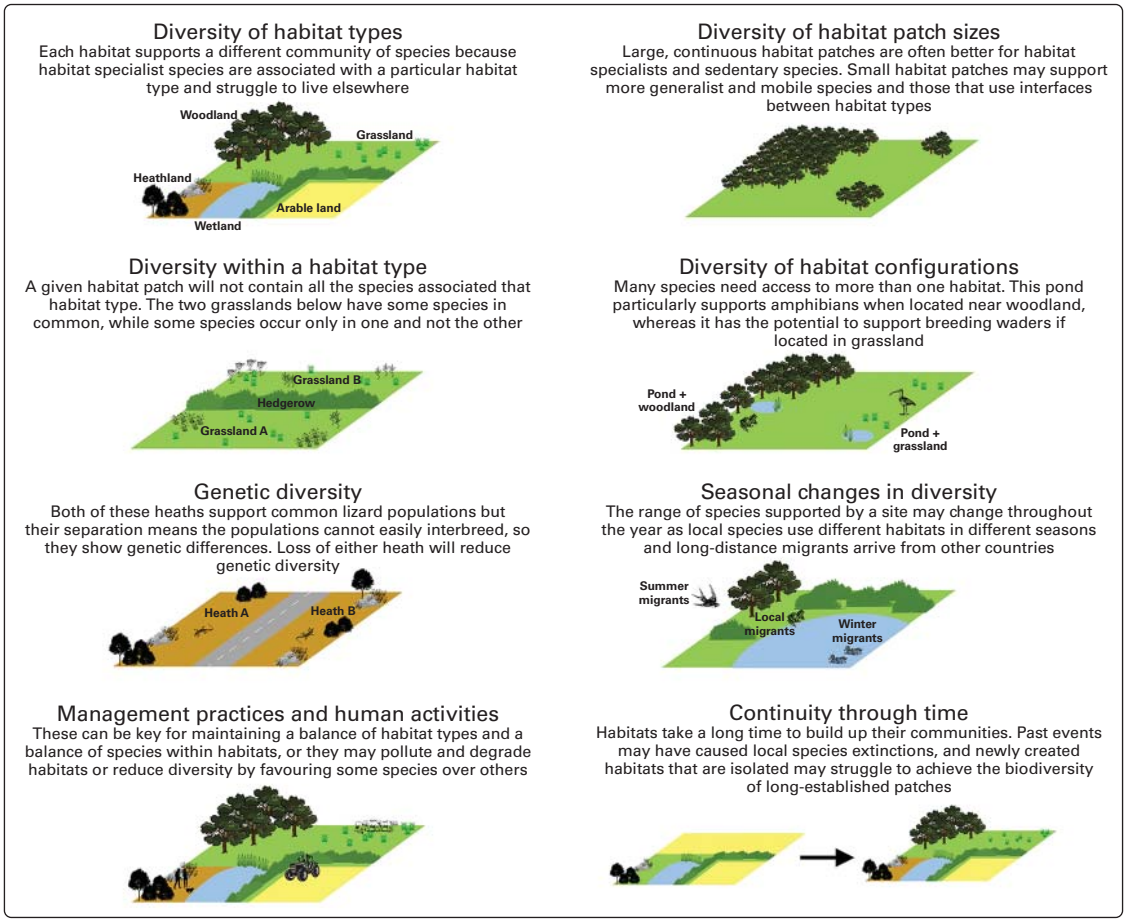

Fig. 1 Factors contributing to the biodiversity of an area—biodiversity is underpinned by variations in local geology, hydrology, topology and climate, which all affect which species and habitats can occur where

consultants Carter Jonas reported that some 5% of local planning authorities were assessed as having an adopted policy, and a further 23% had an emerging policy.[1] Existing practice, driven by policy requirement and/or best practice initiatives, provides some insights into the potential of BNG policy. Early research into existing BNG practices prior to finalisation of the current legislation has already highlighted limitations, including governance, delays between habitat loss and creation, and concerns around discrepancies between the reported and actual conditions of habitats.[2]

This article looks at a further issue—that of how the tool to be used to assess 'biodiversity value' does not consider how habitat patches are actually used by species, and how, as a result, it may promote a development response that is measured as net gain but, in practice, may support less biodiversity than before.

Resolving this issue requires the more fundamental question of how planning *sees* and conceptualises biodiversity to be addressed. The current formalisation of BNG effectively promotes an economic conceptualisation—a balance sheet of habitats scored according to their estimated 'biodiversity value', where loss is ultimately entirely permissible, and replacement may be different and geographically disconnected. Yet this is not consistent with ecological reality: biodiversity consists of myriad living species with different requirements, and habitats will not be fully *inhabited* if they are too small, in the wrong place, or far from other useable habitats. In other words, sustaining diverse communities of species needs place-based thinking. We propose that such thinking, and other well established planning approaches, are precisely the concepts needed to complement the BNG balance sheets, properly represent the needs of species, and ensure that biodiversity gains are actually achieved.

What does biodiversity actually mean?

In general, biodiversity means the variety of life in an area, often with an emphasis on the number and identity of species.[3] It is affected by many factors (see Fig 1). Historically, *all* biodiversity on a site has not necessarily been given the emphasis that it should have. Where biodiversity is considered in

planning, there has to date been an emphasis on species that are *protected*, and in turn the provision of habitat/'accommodation' for said species. Thus, legally protected trees, hedgerows, wetlands, great crested newts, bats, birds, etc. may find themselves left untouched or relocated (including to new, replacement habitats), while all the other species and habitats that contribute to biodiversity could be lost, with little alternative provisions made. Given the significant declines observed, even in widespread species, this is clearly an insufficient approach, and BNG is intended to be more inclusive than this.

