House of Commons

Science, Innovation and Technology Committee

Insect decline and UK food security

Second Report of Session 2023–24

Report, together with formal minutes relating to the report

Ordered by the House of Commons to be printed 28 February 2024

HC 326
Published on 7 March 2024
by authority of the House of Commons

Science, Innovation and Technology Committee

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Summary

Insects contribute to food production through pollination services, manging crop pests, maintaining soil health and recycling nutrients from waste. However, there is a concerning trend of decreasing insect abundance, changes in distribution and reduction in the diversity of insect species in the UK. While there is variation among species and groups, overall, there is a downward trend and the consensus among experts is that in the UK insects are in decline.

It is challenging to quantify insect decline as there is little evidence available for many insect groups about population changes over long periods of time. This Inquiry heard from experts running some of the long-term insect monitoring studies, for example the Rothamsted Insect Survey which has been running since 1964. These long-term studies are vital to further our understanding, monitor population changes, and should be supported with assured long-term commitments from funding bodies over a period of decades rather than years.

Pollinators play a crucial role in ensuring UK food security, but it is important to recognise that insects and invertebrates play more than this one role in supporting food production. Diverse species of insects and other invertebrates are essential for the health of both our natural and agricultural environments, and their populations require careful nurturing and maintenance to support sustainable and resilient food production. There is scope to build on the success of the National Pollinator Strategy by creating a complementary 'National Invertebrate Strategy' that would include provisions for invertebrates that carry out other important ecological roles. As seen in the creation of the National Pollinator Strategy, a National Invertebrate Strategy should include the publication of an implementation plan, containing targets against which progress can be measured and accountability ensured.

The statutory targets to halt and reverse species extinctions and decline in abundance by 2042, in accordance with the Environment Act 2021, are ambitious and welcome. However, the exclusion of numerous invertebrate species and in some cases entire groups, particularly those vital for UK food security such as predatory beetles, from the baseline measures used to monitor progress in achieving the aims, is concerning. As well as the 'Red List' of particular species at a specified risk of extinction, we recommend that a 'Baseline List' should be established, consisting of a wider range of insects and other invertebrates. This would allow a wider view of progress against biodiversity targets during the years ahead and would aid an understanding of trends in biodiversity beyond those species currently endangered.

Public interest in insects often focuses on what scientists term "charismatic" groups like bees and butterflies, but less known, harder-to-identify, and, to many people, unappealing insect species play vital ecological roles and require equal attention. We heard evidence that naturalist skills are declining in the UK. Much knowledge of smaller, lesser-known insect groups lies, as it always has done, with amateurs rather than professional academics. Interest in all insects should be nurtured from a young age, requiring access to nature and the fostering of ecological knowledge and interest,

something the anticipated Natural History GCSE aims to address. Access to this GCSE, once available, is important and welcome, as it can go some way to nurture a passion for entomology in younger generations.

In the UK, 70% of land is farmed, so agricultural practices have a major influence on insect populations. Pesticides used to target pest species such as aphids can have off-target effects on beneficial insects. The impact of pesticides and other chemical inputs on insect species that are not pollinators remains too little understood due to the lack of data on pesticide accumulation in terrestrial environments. The UK has made international commitments to reducing the overall risk caused by pesticides by at least half by 2030. However, the National Action Plan for Sustainable Pesticide Use, a crucial policy to address both knowledge gaps and encourage reductions in pesticide usage, has been delayed by six-years.

The new Environmental Land Management Schemes (ELMS) support land managers in providing environmental goods and services alongside food production. The impact of ELMS on the natural environment, including insect species, should be monitored and adapted as needed throughout its implementation. ELMS must show that it delivers better environmental outcomes than previous agri-environmental schemes. This will require close monitoring, coupled with feedback from farmers and land managers, to give a more comprehensive overview of the individual and collective effects of ELMS implementation on our natural environment.

In agricultural use, most witnesses to our Inquiry did not see the prospect of insecticides being phased out entirely. But in domestic gardens, questions of food security do not arise. The Royal Horticultural Society plans for its garden at Wisley to be 100% pesticide-free by 2025, with the exception of use for specific cases of invasive species. We believe that there is an opportunity to work with leading organisations like the RHS to phase down the use of pesticides in domestic horticulture.

1 Introduction

1. It has already been established by other Parliamentary Committees that insects are vital for food security but are also experiencing population declines.[1] Insects provide vital 'goods and services' for wildlife, food production and human health. Their roles include pollination, pest and weed regulation, decomposition, nutrient cycling, and provision of food for wildlife.[2] Insects can also be used as key indicators for monitoring ecosystems. On the other hand, some insects are considered agricultural pests and transmit diseases between people as well as crops or livestock.

2. It is difficult to assess the quantitative value of insects' role within ecosystems, but evidence submitted to this Inquiry said that internationally, the economic value of pollinators has been estimated as being worth over £134 billion to agricultural markets[3] and around £500 million in the UK.[4] Natural pest control of widespread aphid pests (by ground beetles and parasitoid wasps) has been estimated as being worth up to £2.3 million per year to South East England wheat fields.[5]

3. Over recent years, many international studies, focusing on different insect groups have indicated that there has been a decline in insect abundance, diversity, distribution and biomass.[6] However, the severity of these negative trends varies and may be over- or underestimated. For example, a well-reported 2019 global review,[7] which predicted catastrophic declines in populations, has been criticised by many academics, including witnesses to this Inquiry, due to alleged flaws in its methodology.[8] Uncertainties remain regarding specific insect decline figures and there are variations in trends between insect groups.[9] However, based on the oral and written evidence submitted to this Inquiry it was clear that, in broad terms, insects can be said to be in decline in the United Kingdom.

