Supplementary written evidence submitted by Professor Lynn Dicks (INS0043)

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I am a Board Member of Natural England and a Trustee of the Royal Entomological Society. The opinions and evidence provided here represent my own professional expertise, not the views of either Natural England or the Royal Entomological Society.

How successful are the UK biodiversity initiatives at tackling insect decline?

Our protected areas are not likely, in their current form, to deliver on the statutory target in the Environment Act 2021 to halt the decline in species populations by 2030.

Protected areas hold many more insect species than unprotected areas, for both common and rare species, but **they do *not* seem to be effective at preventing declines in the 'probability of occupancy' over time**. This is based on Cooke *et al* (2023), which analysed data from 1,238 terrestrial invertebrate species (ants, bees, hoverflies, ladybirds, spiders, and wasps) for the period from 1990-2018. The analysis includes Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs), Ramsar Sites, National Nature Reserves (NNRs), and Local Nature Reserves, which are primarily designated for nature conservation. 11% of terrestrial Great Britain is 'protected' under these designations. The analysis excludes National Parks and Areas of Outstanding Natural Beauty, which are protected landscapes, but do not have nature conservation as their primary aim.

Rare species were roughly stable across protected and unprotected areas, with approximately twice as many rare species in 1 km squares with >10% protected areas, compared to 1 km squares with <1% protected areas. **Common species were declining over time** in both protected and unprotected areas, much more steeply in protected areas (Cooke et al. 2023).

The >1,000 species whose abundances are being used to measure progress towards the target to halt decline in species populations are listed in the draft Environmental Targets (Biodiversity) (England) Regulations 2022[1]. Over half of these are invertebrates, and many are common, widespread species. Common and widespread species of insect (bees, hoverflies, bugs, ground beetles) are declining most strongly in areas with high cropland (Mancini et al. 2023). This is why Government must address the state of nature in the wider countryside.

The majority of protected areas in Great Britain (49-57%) are currently in unfavourable condition. We need 'effective' protective areas, in combination with conservation in the wider countryside.

Are there synergies or conflicts with other policy areas?

Policy to improve water quality has delivered clear benefits for insects. Freshwater insects are *not* declining, but recovering, according to many analyses (e.g. van Klink et al. 2020). The recovery may have slowed in recent years, but there is still a long term, significant recovery compared to the 1980s/ early 90s. A recent analysis of data from 1991-2018, from almost 4,000 sites in England and Wales (Pharaoh et al. 2023) showed macroinvertebrate richness increased by 9 % over the period, equivalent to an additional 1.5 taxa on average per site. Communities were improving, gaining pollution sensitive species, especially in urban rivers. This is widely believed to be the result of strong regulation such as the Water Framework Directive, directly tackling sources of pollution into freshwater. The monitoring is excellent (in this case from the Environment Agency and Natural Resources Wales), because freshwater invertebrates are used to indicate water quality. There has been ~~a decline in the number of monit~~ored sites since 2013, due to budget cuts. This reduction in

[1] https://www.legislation.gov.uk/ukdsi/2022/9780348242966#:~:text=The%20long%2Dterm%20biodiversity%20target%20for%20the%20restoration%20or%20creation,created%20by%2031st%20December%202042.

monitoring should be reversed. Government should fund invertebrate monitoring at a representative set of sites, at the highest taxonomic resolution possible, for both terrestrial and freshwater insects (or invertebrates).

Land sharing vs sparing: what are the compromises between high biodiversity and high yield farming?

The land sharing-sparing framework makes a compelling case that if you care about saving the most species, it's better to reduce the footprint of agriculture by farming on the smallest possible area of land – i.e. as intensively as possible, which allows you to spare land for nature. The evidence that supports land sparing as the best strategy comes mostly from bird populations, but also some insect and plant groups. It is summarised in Bateman and Balmford (2023) and Balmford (2021).

Below, I explain how this evidence applies to the design of UK agri-environmental and land use policy, in the context of insect decline.

1. In the UK, and other European countries with a long history of agriculture, much of our most precious biodiversity relies on low intensity agricultural management such as hay cutting and grazing. The shrill carder bee and the large blue butterfly are examples of priority insect species that rely on such management. The only study that specifically applies the land sparing-sharing modelling framework to the UK (Finch et al. 2019) shows that keeping some land for low yielding agriculture (similar to the European concept of 'High Nature Value farmland'), maximises bird populations across lowland agricultural landscapes in England (specifically, Salisbury Plain and the Fens). This is clear evidence that **in the UK, farming plays an important role in nature recovery**. The land sparing-sharing framework has not been used to study insect conservation in the UK, but I would expect similar results.