From a biological point of view, thoroughly measuring the biodiversity of a site (i.e. the variety of life that it supports) could require multiple surveys throughout the year to build up a comprehensive list of all species (animals, plants, fungi, micro-organisms, etc.) making use of the site (both above and below ground). Some of these species may reside entirely on the site, while others may make use of it only at certain times of the year or for certain purposes—for instance, a species might use one of the habitats on the site for nesting but may travel to forage in other habitats elsewhere within the site or on a different site entirely. Since such comprehensive survey work would be both time-consuming and costly, BNG is currently founded on a 'habitat accounting' approach, in which habitats are defined as a specific combination of vegetation, hydrogeology, and/or land use. This approach involves assessing how much of each habitat is present at the site and then making some assumptions about how important each habitat is for supporting biodiversity.

'Critical to achieving BNG is the approach employed to quantify and assess the biodiversity value of individual sites'

The Biodiversity Metric—a way of estimating biodiversity value

Critical to achieving BNG is the approach employed to quantify and assess the biodiversity value of individual sites. Natural England's Biodiversity Metric has been designed to enable developers and other stakeholders to calculate the biodiversity losses and gains resulting from development or a change in land management. Within the current version of the Biodiversity Metric (version 3.1, issued in April 2022), habitats are given a distinctiveness score. Generally, the higher the distinctiveness score, the more specialist species the habitat is assumed to support and the rarer the habitat is nationally, such that its loss potentially means the loss of species that are not found and cannot live elsewhere.

For instance, meadows and fens are given a very high distinctiveness score, whereas scrub is assigned medium distinctiveness and arable farmland is accorded low distinctiveness. If habitats were buildings being scored for their architectural/heritage importance and distinctive role, meadows and fens could be seen as the ecological equivalent of a 19th-century listed concert hall—a magnificent and unique home for the performing arts—whereas scrub, which nevertheless provides important habitat resources for many species, is scored like a modern semi-detached suburban house—still an important form of home, but a very different proposition. These are buildings with very different qualities and purposes, creating unique and non-interchangeable habitats.

When a developer wants to develop a site for human habitat(ion), they must assess the scheme using Natural England's BNG spreadsheet and demonstrate at least 10% more 'biodiversity units' after development than before. The biodiversity unit total is calculated as the habitats' distinctiveness scores multiplied by their area (plus some modifiers based on habitat condition and whether the habitats are mentioned in a local strategy). At this point, the consideration of biodiversity interfaces with the process of development and the planning system, and the developer must decide how an increase in biodiversity units will be achieved. Note that already this is an increase, not necessarily in biodiversity itself, but in the particular metric that has rated the importance of habitats for supporting it.

Operating the Biodiversity Metric to produce net gain

Current outcomes from the interface between ecological considerations and development are diverse, both in wider assessments of quality and success, and specifically with regards to the response to BNG. Planning and development aspirations may well reflect best practice—as set out in, for example, the RTPI/RSPB's *Cracking the Code*,[4] with an integrated approach (shared space for play, SuDs, leisure, biodiversity, etc.)—but in reality development may have limitations in the qualities and outcomes of schemes.[5] To varying degrees, the desired outcome, for some, from the planning and development processes might be a maximum site coverage with (human) housing 'units' and associated modest rear garden areas, in order to optimise scheme viability, together with required 'infrastructure' (in all senses), delivered in line with quantified local planning authority minimum policy requirements. Infrastructure land uses may well be separated (play/water management/informal open space, etc.) and biodiversity may be provided for within the site boundary as part of this on-site infrastructure, or alternatively off-site provision may be used.

A developer specifically wanting to maximise the developable area must therefore minimise the habitat area intended for supporting biodiversity.

Fig. 2 Former arable land sown with a wildflower meadow seed mix (left) and tree planting in the Buddon Valley (right). These habitats will eventually support very different communities of species, and oversight is needed to ensure that successive developments do not always choose the same mitigation habitats, so that the needs of some groups of species are not consistently overlooked as a result of developer preferences for particular habitat types

Such a developer can still achieve an increase in total biodiversity units, despite a reduction in habitat area, if they ensure that poor-condition or low-distinctiveness habitats are replaced with good-condition or high-distinctiveness habitats. This is because the metric operates as a simple multiplication: habitat distinctiveness (and condition) multiplied by habitat area. Since less area of a higher-scoring habitat is needed to supply one 'biodiversity unit', the developer is incentivised to prioritise the highest-scoring habitats within the Biodiversity Metric's distinctiveness rankings. On the face of it, this appears to be a good thing. However, closer inspection shows it to be ecologically problematic.

Diversity cannot be achieved by doing the same thing everywhere

Almost all of the highly distinctive habitats (within the current Biodiversity Metric's rankings) are tied to a specific hydrogeology (either coastal, wetland or mountain habitats); i.e. they are possible only in certain limited locations. The most distinctive habitat that can potentially be created anywhere (according to the Biodiversity Metric) is meadow. Meadow, which is permitted to be upland or lowland, therefore appears as *the* preferable choice for minimising habitat area on a generic site, and, on the face of it, it appears to be an easy thing to create, because seed mixes are easy to buy and sow (although the plants may subsequently struggle to survive and get established[6]). On the other hand, other policy drivers can come into play to predispose the creation of particular habitats; for instance, indications of early biases towards woody habitat creation[2] could reflect a desire to simultaneously satisfy tree-planting targets.

First, the new meadows (or woodlands) may all be rather similar to each other if many developers adopt the same generic seed (or tree species) mixes provided by a limited number of suppliers.[6,7] Even more importantly, if many developers prioritise creation of the same type of habitat, then, even if that favoured habitat has the long-term potential to support many species, there will still be many other species left uncatered for who do not use this habitat (see Fig. 2). Significant oversight, arguably not currently provided for, is therefore essential to ensure that successive developments do not always offer the same habitat solution, with the result that a policy designed to promote diversity inadvertently results in a homogeneous response when put into practice in the landscape.