Drivers of insect decline

4. Insect decline is driven by various factors, and their effects vary across habitats, species, and time. Key drivers of insect decline include habitat loss and fragmentation, climate change, introduction of new species and diseases, light pollution, pesticides and

1 Environment, Food and Rural Affairs Committee, First Report of Session 2023–24, Soil Health, HC245; Environmental Audit Committee, Second Report of Session 2023–24, Environmental change and food security, HC312; Environment Audit Committee, Seventh Report of Session 2012–13, "Pollinators and Pesticides, HC668

2 Buglife (INS0038); The Wildlife Trusts (INS0027); CropLife UK (INS0035)

3 Dr James Hodge (Associate Professor at University of Bristol); Dr Kiah Tasman (Lecturer at University of Bristol) (INS0007)

4 Department for Food, Environment and Rural Affairs, Public urged to help bees, butterflies and other pollinators, 23 May 2022

5 UK insect declines and extinctions, POSTnote 619, Parliamentary Office for Science and Technology, March 2020

6 In a defined group and/or area, abundance is the numerical total of individuals, biomass is their total weight, biodiversity is the number of extant species, and distribution is their incidence across specified location(s). See Q38, Butterfly Conservation (INS0018); Rothamsted Research: Rothamsted Insect Survey (INS0020); UK Centre for Ecology & Hydrology (INS0022); Game & Wildlife Conservation Trust (INS0026); The Wildlife Trusts (INS0027); Biological Conservation Volume 232, April 2019, pp8–27

7 Sánchez-Bayo, Francisco, and Kris AG Wyckhuys. "Worldwide decline of the entomofauna: A review of its drivers." Biological conservation 232 (2019): pp8–27

8 Q68; Komonen A, Halme P, Kotiaho JS (2019) Alarmist by bad design: Strongly popularized unsubstantiated claims undermine credibility of conservation science. Rethinking Ecology 4: pp17–19; Mupepele A C et. al, Insect decline and its drivers: Unsupported conclusions in a poorly performed meta-analysis on trends—A critique of Sánchez-Bayo and Wyckhuys (2019), Basic and Applied Ecology, 2019, Volume 37, pp20–23

9 Q40

other aspects of agricultural intensification.[10] It is difficult to attribute specific drivers to individual declines in insect species. However, land use change and habitat loss are considered by witnesses to be most likely the main contributors to insect decline within the UK.[11]

5. The complexities in driver attribution stem from interactions among the various factors impacting insects. For example, exposure to pesticides and warmer temperatures combined could make bees more vulnerable to parasites.[12]

Government policies

6. Several government strategies and initiatives have been launched in the past decade which include objectives to address wildlife loss and food security. These policies will be addressed later in Chapter 3. They include: the National Pollinator Strategy, Agriculture Act 2020, Environment Act 2021, Green Recovery Challenge Fund, 25 Year Environment Plan, Healthy Bees Plan 2030, Environment Land Management Scheme, and the National Action Plan for Sustainable Pesticide Use. In his speech at the National Farmers' Union conference the Prime Minister announced a new UK-wide Food Security Index to capture and present the key data to monitor food security.[13] Contributors to this Inquiry have said that the effectiveness and feasibility of these policy initiatives require continual assessment and subsequent adjustments if required, as without such attention there were concerns that current schemes are insufficient to address insect decline.[14]

Our Inquiry

Origins

7. We launched an inquiry to examine how recorded and predicted changes in insect populations impact UK food security and how agri-environmental policies are addressing these trends. We sought views on the current evidence base for insect decline statistics and the gaps in our knowledge; the extent to which biodiversity initiatives are addressing insect decline; how crop protection strategies are impacting agriculturally beneficial insect species; and whether there is sufficient co-ordination within government and the UK food system to mitigate insect decline.

8. We have published 48 written submissions to the Inquiry's call for evidence and took oral evidence from 20 witnesses, including academics, individuals from insect and environmental charities, the President of the National Farmers' Union, active farmers, prominent figures in public conservation and the Minister for Nature, Rebecca Pow MP. We visited Rothamsted Research to see the long-running insect monitoring study, the Rothamsted Insect Survey. We also heard from researchers on how their work on both destructive and beneficial insect species for agriculture can have real-world applications for UK farming.

10 Buglife (INS0038); Game & Wildlife Conservation Trust (INS0026); Royal Entomological Society (INS0025); Butterfly Conservation (INS0018); Natural England (INS0037)
11 National Farmers' Union of England and Wales (NFU) (INS0024); Q50
12 Understanding insect decline: data and drivers, POSTbrief 36, Parliamentary Office for Science and Technology, March 2020, p18
13 Government underlines commitment to British farmers, press release, 20 February 2024
14 Natural England (INS0037); Dr James Hodge (Associate Professor at University of Bristol); Dr Kiah Tasman (Lecturer at University of Bristol) (INS0007); Game & Wildlife Conservation Trust (INS0026)

2 Insect population trends

9. In the United Kingdom, the broad conclusion of the evidence that we have taken in this Inquiry is that the insect population in the UK has been in decline - measured by the abundance of insects (the number of individual insects found in a place), the diversity of insects (how many different species are present in a place) and the distribution of insects (number of places that an insect can be found).

10. However, the data that supports this assessment is not perfect. Comprehensive long term data sets are few, and decline is not uniform: some species have increased in abundance while some have dwindled. But more have decreased than have increased.

11. Declining abundance, diversity and distribution has been seen in bees and hoverflies, butterflies and moths, beetles, and freshwater insects since structured monitoring began in the 1970s.[15] The written evidence submitted to this Inquiry includes many references to these dimensions of decline in various insect groups. Examples include:

- In the UK 80% of butterfly species have decreased in abundance or diversity, or both since the 1970s. On average, UK butterflies have lost 6% of their total abundance at monitored sites;[16]
- long-term abundance trends were calculated for 427 species of moth between 1968–2017. 41% (175 species) had decreased and only 10% (42 species) increased, with the remaining 49% (210 species) having trends that did not show statistically significant change;[17] and
- the Sussex Study, run by the Game and Wildlife Trust found that overall invertebrate abundance had declined by 37% from 1970 to 2019.[18]

12. However, many contributors highlight the knowledge gaps in insect decline data, especially for lesser-known insect groups such as springtails.[19] Even for well-studied groups such as bees, there is a lack of evidence and data on the abundance of many species. The International Union for Conservation of Nature (IUCN[20]) Red List of European Bees concluded that over half of Europe's estimated 2000 species of bees were "data deficient"; meaning that there was too little or no information available on the abundance and distribution of these species to assess their conservation status (i.e. Vulnerable, Threatened or Least Concern).[21] Although there was not total agreement between witnesses and in the written evidence regarding the *extent* of insect decline, Professor Goulson of the University of Sussex reflected a general consensus within the scientific community that insect population numbers are globally trending downward.[22]