2. Small habitat features, such as hedgerows and field margins, must be part of highly productive farmland, if it is to be sustainable in the long term. Some researchers (e.g. Collas et al. 2023) have characterised these features as 'land sharing' and argue that the evidence doesn't support their use for biodiversity conservation, because they support only common species, creating an apparent conflict between current policy and the 'scientific evidence'. For insects, however, many common species are declining in likelihood of occupancy (Mancini et al. 2023) and abundance (Fox et al. 2021) in agricultural landscapes. These species deliver ecosystem services that are important to food production – pollination, pest regulation and nutrient cycling. Some evidence shows that up to 8% of total land area can be taken out of production without reducing overall yield, if small distributed patches of habitat and linear features are *well-managed* and carefully *placed in less productive areas* (Pywell et al. 2015). In this way, **hedgerows and field margins are compatible with minimising the areal footprint of agriculture** (i.e. with 'land sparing'), and should be considered an aspect of delivering high yields sustainably. This is especially true for pollinator-dependant crops, because pollinators are strongly influenced by the proportion of natural habitat in the landscape, and their numbers are increased by specific features like hedgerows and field margins (Alison et al. 2022). For natural enemies like ground beetles, which contribute to the production of both pollinator-dependent and non-pollinator-dependent crops, the role of natural habitat patches at landscape scale is less clear. Farm management, particularly the management of pesticides and fertilizers, may be more important than landscape structure, for supporting thriving communities of these animals.

3. Evidence being quoted to support the statement that 'land sparing is more *cost-effective* than land sharing for nature conservation' comes from a careful analysis of the cost-effectiveness of different farm management interventions for conservation of three bird species – bullfinch,

yellowhammer and lapwing (Collas et al. 2023). The analysis is excellent, but I do ***not*** consider it a sound evidence base on which to abandon support for elements of farmland management such as hedgerows, flower strips and in-field winter stubbles, which are known to support insects and improve soil quality (e.g. Garratt et al. 2017). Collas *et al* (2023) provide evidence that larger areas of wet grassland are more cost-effective per unit area than overwinter stubble for lapwing conservation, for example, and larger areas of scrub are more cost-effective for yellowhammer conservation than overwinter stubble or hedgerows. Larger areas of semi-natural habitat are clearly important for many species, and need to be incorporated into farmed landscapes, to reverse farmland bird declines. In my view, this should not be at the expense of well-managed hedgerows and regenerative soil management. The focus of research should be on improving the productivity and resilience of sustainably managed farmland, with well-managed small habitats and soils that are not degrading.

4. We need much more research looking at the **relationship between fine-scale landscape structure, farm management and overall food production at landscape scale**. If this research involves actively testing interventions, providing stronger evidence than 'space-for-time substitution', it *must* be funded for longer than three years. This is because the limited available evidence shows that it takes four or five years for the effects of management on crop yield to become apparent (Pywell et al. 2015, Blaauw and Isaacs 2014). A recent meta-analysis found no overall effect of planted flowers strips on crop yield (Albrecht et al. 2020), for example, but most of the planted flower strips tested were less than three years old. Arguably, this does not allow time for insect populations to respond *enough* to change crop yield. The flower strips consistently enhanced pest control services in adjacent fields by 16%.

5. The **design and management of small habitat features such as hedgerows and field margins in farmland is crucially important**, if they are to form an effective element of highly productive landscapes. Currently many are not in particularly good condition, and do not provide high quality resources for pollinators, natural enemies or other farmland wildlife. This may be one reason why birds and insects continue to decline in farmed landscapes, and would influence the outcome of land sparing-sharing analyses based on population densities in existing landscapes. The Biodiversity Metric 4.0, used in Biodiversity Net Gain policy, could be used to drive improvement in management, if it included condition assessments for cropland features such as field margins, as well as flower densities or blooming sequence as elements of habitat condition for hedgerows. At present these habitats are not scored for condition, and agri-environment payments are not based on results, so incentives for good management are lacking.

Comments on the Bugs Matter 'splatometer' study, discussed by Matt Shardlow, of Buglife in oral evidence:

The statement that there has been a "64% decline in flying insect numbers in 20 years" from the Bugs Matter study is not scientifically robust, because it is based on only two data points – June 2004 and June-August 2022. Such snapshot comparisons between two time-points do not reflect abundance trends through time accurately. Scientists studying insect decline recommend that time series with **at least 10 time-points** (i.e. ten years) are required to make **robust trend estimates** (Didham et al. 2020). Data from 2021 in the Bugs Matter study are not included in the trend estimate, and comparisons between 2022 and 2023 data are also uninformative, given the inherent variability of insect populations and weather conditions. The report itself acknowledges this:

> "However, these results are based on data with low temporal resolution and consequently we interpret this change between two points in time with caution. Inter-annual variation in a range of unmeasured factors that could influence flying insect activity or abundance, such as the record-breaking summer temperatures in

2022, could significantly influence the observed pattern. To draw robust conclusions about long-term trends in insect populations in the UK, scientists require data from multiple years, over long time periods, and over large spatial scales"

This does not mean the splatometer study will not provide extremely valuable data, seven years from now. It is an acceptable, standardised method with which to measure insect numbers and I strongly support its continuation. It cannot yet provide reliable information about how insect populations are faring in the UK.

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