The importance of such oversight is further underlined when considering what previous habitats the newly created and highly distinctive habitat might be replacing.

A habitat's national distinctiveness versus local importance

The current BNG construct is based upon a concept of habitat replacement, but, when biodiversity beyond protected species is involved, this replacement may not be like for like.

The Biodiversity Metric includes some 'habitat trading' rules based on the habitats' distinctiveness scores. Although habitat trades among the lower tiers must stay within the same broad habitat type, this is not the case when moving upwards in distinctiveness. Since our chosen meadow habitat is so high scoring, it is permitted to replace any habitat scored as medium or below. This includes secondary woodlands, any heathlands not in tip-top condition (often hard to achieve without well funded management or a large supply of local volunteers), and ponds not designated as priority habitats. These habitats have such vastly different ecological functions from a meadow that many of the local species that were making use of these previous habitats will be unlikely to be able to make use of

the new meadow habitat (see Fig. 3). If they can make use of it, it may provide them with far fewer resources, or a different type of resource (for example foraging rather than nesting), than the previous habitat.

Crucially, these previous habitats may not be high scoring for ecological importance/distinctiveness when viewed in a *national context*, but at *local scale*—on a scale relevant to the day-to-day survival of local species—they may be the only patch of scrubby heath or secondary woodland or pond, etc. in the locality. As such, individual local species' populations may be totally dependent on them for essential resources. If that patch of habitat is gone and replaced with a habitat of no use to them, those local species will be gone too—their population will be locally unviable and, at local scale, the species will go extinct. A habitat that is not particularly distinctive nationally may therefore be extremely important for supporting biodiversity locally if there are no other habitat patches in the vicinity that fulfil its ecological function. Crucially, 'in the vicinity' here means within the relevant movement range of, and accessible to, the local species in question (see Fig. 4 on the next page).

As a result, the local importance of habitats is expected to be site-specific and, within the same local authority area, a given habitat may have greater local importance at some proposed development sites than at other sites. This is in contrast to the regionally set 'strategic significance' multipliers that are already included in the Biodiversity Metric, which are expected to represent county-level habitat priorities (for example determined by a Nature Recovery Network), such that many developments sites within a local authority area might receive the same strategic significance multipliers.

Omission of these local consequences (the final tier of a national-regional-local hierarchy of scales) is a critical limitation in the currently proposed implementation of BNG. The existing habitat trading rules do not give adequate consideration to the current ecological function of habitats in the locality, i.e. the ways those habitats are being *used* by species, often as just one element of a multi-functional habitat mosaic that extends beyond the site (a consideration that becomes more important the smaller the site). Determining whether the proposed 'habitat trades' should be permitted at a local level means considering the needs of local species

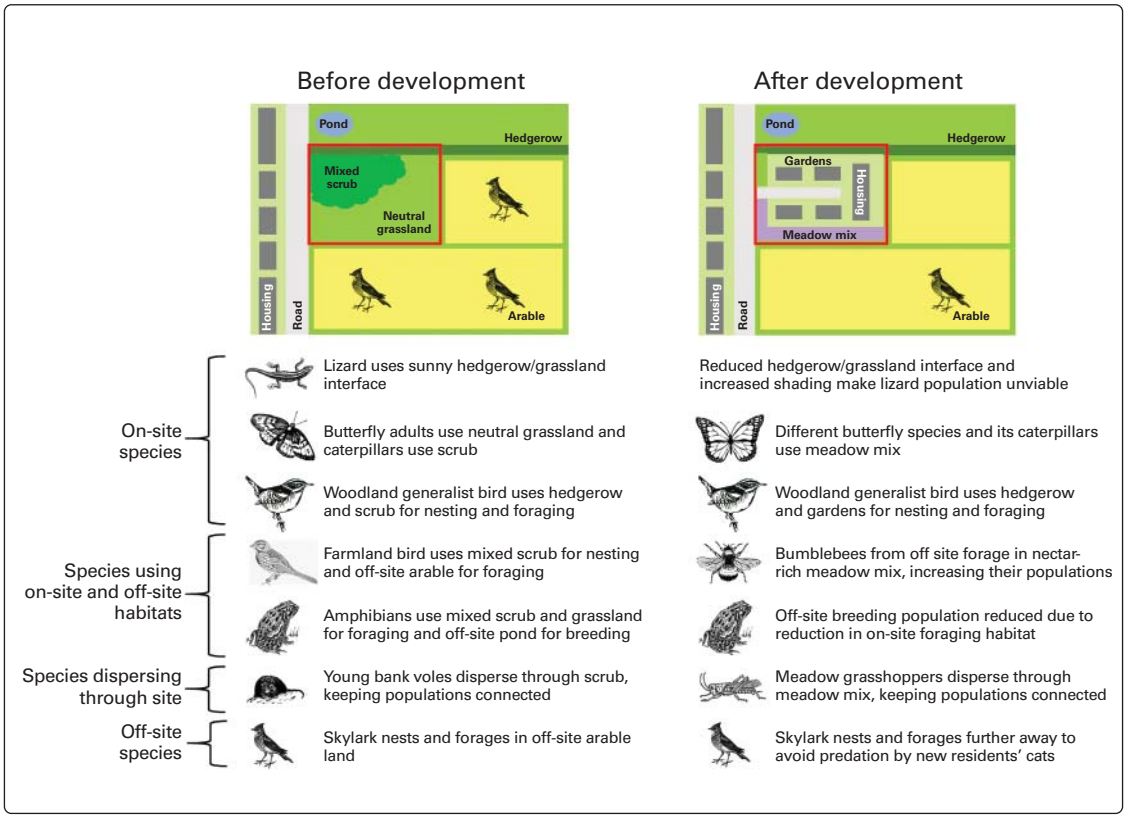

Fig. 3 Changing the composition of habitats on a development site (as outlined in red) affects which species can use the site and for which purposes, potentially affecting not only species residing on the site but also those that use both on- and off-site habitats, those that disperse through the site, and those residing nearby. Such a habitat trade from two medium-distinctiveness habitats to a highly distinctive meadow habitat may nonetheless satisfy the BNG metric, despite these changes potentially causing real-world biodiversity loss on the site itself and/or in the wider area