15 UK Insect Decline and Extinctions, POSTnote 619, Parliamentary Office for Science and Technology, March 2020
16 Butterfly Conservation (INS0018)
17 Butterfly Conservation (INS0018)
18 Game & Wildlife Conservation Trust (INS0026)
19 Collembola, omnivorous, free-living organisms, forming the largest of three groups of hexapods sometimes grouped together and called Entognatha. See also Rothamsted Research: Rothamsted Insect Survey (INS0020); UK Centre for Ecology & Hydrology (INS0022); The Wildlife Trusts (INS0027)
20 The IUCN is the acknowledged global authority on the status of the natural world and the measures needed to safeguard it.
21 Nieto, A., European Red List of bees, IUCN: International Union for Conservation of Nature. European Commission, IUCN European Union Representative Office, IUCN Species Survival Commission (SSC), IUCN Species Survival Commission (SSC), Bumblebee Specialist Group, 2014
22 Q73

Drivers of insect decline

13. Fully understanding the data on the drivers of insect decline is challenging as there is limited evidence on how drivers influence each other, and which drivers are having the greatest impact.[23]

14. Particular drivers, such as climate change, may benefit some insects but be detrimental to others. For example, researchers at Imperial College London told us in their evidence that some UK butterfly and bumblebee species are experiencing geographic expansion whereas related species are experiencing contraction in their range.[24]

15. In 2020, the Parliamentary Office for Science and Technology produced a detailed brief outlining the data limitations behind recent work on understanding the drivers of insect decline. It reported that much of the research was conducted in controlled laboratory environments, focused on individual organisms, or was undertaken over short time periods (1–2 years) that are not relevant for long-term population-level processes.[25]

Current research into insect decline

16. In the UK the main insect monitoring projects led by university researchers are:

The Rothamsted Insect Survey (RIS)

17. The Rothamsted Insect Survey (RIS) has been running both suction and light- trap networks since 1964 and during this Inquiry was led by Dr James Bell. The suction-trap network currently comprises 16 traps 12.2 meters high (12 in England, 4 in Scotland) which count aphids, and 80 light traps in the UK and Ireland which count moths. Its long-term data provides information on aphids, larger moths and many other migrating insects to scientists, growers, conservation organisations, individuals and policy makers.[26] The long-term data from the Rothamsted Insect survey has shown that the total abundance of larger moths caught in the RIS light-trap network in Britain has decreased by 33% over 50 years (1968–2017). Losses were greater in the southern half of Britain (39% decrease) than in the northern half (22%).[27] The survey has also found that agricultural pest abundance, such as aphids and pollen beetles either remain stable or are increasing which may have negative implications for food production.[28]

UK Pollinator Monitoring Scheme (UK PoMS)

18. The UK Pollinator Monitoring Scheme (PoMS) is part of the Pollinator Monitoring and Research Partnership, a collaborative project funded by the Department for Environment, Food, and Rural Affairs (Defra), the Joint Nature Conservation Committee, devolved governments and charitable originations such as the Bumblebee Conservation Trust. It is led by Dr Claire Carvell from UK Centre of Ecology and Hydrology. UK

23 Q50
24 Mr James Heyburn (Policy & Engagement Officer at Imperial Policy Forum); Dr Richard Gill (Senior Lecturer, Department of Life Sciences at Imperial College London) (INS0012)
25 Understanding insect decline: data and drivers, POSTbrief 36, Parliamentary Office for Science and Technology, March 2020, p6
26 Rothamsted Research: Rothamsted Insect Survey (INS0020)
27 Butterfly Conservation (INS0018)
28 Rothamsted Research: Rothamsted Insect Survey (INS0020)

PoMS was established in 2017 and volunteers count how many pollinators visit a flower and for how long over a ten-minute period. Volunteers then submit this data through a dedicated app. In its 2022 Annual report, the UK PoMS results showed that pollinator numbers fluctuated across the five years of the study (2017–2022). However, researchers were cautious at drawing conclusions from this data as five years is too short a time to determine long-term population trends.[29]

DRUID Study

19. The four-year DRUID (Drivers and Repercussions of UK Insect Decline) project which began in 2021 is led by Professor Kunin of the University of Leeds, with partners from Rothamsted Research, the University of Reading, and the UK Centre for Ecology & Hydrology, and has received £2.3 million in funding. The aim of the project is to provide a definitive answer on whether UK insects are declining overall, and if so, what the main causes of the decline are. In the DRUID project, researchers will be drawing on different types of data–from 30 years of biological records and from high-tech sensors, such as weather radar. As of June 2023, the project has collected data on more than 4000 insect species and developed tools to use weather radar to monitor insects on a broad geographic scale.[30] Key findings from this project are expected to be published in 2024.[31]

20. The UK is one of the best monitored countries globally for insects, largely due to the establishment of the Rothamsted Insect Survey in 1964 and the UK Butterfly Monitoring Scheme (UKBMS), which started in 1976.[32] However, even this wealth of knowledge is concentrated on a few insect groups, namely, moths, butterflies and aphids. Professor David Goulson of the University of Sussex, told this Committee that: "There are massive knowledge gaps in the sense that the large majority of insect species are not being monitored at all".[33]

21. Another challenge in accurately quantifying the true levels of insect decline, both in the UK and globally, is the disagreement among experts on how insect population data in interpreted.

Bugs matter

22. The Kent Wildlife Trust (in partnership with Buglife and the Royal Society for the Protection of Birds (RSPB)) run Bugs Matter—the national citizen science survey of 'bug splats' on vehicle number plates to monitor flying insect abundance. The survey involves participants counting the number of insect splats on their front number plate at the end of a journey, and submitting the count via a mobile app, along with a photograph of the number plate. The report compiled from the data collected up until December 2022 concluded that compared with 2004, in England there was a 67.5% reduction in observed squashed insects, in Scotland a 40.3% reduction, and in Wales a 74.8% reduction.[34]

29 UK Pollinator Monitoring Scheme (2023) The UK PoMS Annual report 2022. UK Centre for Ecology & Hydrology and Joint Nature Conservation Committee, p18