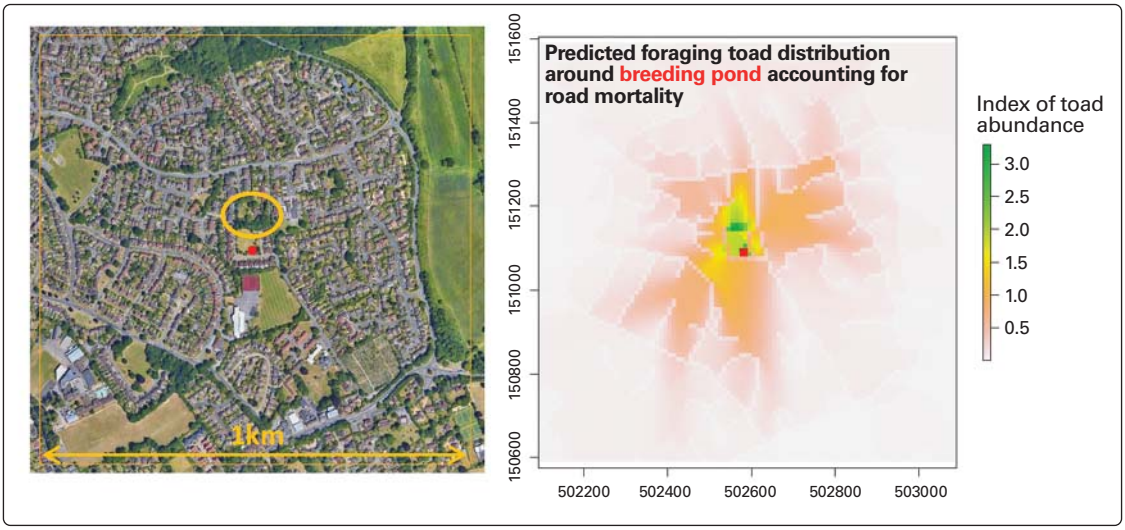

Fig. 4 The secondary woodland on the site of the infill development circled in yellow-orange is not considered a distinctive habitat because there are many examples of secondary woodland nationally and it is less biodiverse than ancient woodland. However, there is a toad breeding pond off site (marked in red) and computer simulations (using the Amph4pop model, incorporating toad habitat preferences, movement ranges, and road mortality) predict that this secondary woodland is where most of these breeding toads are expected to be foraging, raising concerns over whether this toad population would persist without access to this habitat. Although not considered nationally important, this secondary woodland is therefore very important for supporting biodiversity locally

alongside county- and national-level conservation priorities and requires oversight from individuals with good ecological understanding and local knowledge.

Avoiding loss or decline of existing local species through locally unsuitable 'habitat trades' is of particular importance if the new habitat does not in reality support the level of biodiversity that its national distinctiveness score would suggest when implemented in the proposed location—an issue that we consider next.

A highly distinctive habitat that is too small and isolated will not realise its biodiversity potential

Species-area relationships are well established concepts in ecology. The smaller a habitat patch, the fewer specialist species can be supported within it, because many species have minimum area requirements (i.e. the size a habitat patch needs to be for it to contain enough resources for them to live and reproduce there and so maintain viable populations[8]). Furthermore, the more isolated a habitat patch is from other similar habitat patches, the fewer specialist species it typically supports, because they are less able to bridge the long distances and colonise the site. The current Biodiversity Metric does not take this into account, and this is where the distinctiveness scores (roughly representing the habitat's contribution to supporting biodiversity nationally) can separate still further from a habitat patch's actual value in supporting biodiversity on the ground.

Our new highly distinctive meadow habitat was chosen to enable minimum habitat area and maximum developed area. In other words, it may be small. For a mental picture of a species-rich meadow, imagine vast chalk downlands in an Area of Outstanding Natural Beauty with skylarks singing overhead, or an upland hay meadow with breeding lapwings, or the wide open spaces of a water meadow with its attendant summer cattle. All of these are sunny open spaces, grazed and/or cut to maintain the careful balance of their diversity. In some situations, what the developer ultimately delivers, however, is essentially a wildflower verge, exposed to traffic pollution, over-shaded by shrubs and houses, and over-fertilised by every dog that walks past needing a pee[9] and by fertiliser drift from nearby houses. Furthermore, meadows are one of our highest-maintenance habitats (even expert farmers find keeping biodiverse meadows in top condition a constant professional challenge), and effective and habitat-appropriate maintenance then becomes a key challenge, often falling to cash-strapped local authorities.

In trading a medium- for a high-distinctiveness habitat, there is an implicit suggestion that the number of species on the site might increase, and that any (assumed smaller number of) local species lost through the change of habitat would be replaced by a larger number of meadow-dependent species colonising the new habitat. However, these species are unlikely to arrive if there are no other meadows nearby (the chances of a small blue butterfly successfully crossing Guildford to reach a tiny wildflower strip on an infill development is vanishingly small), and, even if they did arrive, they would not necessarily recognise this as a habitat

that they could live in if it did not meet their area requirements or if nearby land uses made it undesirable (for example causing shade or acting as a source of predators). The patch might act as a stepping-stone and assist some species to move through the landscape to access more suitable areas, but it would not be a fully functioning biodiverse meadow with a full complement of resident species (see Fig. 5).