30 Q88

31 UK Centre for Ecology & Hydrology (INS0022)

32 Rothamsted Research: Rothamsted Insect Survey (INS0020); Royal Entomological Society (INS0025)

33 Q54

34 Kent Wildlife Trust and Buglife , Bugs Matter Technical report 2022, 2023

23. The study has been criticised by the National Farmers' Union (NFU). It warned that from the survey there is no way of knowing what insect species are declining. Further, given that the data was collected only a few feet above a road, it did not adequately reflect the insect abundance in the wider environment.[35] Professor Potts of the University of Reading concluded that the technical report of the Bugs Matter survey accurately represented the findings of the study. However, he said that the secondary reporting of the results in the media conflated a change in number of squashed insects on number plates with a dramatic and certain decline in insect populations or "insectageddon".[36]

2019 Sanchez-Bayo - Wyckhuys review

24. A 2019 review article publish by Sánchez-Bayo and Wyckhuys analysed long-term survey data from 73 studies, mainly from Europe and North America.[37] From this analysis the authors concluded that "insects as a whole will go down the path of extinction in a few decades". The findings of this study were widely reported in the popular press and led, for example, to a *Guardian* headline "Plummeting insect numbers 'threaten collapse of nature".[38]

25. However, many researchers in the field criticised both the methodology used in the review and the alarmist nature of the coverage it attracted. Scientists from Finland published a rebuttal article which claimed that the study only looked at evidence from a limited number of countries and misinterpreted conservation data which led to an over-estimate in the extent of insect decline globally.[39] Whilst disagreeing with the conclusions of the Sánchez-Bayo and Wyckhuys review, Professor Potts said the review's publication led the scientific community to publicly support more rigorous studies.[40]

Further Ambitions

26. As described by the Minister for Nature, Rebecca Pow MP, UK insect monitoring projects, are 'envied globally'. However, we heard that the UK Pollinator Monitoring Survey (UK PoMS) budget is a modest £216,000 per year,[41] while the Rothamsted insect survey has had a budget of £2.2 million over five years.[42]

27. Dr Claire Carvell, leader of UK PoMS, believed that data from UK PoMS could feed into the biodiversity indicators (see Chapter 4). However, she said that this would require more allocated funding for long-term monitoring projects:

> The ecological research is well funded, but the long-term monitoring is difficult. We need timescales of more than five years, and we do not often see grant round proposals coming in for that period.[43]

35 National Farmers' Union of England and Wales (NFU) (INS0024)
36 Q64
37 Sánchez-Bayo, Francisco, and Kris AG Wyckhuys. "Worldwide decline of the entomofauna: A review of its drivers." Biological conservation 232 (2019): pp8–27
38 Plummeting insect numbers 'threaten collapse of nature', The Guardian, 10 February 2019
39 Atte Komonen, Panu Halme, Janne S. Kotiaho. Alarmist by bad design: Strongly popularized unsubstantiated claims undermine credibility of conservation science. Rethinking Ecology, 2019; 4: 17 DOI: 10.3897/rethinkingecology.4.34440
40 Q68
41 Q81
42 Q94
43 Q83

28. We heard that long-term monitoring of insect populations would require projects to run over a minimum of fifteen years in order to differentiate between yearly or seasonal fluctuations in insect populations and long-term trends.[44] Professor Kunin explained that:

> Ultimately, if you want to have a value in a standardised monitoring programme, you have to maintain it for a long time. There is an awful lot that happens in the same populations in very short timescales. There are big differences from one year to the next.[45]

29. Other witnesses also wanted to extend the studies to include more species. Dr Bell, then Lead of the Rothamsted Insect Survey, said:

> If I only had one message, it would be that we should commit to a clone of the insect survey elsewhere doing other things and have the long vision to fund that for not just the usual three or five-year cycle but a decent amount of time to show real evidence that agriculture has changed, for example, or that the carbon capture environments are still supporting insects.[46]

New technologies

30. The Natural History Museum has over 34 million insect specimens, with the earliest dating from 1680.[47] Advances in genomic sequencing have opened up the potential for mining these vast datasets to comprehend not only how insect populations have changed over the centuries but also to identify the most effective ways of supporting these populations. Dr Erica McAlister, Senior Curator of Diptera (flies) at the Natural History Museum, said:

> The specimens themselves are covered in pollen, and their guts have pollen in them. If we started to look properly at what is in the collections, we could find a wealth of information about which insects are associated with which plants and, if we are going to have seed mixes, which are the best for different groups of insects.[48]

31. Some witnesses suggested that new technologies can be used to identify insect species at a large scale, and therefore allow the analysis of large datasets in absence of taxonomy experts. John Holmes, Director of Strategy, Natural England, suggested that DNA or acoustic sampling,[49] could be used to distinguish between similar looking species.[50]

32. In 2021, the Defra DNA Centre of Excellence and the Joint Nature Conservation Committee (commonly known as JNCC), published "An Action Plan for making progress with using DNA to monitor terrestrial invertebrates".[51] In her follow up evidence Dr Carvell detailed how DNA sampling could be used to support taxonomic analysis:

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44 Q90
45 Q89
46 Q94
47 Q26
48 Q26
49 Acoustic sampling is a non-invasive technique where sound recordings are analysed to identify the unique acoustic signatures of insect species.
50 Q280
51 Joint Nature Conservation Committee, Report 691, An Action Plan for making progress with using DNA to monitor terrestrial invertebrates, October 2021

> Combining the traditional taxonomy with high-throughput and non-destructive DNA sequencing could provide a powerful tool for understanding population changes across a vast range of insect groups in the near-future.[52]

33. Artificial Intelligence (AI) could also be employed for the identification of insect species from images. Several spinout companies have expressed interest in collaborating with insect research groups to establish new AI businesses dedicated to wildlife monitoring.[53] Many of these companies are looking ahead to being able to develop and sell services in support of land use initiatives such as the Government's expanded Sustainable Farming Incentive scheme which is expected to require biodiversity monitoring in the agricultural sector.[54] However, as Professor Kunin explained, there are some limitations to this technology as often species are only distinguished by dissecting genitalia and " … the best camera in the world is not going to do that".[55]

34. **During this Inquiry it has become evident that substantial knowledge gaps persist in our understanding of insect populations. Despite the UK being a leader in this field of research, there remains a scarcity of comprehensive and comparable data which poses a significant challenge in accurately assessing the extent and underlying causes of insect decline.**

35. **The lack of long-term monitoring programmes for many insect species, and inconsistent data collection methods, hampers the ability to discern trends over time.**

36. ***The Government and its agencies like UKRI should produce a clear strategy for sustaining long-term insect monitoring research. This involves not only maintaining existing projects but also initiating new studies that can address insect data gaps. Funders should commit to the longer term funding which is needed for insect monitoring projects, extending beyond the usual five-year cycle of research grants and ensure that these studies have clear channels for the incorporation of data collected by amateur groups.***

Communicating insect decline data

37. Communicating uncertainty to the public has always been a challenge for scientists but is an important part of public engagement. However, whilst "science is not an exact science"[56], witnesses expressed a clear need to accurately communicate insect decline evidence including the gaps in our understanding and the reasons behind disagreements among experts. If not, Professor Potts warned that:

> One of the risks is that if it shows that the scientific community—and this is a great parallel with climate change—cannot agree across the board, that can place the question in the public's mind, "If the scientists cannot quite agree on this, who do we believe?"[57]

52 Dr Claire Carvell (Senior Ecologist at UK Centre for Ecology and Hydrology) (INS0045)
53 Q97
54 Q97
55 Some insect species are visibly indistinguishable from one another. However, different shaped genitalia means that the insects cannot successfully reproduce. One defining feature of a 'species' used by biologists is the ability to reproduce and create fertile offspring. Q95
56 Q69
57 Q71

38. The National Farmers' Union said in its evidence that the concept of 'insectageddon' was putting unwarranted negative attention on farmers. It said:

> … we do not think the evidence justifies insectageddon headlines or insectinction campaigns and the blaming that inevitably accompanies them.[58]

39. Professor Potts said that the use of emotive language when communicating insect decline "was a double-edged sword" and that, whilst raising awareness was good, "there needs to be support for better communication as well".[59] However, Professor Goulson believed that the terminology was not as important as the message:

> Whether you call it an apocalypse, insectageddon or whatever, there is certainly a serious problem with our insect populations declining and that has consequences for all of us.[60]

40. While the concept of 'insectageddon' is arresting, some witnesses believed that, lacking a sense of required action, such talk was unproductive. Chris Packham CBE, naturalist, conservationist and environmental campaigner, said:

> From my point of view, we need to move people on. It is not just about grabbing their attention with 'insectageddon'. That is fine, but, unless you go through the process of explaining that in detail and equally empowering them to do something about it at the end, your point is valid, because, basically, you are just terrifying them and leaving them even further incapacitated with perhaps even more eco-anxiety.[61]

41. **Effective communication of the reality of insect decline needs to be accompanied by communication of actions that can address it. A fatalistic approach risks reducing the chances of changes being made to policy, behaviour and practices that can make a real difference to stopping and reversing insect decline. Empowering both the public and policy makers is a more effective tool for change than implying hopelessness.**

42. ***The Government and its agencies should consider ways in which to communicate not only the reality of insect decline but also the attainable steps that can be taken to tackle it.***

58 National Farmers' Union of England and Wales (NFU) (INS0024)
59 Qq71–72
60 Q73
61 Q179

3 The importance of insects for UK Food Security

43. Insects play pivotal roles in both the natural ecosystem and in food production that benefit the global population. Dr Erica McAlister, Senior Curator of Diptera (flies) at the Natural History Museum, enthused about the various roles that insects play:

> About 80% of described animals are insects—and that is only the species described so far. Their roles are so important. Not only are they important in pollination, but they underlie so many of our ecosystems. When it comes to recycling of nutrients, biological control within those and regulating ecosystems, insects are very important. The amazing thing about insects is that because they go through this change in their life cycle they can get into many different parts of the environment. You name it, insects have got there.[62]

44. For example, dung beetles play a crucial role in maintaining pasture which livestock feed upon by fertilising and aerating soils and helping to reduce greenhouse gas emissions. Disruptions to their populations have negative impacts on both soil health and the long-term food production of these areas.[63] It has been estimated that dung beetles may save the UK cattle industry £367 million per annum through the provision of ecosystem services.[64]

45. Another key role that insects play in food production is natural pest control.[65] During our visit to Rothamsted Research, we were shown how a newly described parasitoid wasp species which predate on cabbage-stem-flea-beetles could be encouraged as a biocontrol measure against the oil seed rape pest that is developing resistance to chemical pesticides.

Invertebrates

46. Whilst the majority of pollinators in the UK are insects, non-insect invertebrates play pivotal roles in food production. Professor Lynn Dicks, University of Cambridge, described to us how invertebrates more widely were " … involved in making a productive landscape for food production".[66] For example:

- Earthworms are essential for soil aeration and nutrient cycling and their activities also help break down organic matter, releasing nutrients that are crucial for plant growth;[67]
- spiders and centipedes serve as natural enemies to crop pests. They prey on insects such as aphids that can damage crops, providing a form of biological pest control which may reduce the need for applying chemical pesticides;[68] and

62 Q1
63 The Wildlife Trusts (INS0027)
64 Buglife (INS0038)
65 Professor Sara Goodacre (Professor of Evolutionary Biology and Genetics at University of Nottingham) (INS0002); Mr James Heyburn (Policy & Engagement Officer at Imperial Policy Forum); Dr Richard Gill (Senior Lecturer, Department of Life Sciences at Imperial College London) (INS0012); Green Alliance (INS0017)
66 Q122
67 Sustain the Alliance for Better food and Farming (INS0019); The Wildlife Trusts (INS0027)
68 Professor Sara Goodacre (Professor of Evolutionary Biology and Genetics at University of Nottingham) (INS0002)

- the presence or absence of specific invertebrate species, such as snails, in aquatic ecosystems can serve as indicators of water quality. Monitoring these species can help assess environmental conditions and potential pollution.[69]

47. Minster for Nature Rebecca Pow MP told us how the Government's work in improving soil health policy for farming would help invertebrates such as earthworms and nematodes.[70] The Environmental Improvement Plan (EIP) sets out a target to bring at least 40% of England's agricultural soil into sustainable management through farming schemes by 2028, increasing this to 60% by 2030.[71]

48. We heard encouraging evidence that freshwater invertebrates were recovering, both in the UK and globally, and there has been documented returns of pollution-sensitive species to UK waterways, largely due to water quality policies and monitoring programmes run by the Environment Agency.[72] However, terrestrial invertebrate species are declining with studies showing that earthworm abundance has reduced by between 33% and 41% over the last 25 years.[73]

Pollinators

49. Pollinators play a crucial role in both UK and global food security.[74] A 2009 study referenced by the World Economic Forum in 2021, found that globally 35% of food production (by mass) comes from pollinator dependant crops and in their absence, crop production would reduce by 5% in higher-income countries and 8% in lower-to-middle-income countries.[75]