This is a question of ecological use. Currently there is no mechanism to prevent a medium-distinctiveness habitat that is currently well used by local species being replaced with a patch of high-distinctiveness habitat that may, in practice, be of much less use to the specialist species normally associated with it. Independent scrutiny of proposed 'habitat trades' is therefore needed to examine the ecological functions ('uses') of the site before and after the proposed habitat change, for both current and potential future species communities.

Offsetting—acceptable or unacceptable?

One way to get around the fact that highly distinctive habitats will not realise their potential in inappropriate contexts is to permit mitigation habitats to be created off site rather than on site ('offsetting')—for example instead of creating a strip of meadow habitat within a new housing development, it might be created next to an existing meadow elsewhere.

The first question that this raises is: what habitat was at the chosen offset site previously? Its habitats will likewise be entered into the Biodiversity Metric spreadsheet and all the above considerations will apply to the chosen offset site too: that this is an instance of 'ecological development' (conversion to non-human-centric habitats and/or between ecological uses) rather than traditional development (conversion to human-centric habitats and/or between human uses) is irrelevant. It may still cause change of habitats and ecological functioning whose knock-on effects for species using or local to the offset site must also be examined.

Favouring the idea of offsetting is the argument that non-human life *within* new development is to varying degrees incompatible with the co-occupation of this land by humans—for example, sustainable drainage systems (SuDS) (water) and play, untidy wildness within an otherwise quasi-artificial manicured world, and sub-optimum outcomes for biodiversity through humans (and pets) degrading habitats. It is also argued by some that off-site solutions offer advantages for landowners, developers and local planning authorities—as noted by the Environment Bank, they offer 'a groundbreaking new *product* that gives developers a … way to implement BNG and at the same time provides the opportunity for landowners to diversify their business' (emphasis added).[10] It is therefore perhaps not surprising the idea of off-site 'habitat banks' are currently generating significant interest within the planning and development industry.

While it is true that some species cannot tolerate close proximity to contemporary human habitats and behaviours (and for these, habitat provision away from human habitation may be preferable), there are a huge number of species that could inhabit suburban areas (if accessible habitat resource provision is made for them). Links between exposure to biodiversity and human health and wellbeing benefits suggest that 'othering' agendas, which spatially and psychologically separate biodiversity and human habitation, are not in the interests of human communities. Requiring people to travel to specific areas to experience nature is likely to reduce their frequency of exposure, increase transport emissions, and increase inequalities and inequities in access to nature. It also potentially risks increasing disturbance to wildlife if public pressure is concentrated on visiting specific areas.

The Lawton Report[11] recommended 'bigger, better, more joined up' habitats. On the one hand, offsetting concepts provide a mechanism for 'relocating' habitats to predetermined strategic areas (for example those identified by a Local Nature Recovery Strategy), but this potentially comes at the expense of providing habitat connectivity through developed areas, i.e. connectivity may be increasing in some areas but decreasing in others. It is always important to ask: connectivity between what, for what species, and for what purpose?

A high-speed rail line may increase connectivity between two cities, but it may reduce connectivity for rural communities who have had their footpaths and landholdings severed by its route at local level. Just as people require connectivity at different scales for different purposes, so too do other species. Should maintaining functional connectivity on/around the site for existing local biodiversity always be sacrificed to augment larger-scale connectivity elsewhere, especially when this larger-scale connectivity may be poorly evidenced?

The fact that 'replacement' habitats may be disconnected from the original site habitats is problematic for species with limited mobility (such as the common lizard, which may never be able to reach and colonise the new habitat patch) and those with multi-generational place-attachments (for example, toads faithfully return to their ancestral breeding ponds).

Although the Biodiversity Metric currently downgrades 'biodiversity units' that are offset at increasing distance, the notion of 'too far' depends on the specific situation (surrounding landcover, type of species involved). Does creating some more highly distinctive habitat beside an already biodiverse area make up for a suburban community's loss of its only population of common toads? Is it acceptable for some areas to be highly biodiverse and others not, given that an individual county,

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Fig. 5 A species-rich wildflower meadow near Wareham, Dorset (upper image) and a wildflower verge near Earlsdon, Coventry (lower image). Larger habitat patches that are better connected to other similar habitats usually support more specialist species. The sown roadside verge (lower image) has more plant species than if it were mown turf, but an equivalent area within the meadow (upper image) supports even more species, including rare specialists that cannot reach and colonise the verge. The bigger a meadow, the greater the chance that it can also support larger animals, such as ground-nesting birds, further increasing its biodiversity

borough or parish may want to report the state of nature within their area? Decisions must be made on whether the scale of individual displacements is acceptable to the local community, where 'community' encompasses both human and other species.

Representation

It is telling that there is no 'stop condition' within the currently proposed implementation of BNG. Developers are encouraged to make provisions for biodiversity on site, then off site, then to buy biodiversity credits, and finally as a last resort to buy statutory biodiversity credits. These credits are promises that some habitat will be created to support biodiversity in the future and are entered into the spreadsheet. If such credits are available for sale, statistical net gain can be demonstrated in any situation, irrespective of the locally experienced biodiversity loss, and this poses a serious limitation on BNG's ability to represent the interests of biodiversity in decision-making.

Ultimately, the development industry will be operating the Biodiversity Metric based on its design and their priorities, requirements, and outcome preferences, within the provisions of the permitted system and approach. Although ecological consultants are engaged by developers, they too operate (legitimately and with integrity) within this construct. When it comes to formulating the biodiversity net gain plan (i.e. which habitat trades will be used), biodiversity therefore has no genuinely independent representation within this decision-making process.