50. Food security requires access to the necessary nutritional elements for human health, such as vitamins and minerals. These are provided by fruits and vegetables, many of which require pollination for production. Professor Simon Potts from the University of Reading, described how a shortfall in pollination in the UK could result in poor yields and lower quality produce:

> A good example is that for one variety of apple, Gala, in Kent—quite a small area, but important for apple production—the deficit in pollination equates to something like £5 million in lost production. That could be fixed with some very simple interventions to boost pollinators—particularly wild pollinators.[76]

51. Evidence also points to the importance of considering the impact of insect decline outside the United Kingdom. In the UK, cereals account for the majority of total arable crop area in the UK (72%) and they do not require insect pollination.[77] However, both oral and written evidence highlighted to us that the UK imports around 50% of its food from

69 Q115
70 Q313
71 Rebecca Pow MP (Minister for Nature at Department for Environment Food and Rural Affairs) (INS0049)
72 Q115
73 Buglife (INS0038)
74 CropLife UK (INS0035)
75 Aizen, M. A., Garibaldi, L. A., Cunningham, S. A., & Klein, A. M. (2009). How much does agriculture depend on pollinators? Lessons from long-term trends in crop production. Annals of botany, 103(9), 1579–1588
76 Q41
77 Department for Environment Food and Rural Affairs, Agricultural Land Use in United Kingdom at 1 June 2022, 15 December 2022

overseas, much of which is in the form of pollinated crops, and therefore insect decline experienced in other countries impacts UK food security.[78] Professor Potts highlighted the challenges that policy makers face in addressing insect decline overseas but also the importance for UK food security.

National Pollinator Strategy

52. The National Pollinator Strategy, introduced in 2014, is scheduled for renewal in 2024.[79] This strategy outlines a decade-long plan aimed at supporting the survival and flourishing of pollinating insects. A mid-way review of the strategy led to the Pollinator Action Plan for 2021 to 2024.[80] The strategy's implementation plan, published in November 2015 sets out the Government's approach to executing the actions outlined in the strategy and monitoring its delivery and impact.[81] The National Pollinator Strategy aims to deliver across five key areas:

i) Supporting pollinators on farmland;

ii) Supporting pollinators across towns, cities and the countryside;

iii) Enhancing the response to pest and disease risks;

iv) Raising awareness of what pollinators need to survive and thrive; and

v) Improving evidence on the status of pollinators and the service they provide.

53. Professor Phil Stevenson, Head of Trait Diversity and Function at the Royal Botanical Gardens, Kew, who was involved in the strategy's development, praised the National Pollinator Strategy as an " … excellent model for how you can bring together experts and stakeholders to design an action plan to deliver outcomes that benefit pollinators".[82] However, Dr McAlister saw a place for a strategy that covered the wider ecological roles of invertebrates:

> We need a strategy that focuses more on all the insects. When looking through the pollinator strategy, I saw that it was very much on bees. I feel that it is very much outdated.[83]

54. The invertebrate charity Buglife went further in its written evidence calling the strategy "no longer fit for purpose" and that it "fails to properly address many pressures pollinators face".[84]

55. John Holmes, Director of Strategy for Natural England, which is responsible for promoting the aims of the National Pollinator Strategy to farmers, said that the policy

78 Q41; Dr Alexander Waller (Visiting Professor of Environmental Ethics and Science Education at American University of Sovereign Nations) (INS0005)
79 Department for Environment, Food and Rural Affairs, National Pollinator Strategy: for bees and other pollinators in England , 4 November 2014
80 Department for Environment, Food and Rural Affairs, National Pollinator Strategy: Pollinator Action Plan, 2021 to 2024, May 2022
81 Department for Environment, Food and Rural Affairs, National Pollinator Strategy: Implementation Plan, November 2015
82 Q10
83 Q10
84 Buglife (INS0038)

was successful at raising awareness and prompting actions, and that it highlighted to the public the importance of pollinators and what role individuals could play in protecting them.[85]

56. The National Pollinator Strategy is due to be updated in 2024. Buglife wrote to us calling for a more comprehensive approach to be followed in the review process, one that considers the impacts of all pollinator species and the threats they face.[86] Mr Holmes recommended that it should include a "comprehensive monitoring of pesticides in the terrestrial environment".[87] In evidence before this Committee, the Minister for Nature, Rebecca Pow MP, sought to assure us that the updated National Pollinator Strategy would aim to expand the variety of pollinators encompassed:

> We are now revising that pollinator strategy and looking at what more we need to do and what insects have been left out, because it is not only about bees, of course: it is a much wider range of insects.[88]

57. **While pollinators play a crucial role in ensuring UK food security, it is essential to recognise that insects and invertebrates play more than this one role in supporting food production. Diverse species are essential for preserving ecosystems, and their populations require careful nurturing and maintenance to support sustainable and resilient food production.**

58. ***We commend the success of the National Pollinator Strategy and eagerly await the 2025–2035 update that we expect to be published by September 2024. There is scope to build on the work of the strategy by creating a complementary 'National Invertebrate Strategy' that would include provisions for invertebrates that carry out other important ecological roles. As seen in the creation of the National Pollinator Strategy, the National Invertebrate Strategy should include the publication of an implementation plan, containing accountability targets, linked to the strategy every five years for non-pollinating, agriculturally beneficial, invertebrates.***

59. **The United Kingdom relies significantly on the global production of various horticultural crops, including fruits and salad vegetables. These imported foods may be subject to vulnerabilities, such as wars, which can see significant price increases. Approximately 50% of the food consumed in the UK comes from overseas. Therefore, it is integral to UK food security that the issues regarding insect decline and food production are also addressed at an international level. *The UK Government should use its position in international forums to advocate for and address the issues highlighted in this report on a global scale. Collaborative efforts are essential to mitigate the challenges posed by insect decline and to secure sustainable and resilient food systems worldwide.***

Charismatic insects

60. Certain animal species attract greater public attention than others. In conservation biology, the term 'charismatic species' refers to the idea that certain species, often characterised by attractiveness or impressiveness, become the primary focus of public interest and research funding.