BNG plans must be approved by the local authority and are a potentially critical dimension to BNG aspirations, but the government has made

only limited commitment to increase support and finances to operationalise the new provisions for BNG thus far. This sits within a wider context of resource deficit that extends to include landscape architects, ecologists, and urban designers.[12] The resource challenge is significant and impactful; in a context of finite people, skills, and time, representation becomes compromised further. Concerns have already been raised about local authorities having sufficient resources to monitor and enforce ongoing management of mitigation habitats, i.e. to represent the interests of biodiversity long term.[2] But this resource deficit also critically affects a local authority's ability to represent the interests of biodiversity at the point of BNG plan approval.

It is unclear what the scope of the phrase 'approved by the local authority' is intended to be—whether this is limited to simply checking that the BNG calculations add up on paper, or also includes checking that the baseline habitat conditions have been correctly assessed on the ground, or extends, as suggested here, to scrutinising the ecological appropriateness of mitigation habitats to assess whether projected biodiversity outcomes are likely to be realised, given the many ecological factors omitted by the Biodiversity Metric. Insufficient resourcing of local authorities would promote the first of these three scenarios, raising grave concerns that BNG could become another example of the 'processisation' of planning,[13] potentially focused solely on meeting artificial metric-based criteria while biodiversity continues to decline unmeasured in reality.

Furthermore, clarity over the grounds on which local authorities can refuse and/or have the confidence to challenge the approach/intentions in a BNG plan will be essential. A local authority's ability to represent the interests of its biodiversity will be severely compromised if planning appeal concerns (defensible grounds for refusal and matters of 'costs') make local authorities hesitant to challenge BNG plans that, despite doubts about their ability to achieve gains in practice, still appear to meet the BNG criteria on paper. Will there be acceptance that the Biodiversity Metric is a tool to *aid* decision-making—one that might sometimes show a 'measurable increase' in biodiversity because its measurements can never capture all place-specific ecological consequences, and that BNG plan approval may still be refused after integrating value-based judgements around the local importance of these omitted factors?

If official approval *were* based only on whether the required increase in biodiversity units had been met, then it would be down to local people having sufficient connection with their local wildlife, realising the potentially unrepresented biodiversity consequences, and having enough time and energy (and it takes a lot) to stand up for the needs of their local wildlife. Usually, these community groups will try to get a relevant conservation non-governmental organisation (NGO) involved. This NGO may itself have limited staff and resources and be so busy fighting national infrastructure projects that they may have to take strategic decisions around which small-scale developments they can and cannot get involved with and the level of support they are able to offer.

Yet, it is these multiple, individually small land use changes that accumulate to erode the whole—every development, every flailed hedgerow, every tree removed, every garden that's converted to paving and plastic grass. Many of these changes fall within permitted development or do not constitute development at all: in these case, since express permission is not required, BNG will not be applied and the interests of biodiversity (besides protected species) will not be considered at all. If biodiversity gains are to be achieved, then we must account for the fact that landscape changes which we consider to be immaterial may be material for other species, and these ecological impacts require representation.

How should planning conceptualise biodiversity?

Here, the importance of the historic emphasis upon *protected* species within planning provisions must be stressed—a scenario within which species and habitats that are not protected can be lost to development. This raises fundamental questions with regards to how biodiversity is now seen, valued and conceptualised within the provisions of BNG.

In some respects, the idea of offsetting takes the children's story of *The Animals of Farthing Wood* and simply converts it into policy form; i.e. nature can go and live somewhere else. Needless to say, communities of species do not in reality get together and head off to find a fabled nature reserve when their habitat patch is destroyed. The reality is those who cannot disperse are killed during the works themselves, die through lack of food or shelter, or are picked off by predators *in situ*. Those who can disperse might not survive the journey or reach suitable habitat in time (given that individuals often will not know where the next suitable habitat patch is), likewise risking death through predation, starvation, or misadventure. And, ultimately, there is a limit to the number of individuals of a species that can fit into even the best-quality nature reserve.

The current system is effectively predicated on acceptance of loss/death, with statistical BNG achieved via quantified, alternative provision. A pragmatic view on this would accept its inevitability to some varying degree, but it is suggested that it is important that this matter is emphasised, given that it is not merely a *possible* outcome of development, but is effectively the very basis for how BNG is designed—it is embedded implicitly in the word

'net' that lies at the heart of biodiversity net gain. 'Net' accepts loss, death and destruction of populations. This attitude is somewhat at odds with the planning system's usual approach of avoiding harm.

The BNG spreadsheet's habitat accounting approach presents an economic conceptualisation of biodiversity, and this has propagated through into phrases such as 'habitat banks' and 'delivering biodiversity' via a 'product', which have readily been taken up by the business sectors that they are designed to appeal to. These phrases have connotations that are at odds with, and can obscure, the ecological reality. A delivery driver may be well aware that delivery is a process that takes time, but very many people's experience of delivery is of one mouse click, after which, with no further effort, the object subsequently arrives fully formed and functional (otherwise it is sent back). Developers are used to providing houses that, when handed over, are ready for people to live in. This is not the case with habitats.

A new woodland takes hundreds of years before it has reached the condition where it is capable of housing close to its full potential of species; not only do trees take time to mature and senesce (i.e. to provide both living and deadwood habitats) but woodland ground flora are some of the slowest colonising plants, spreading less than a metre per year,[14] and as a result they take a very long time to reach and colonise a new woodland. Equally, a new meadow takes decades to mature into the complex mix of plant species, below-ground microbes, and insects and other animals that characterise the habitat that one is trying to re-create (by which point the proposed 30-year protection and management plan initiated under BNG may be up and its future might again be uncertain).