85 Qq269–270
86 Buglife (INS0038)
87 Q271
88 Q300

61. Historically, insect monitoring has focused on more charismatic species like bees, butterflies and moths.[89] Consequently, there is a notable scarcity of data concerning non-charismatic yet agriculturally significant and beneficial insects.[90] Researchers at Imperial College London highlighted in their written evidence that these preferences have led to heavy biases in data sets: "People tend to gravitate to looking at the more charismatic, larger bodied, easy to identify, accessible, and 'warm-loving' insect".[91] To enhance both awareness and research concerning non-charismatic insect species, some contributors suggested that the Government should intervene by offering support to charities, landowners, and farmers who spearhead significant efforts in addressing insect decline outside of the most charismatic species.[92]

62. Nature presenter Chris Packham CBE provided us with valuable insights into how to raise the profile of insects that are typically overlooked. Using the example of mosquitoes, Mr Packham outlined the evolutionary process of a story employed in the BBC programme 'Springwatch':

> In [the mosquito piece], we took, you might argue, a slightly more superficial approach to it in that we showed its intrinsic beauty. The beauty included its extraordinary life cycle and the way it lays its eggs. We also integrated the fact that those eggs and the adult mosquitoes that emerge after the larval stage are implicitly important for those returning swallows when they get back from Africa. Again, we are drawing people's attention to an animal that they may not like but they want to see because it is beautiful, and then we are trying to build a slightly more sophisticated understanding of why it is beautiful not just in a physical sense but in an ecological sense by explaining that its abundance is necessary to feed those returning swallows.[93]

63. Some contributors criticised the focus on charismatic species to the detriment of other important insect species.[94] However, others saw their importance in raising awareness: charismatic species can serve as a valuable gateway into entomology, igniting an interest that may extend to broader aspects of the field. As Dr McAlister explained:

> People talk about charismatic versus non-charismatic, but the more you study about any subject the more you get drawn into it.[95]

Urban Beekeeping

64. Whilst there are over 270 native wild bee species in the UK, there is only one honeybee, *Apis mellifera,* which has been domesticated and is used for commercial and

89 The Wildlife Trusts (INS0027)
90 Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023)
91 Mr James Heyburn (Policy & Engagement Officer at Imperial Policy Forum); Dr Richard Gill (Senior Lecturer, Department of Life Sciences at Imperial College London) (INS0012)
92 Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023)
93 Q173
94 Mr Steve Garland (INS0004); Buglife (INS0038)
95 Q32

amateur beekeeping. One witness to this Inquiry characterised honeybees, together with butterflies, as the more charismatic insect groups in the UK, most likely because we can "see ourselves" in bees and can identify with them.[96]

65. Professor Stevenson said that, although honeybees are a good entry point for amateur entomologists, very high levels of urban beekeeping, especially in London can actually have a determinantal effect on other insect species.[97] He explained that high levels of domestic beekeeping were impacting the availability of pollen and nectar in the areas around each hive that other insects such as hoverflies and moths feed on.[98] Whilst high volumes of domestic beekeeping in an urban area is not driving insect decline at the same scale as habitat loss or climate change, people could be encouraged to support bee populations in other ways such as providing nest boxes in urban gardens for wild species.[99]

66. Evidence collected by Kew found that London had enough green spaces to support 7.5 honeybee hives per square kilometre. However, in some areas of the city there are as many as 50 hives per square kilometre and in one specific location there were 400 hives per square kilometre.[100] In follow up evidence, Kew said:

> The messaging to save bees - which has been in response to evidence of the decline of some wild bee species - has been oversimplified to encourage people to keep honeybees, even when honeybees are not in decline or at risk.[101]

67. In a later session, Mr Packham told us how science communicators are responsible for conveying messages to the public which are easily accessible, but this may have led to confusion over which type of bees needed protection:

> We try our very best—and it is not always easy—to build that increasing sophistication into our messaging ….I would say, there, that we as the communicators should have used the entry level and immediately developed [the message] slightly more quickly than we have, and not been left with a legacy whereby everyone thinks that the survival of the human species is dependent on the domesticated honeybee.[102]

68. However, beekeepers often possess extensive knowledge, combined with practical experience, and can demonstrate a deep understanding of the complexities of land use change, agrochemical effects, and the influence of shifts in seasonal changes on insects in local ecosystems.[103] Paradoxically, despite honeybees serving as crucial commercial crop pollinators, research by Dr Siobhan Maderson at Cardiff University revealed that many beekeepers consider agricultural areas as less appealing habitats for their bees, favouring urban and suburban environments for their hives.[104]

96 Q7
97 Q7
98 Q9
99 Q9; Q43
100 Royal Botanical Gardens, Kew (INS0044)
101 Royal Botanical Gardens, Kew (INS0044)
102 Q173
103 Dr. Siobhan Maderson (Research Associate at Cardiff University) (INS0016)
104 Dr. Siobhan Maderson (Research Associate at Cardiff University) (INS0016)

The National Bee Unit

69. The National Bee Unit (NBU) is part of the Animal and Plant Health Agency (APHA) and delivers the Bee Health Programmes for domestic and commercial beekeepers on behalf of Defra and the Welsh Government in England & Wales. The role of the National Bee Unit is to provide information for beekeepers, to help keep their domestic colonies healthy and productive. The current team of 80 people comprises laboratory diagnostics, programme support, research personnel and 60 home-based Bee Inspectors who are managed by the National Bee Inspector (NBI).[105] The NBU maintains a voluntary database of active beekeepers called BeeBase, which provides those registered with visits from the National Bee Inspector and advice on how to keep bees healthy.