New developments do not themselves actually 'deliver' a human community; they create the buildings, spaces, and places within which communities can form. Yet slogans around the conceptually equivalent notion of 'delivering biodiversity' (an aggregate of species living together in a more or less ordered community) are proliferating. Likewise, a common understanding of a bank would be that a pound coin put in would generally still (physically) be a pound coin when retrieved later, whereas not only can a habitat take a long time to create, but it also will not stay that way unless constantly maintained—a 'banked' heath not adequately attended to may well be a woodland or even a stand of brambles and bracken ten years later.

Temporal multipliers and risk factors, hidden away within the BNG spreadsheet, represent these long timescales and the likelihood the habitat accidentally morphs in the bank, but the words being used do not. Framing biodiversity in language that does not naturally convey ecological realities risks fostering an unrealistic conceptualisation of biodiversity: such language may encourage financial interest in biodiversity, but is potentially unhelpful for local authorities, who require conceptualisations that enable them to better understand and meet the needs of biodiversity.

'We urge planners to look beyond economic conceptualisations and see biodiversity gains not as abstract 'habitat trading', but as making choices that meet the needs of multi-species communities. Accounting for biodiversity simply means multi-species place-making'

Crucially, these abstract economic conceptualisations overlook the fact that biodiversity is composed of a multitude of living individuals, many with multi-generational connections to the land. Ecology is the study of these relationships between living organisms and their physical environment, and ecologists use the word 'community' to describe the collection of species living in an area. Geographers, historians and planners are well aware of the risks and complexities of displacing human communities for (often) economic reasons. Biodiversity offsetting can be seen as a modern extension of this phenomenon to other species—and all the same risks of loss of community functioning apply.

Planners have been dealing with such issues for decades and understand what is needed to support diverse, vibrant communities. Bringing in this experience is essential to avoid simply repeating the mistakes of the past in the more-than-human dimension. Planning approaches have spent decades evolving to a stage where the focus is on place-making that respects connections and is sensitive to the lived experience—there is no need for planners to settle for balance sheet conceptualisations of biodiversity that overlook the importance of these factors. We therefore urge planners to look beyond economic conceptualisations and see biodiversity gains not as abstract 'habitat trading', but as making choices that meet the needs of multi-species communities. Accounting for biodiversity simply means multi-species place-making.[15]

An ecological permission system for habitat changes

There is widespread acknowledgement that BNG should be 'more than just a number',[16] that baseline habitat condition should be verified, and that

mitigation habitats should be registered, maintained and monitored to ensure that BNG plans are correctly implemented. This article has highlighted that significant risks of unmeasured biodiversity loss exist prior to this, at the point of BNG plan development. Independent and strategic oversight is needed to ensure that developers do not always prioritise creation of the same habitats; that the ecological functioning and local importance of habitats is considered alongside their national distinctiveness when choosing mitigation habitats; that the socio-ecological appropriateness of offsetting is assessed on a case-by-case basis; and that the needs of local species' populations are adequately represented within this decision-making process. Above all, there must be clarity that a BNG plan may be refused on these grounds, given that no generic metric can adequately capture such place-specific factors.

Critical to the development of a more effective approach is an integrated and holistic approach to site development that embraces all existing biodiversity and BNG opportunities alongside nature-based approaches to SuDS, play, and open space provision. The current sequential hierarchy of 'on site', 'off site', 'credit' has validity, but the emphasis must be on considering the ecological function of sites within the wider landscape. Multi-species place-based thinking is key, and this holistic approach must transcend the scale of development, bearing in mind the important role of small spaces, including private garden land, in supporting biodiversity.

'If BNG is to be truly achieved, spreadsheet metrics and the planning system approach must be complemented by some form of ecological permission system to sit alongside the planning system and existing provisions for protected species in the same way as other parallel systems'

We propose that, if BNG is to be truly achieved, spreadsheet metrics and the planning system approach must be complemented by some form of ***ecological permission system*** to sit alongside the planning system and existing provisions for protected species in the same way as other parallel systems (for listed buildings, Building Regulations, environmental health, etc.), interfacing in a manner that creates a genuinely holistic and effective management approach for the built and natural environment. This would create a dedicated space for representation in the same manner that, for example, a listed building can be considered for listed building consent distinctly and separately from the question of whether planning permission should be granted.

If a developer/property-owner wants to change the habitat composition of a site, this will affect which species can use the site and for what purposes (see Fig. 3); this is an instance of ecological development, and the developer/property-owner would therefore need to apply for, secure and comply with ***ecological permission*** to go ahead, just as they would need planning permission in some form for the wider development scheme.

Importantly, design of such a system must be mindful of the liberalised planning system in England, with arrangements to ensure that permitted development and prior approval permissions do not circumvent the need for ecological permission, as they can on other quality controls. The starting point for the design of an ecological permission system must be all matters that constitute 'development' within planning legislation, not merely those requiring express planning consent, in order to ensure that cumulative minor developments do not undermine attempts to address ecological decline. Clearly, this will be seen as a challenging proposition, but it is viable if one considers how permitted development itself is operationalised through conditions and/or prior approval, and parallels with listed building consent and Building Regulations show how it could be operationalised.

This new ecological permission system, in whatever form it takes, must be resourced with independently positioned ecologists (***ecological planners***) who scrutinise the current habitat composition of land, consider the roles that it fulfils within the wider ecological landscape, and ascertain how change can still fulfil and/or enhance the site's multiple ecological roles. Decisions would be made separately on their own merits, in the same manner as decisions on planning, listed building, building control, etc.—they would interface, but would be fundamentally specific to their own scope and focus.

Such decision-making cannot be made using a spreadsheet operated by non-specialists, and it cannot be achieved by a habitat scoring system based on the scarcity of individual habitats nationally. It requires knowledgeable human beings, who are able to consider the national perspective alongside the needs of *local* species and local on-the-ground information. In this way, the system would become sensitive to the individuality of place—the foundations of biodiversity itself. Land must be considered with regard to *all* the ecological impacts of development change, both on site and in the

surroundings, not just those that affect legally protected species and sites.

The role of ecological planners would be to ensure that any proposed development, whether aimed to address the housing crisis or any other human need, does not worsen the housing crisis that biodiversity itself is facing. This system must, of course, be resourced effectively, requiring meaningful state investment and support to ensure the availability of adequate numbers of effectively trained ecological professionals.

An ecological permission system that is as expansive as suggested above is an enormously challenging proposition. It would have a scope, complexity, intrusiveness, and implication that would genuinely represent a transformational moment in land/place management. However, if we are to address biodiversity decline in a holistic, genuine, inclusive, local and meaningful way, and, indeed, if we are to convert the words of the government's 25 Year Environment Plan into actions that genuinely leave the environment in a better state for future generations, we need to have a conversation about how such a system could be created.

We need to stop seeing biodiversity as something 'other' but instead as representing communities of species whose needs can be met through multi-species place-making. Within this framework, an ecological permission system of some form could finally give biodiversity the independent representation that it needs in human decision-making.

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Notes

1 *Early Introduction of BNG to Local Plans in England*. Carter Jonas, Apr. 2022. www.carterjonas.co.uk/research-and-insight/biodiversity-net-gain-local-plans

2 S zu Ermgassen, S Marsh, K Ryland, *et al.*: 'Exploring the ecological outcomes of mandatory Biodiversity Net Gain using evidence from early-adopter jurisdictions in England'. *SocArXiv*, Sept. 2022 (submitted). https://osf.io/preprints/socarxiv/tw6nr/

3 For further detail, see I R Swingland: 'Biodiversity, definition of'. In S A Levin (Ed.): *Encyclopedia of Biodiversity*. Academic Press, 2001, pp.377–91

4 *Cracking the Code: How Design Codes Can Contribute to Net-Zero and Nature's Recovery*. RTPI Research Paper. RTPI/RSPB, Mar. 2022. www.rtpi.org.uk/media/11054/design-codes-report-final.pdf

5 *A Housing Design Audit for England*. Place Alliance, Feb. 2020. https://indd.adobe.com/view/23366ae1-8f97-455d-896a-1a9934689cd8

6 R F Pywell, J M Bullock, D B Roy, *et al.*: 'Plant traits as predictors of performance in ecological restoration'. *Journal of Applied Ecology*, 2003, Vol. 40 (1), 65–77. https://besjournals.onlinelibrary.wiley.com/doi/full/10.1046/j.1365-2664.2003.00762.x

7 K D Holl, J C Luong and P H Brancalion: 'Overcoming biotic homogenization in ecological restoration'. *Trends in Ecology & Evolution*, 2022, Vol. 37 (9), 777–88. Available at https://justinluong.com/assets/pdf/Holl%20et%20al.%20-%20Biotic%20homogenization%20-%202022.pdf

8 See, for example, G Pe'er, M A Tsianou, K W Franz, *et al.*: 'Toward better application of minimum area requirements in conservation planning'. *Biological Conservation*, 2014, Vol. 170, 92–102. www.cts.cuni.cz/~Storch/publications/Peer_et_al_2014_BiologicalConservation_Minimum_area_requirements.pdf

9 P De Frenne, M Cougnon, G P J Janssens and P Vangansbeke: 'Nutrient fertilization by dogs in peri-urban ecosystems'. *Ecological Solutions & Evidence*, 2022, Vol. 3 (1), e12128. https://besjournals.onlinelibrary.wiley.com/doi/full/10.1002/2688-8319.12128

10 See the Environment Bank website, at https://environmentbank.com/

11 *Making Space for Nature: A Review of England's Wildlife Sites and Ecological Network*. Lawton Review. Department for Environment, Food and Rural Affairs, Jan. 2010

12 M Carmona and V Giordano: *The Design Deficit: Design Skills and Design Governance Approaches in English Local Authorities*. Place Alliance, Jul. 2021. http://placealliance.org.uk/wp-content/uploads/2021/07/Design-Skills-in-Local-Authorities-2021_Final.pdf

13 J Sturzaker: 'Resistance to reform — from spatial planning to localism'. *Town & Country Planning*, 2011, Vol. 80, Jul./Aug., 319–21

14 J Brunet and G Von Oheimb: 'Migration of vascular plants to secondary woodlands in southern Sweden'. *Journal of Ecology*, 1998, Vol. 86 (3), 429–38. https://besjournals.onlinelibrary.wiley.com/doi/full/10.1046/j.1365-2745.1998.00269.x

15 W Fieuw, M Foth and G A Caldwell: 'Towards a more-than-human approach to smart and sustainable urban development: Designing for multispecies justice'. *Sustainability*, 2022, Vol. 14 (2), 948; C Sachs Olsen: 'Co-creation beyond humans: the arts of multispecies placemaking'. *Urban Planning*, 2022, Vol. 7 (3), 315–25. https://oda.oslomet.no/oda-xmlui/handle/11250/3023871; and R Setiadi, S Z Nadhiroh and C Rupprecht: 'A regulatory framework assessment on multispecies urban planning in Indonesia: a case study of two Indonesian cities in Java and Borneo'. Pre-print. Jul. 2021. Available at www.researchgate.net/publication/353591030_A_Regulatory_Framework_Assessment_on_Multispecies_Urban_Planning_in_Indonesia_A_Case_Study_of_Two_Indonesian_Cities_in_Java_and_Borneo

16 M Hughes: 'Biodiversity Net Gain — more than just a number'. Blog entry. Natural England, Sept. 2021. https://naturalengland.blog.gov.uk/2021/09/21/biodiversity-net-gain-more-than-just-a-number/