70. Together with Bee Health stakeholders, the National Bee Unit helped to develop the Healthy Bees Plan 2030. The plan focusses on achieving four key outcomes:

i) Effective biosecurity and good standards of husbandry, to minimise pest and disease risks and so improve the sustainability of honeybee populations;

ii) enhanced skills and production capability/capacity of beekeepers and bee farmers;

iii) sound science and evidence underpinning the actions taken to support bee health; and

iv) increased opportunities for knowledge exchange and partnership working on bee health and wider pollinator needs.[106]

71. While managed bees contribute substantial pollination services, research suggests that the majority of crop pollination in the UK is provided by wild pollinators.[107]

72. **Charismatic insect species, of which the honeybee is a prime example, serve as invaluable ambassadors for the field of entomology, rendering the subject more accessible to the public and bringing to public attention this often-overlooked animal group. The concentrations of high numbers of hives in a small number of specific geographical areas may have detrimental effects on wild pollinator species due to resource competition. Consequently, there is a need to extend the range of conservation efforts to include the over 270 wild species of bees in the UK, acknowledging the importance of preserving the entire spectrum of biodiversity for a more balanced and resilient ecosystem.**

73. ***Defra should expand the remit of the National Bee Unit, to include a focus on wild bee health. This should include both developing internal expertise and fostering collaboration with entomology experts and producing biennial reports, as part of the National Pollinator Strategy update previously recommended in this report. The Unit should also produce guidance to keepers about the potential impacts of over densification of hives on wild pollinator species.***

105 National Bee Unit, About us, accessed 19 December 2023

106 Department for Environment, Food and Rural Affairs, Healthy Bees Plan 2030, 3 November 2020

107 Cambridge Global Food Security Interdisciplinary Research Centre, Wolfson College Interdisciplinary Research Hub on Sustainability & Conservation, and the Cambridge Institute for Sustainability Leadership (INS0036)

Education and Skills

74. When questioned about their attraction to the field of entomology, many experts providing evidence shared stories of their early fascination with nature. Mr Packham described his early encounter with a ladybird from a neighbour's garden,[108] and Dr McAlister, from the Natural History Museum recalled that she was brought up "quite feral" and was free to explore the natural world as a child.[109] These recollections reinforced the significance of early encounters with nature in cultivating interests that may persist into adulthood.

75. Professor Goulson of the University of Sussex observed that, despite most young children loving insects during primary school bug hunting activities, a shift tends to occur as they grow older.[110] By their teenage and adult years, many individuals tend to lose this fascination, often responding to insects with aversion and sometimes an instinct to kill them. This change was attributed by Professor Goulson to a lack of familiarity, exposure, and knowledge about insects.[111]

Engaging young people

76. Witnesses to this Inquiry agreed that cultivating an early interest in insects is crucial, not only for the field of entomology but also for broader policymaking and raising public awareness. This was seen as essential for addressing current and future challenges related to insect decline.

77. Researchers from Queen Mary University emphasised the vital role of public awareness in successful insect conservation. They proposed that education programmes and outreach initiatives across schools, communities, and public campaigns could achieve these aims.[112]

78. We heard in our Inquiry how both the Royal Botanical Gardens at Kew and the Natural History Museum were heavily involved in educational outreach programmes, as museums are more than just "bones and stone".[113] For example, in its written evidence, Kew pointed to the number of pupils that were involved in its outreach programmes:

> In the last financial year (2022–2023), over 85,000 school pupils visited Kew Gardens on a school trip with over 45,000 participating in a school-led session. Over 7,000 school teachers are subscribed to the online learning platform Endeavour, which has a reach of c.210,000 pupils.[114]

79. However, Professor Stevenson of the Royal Botanical Gardens, Kew acknowledged that, whilst many schools contact Kew to organise visits, the gardens could do more to engage local communities by themselves contacting schools to let them know what Kew could offer.[115] Not all students have access to London, and many other museums, gardens, and nature reserves throughout the country offer valuable opportunities for both

108 Q168
109 Q32
110 Q53
111 Q53; Q27
112 Queen Mary University of London (INS0033)
113 Qq27–31
114 Royal Botanical Gardens, Kew (INS0044)
115 Q28

in-person visits and online resources. Platforms like Kew's Endeavour,[116] or the online entomology demonstrations produced by the National History Museum,[117] can enhance access and participation.

80. To both encourage and support this outreach work, Professor Stevenson recommended that the Government should "Provide the schools with the resource they need to get to where they need to go to learn about insects," whilst Dr McAlister called for more funding for institutions to help them provide this type of outreach.[118]

Natural History GCSE

81. The Department for Education announced in April 2022 that the GCSE curriculum would contain a qualification in 'Natural History' by 2025.[119] The aims of the new Natural History GCSE are to enable young people to explore the world by learning about organisms and environments, environmental and sustainability issues, and gain a deeper knowledge of the natural world around them. It also intends to develop the basic skills needed for a career in the natural world, for example observation, description, recording and analysis.[120]

82. Witnesses to this Inquiry were supportive of the new qualification, highlighting how it will allow pupils to learn about the broader ecosystem and the value of insects within it.[121] While the Bumblebee Conservation Trust was concerned that the qualification may not be available to all students, both Professor Stevenson and Dr McAlister agreed that the Natural History GCSE would address the lack of entomology currently covered in the core sciences.[122]

Higher education and vocational work

83. A 2023 report from the Royal Entomological Society,[123] highlighted that one of the so called 'Grand Challenges' of the discipline was the need to increase entomological awareness, appreciation, and skills. In its written evidence it went further to say that entomological skills are not adequately prioritised in many university undergraduate and postgraduate courses.[124] Both the Biotechnology and Biological Sciences Research Council (BBSRC) and the Medical Research Council (MRC) identified entomology as a subject of "concern" in their 2017 review of vulnerable skills.[125] In her evidence, Dr McAlister told us of the lack of opportunities for training professional entomologists:

116 Royal Botanical Gardens, Kew (INS0044)
117 Q29
118 Qq30–31
119 Department for Education, Sustainability and climate change: a strategy for the education and children's services systems, 22 April 2022
120 Department for Education, The Education Hub, The new Natural History GCSE and how we're leading the way in climate and sustainability education – your questions answered, 25 April 2022
121 Q8
122 Q8; Darryl Cox (Senior Science and Policy Officer at Bumblebee Conservation Trust) (INS0034)
123 Luke, S.H., Roy, H.E., Thomas, C.D., Tilley, L.A., Ward, S., Watt, A., Carnaghi, M., Jaworski, C.C., Tercel, M.P., Woodrow, C. and Aown, S., 2023. Grand challenges in entomology: Priorities for action in the coming decades. Insect conservation and diversity, 16(2), pp173–189
124 Royal Entomological Society (INS0025)
125 Biotechnology and Biological Sciences Research Council and the Medical Research Council, BBSRC and MRC review of vulnerable skills and capabilities, 20 December 2017, p3

> There are not enough insect specialists and lecturers to teach a lot of these courses. They can specialise more at Master's level, but the three-year zoology degree is dominated by vertebrates.[126]

84. Professors Potts and Goulson noted the limited enrolment of entomology students at their respective universities but expressed optimism about a reversal in the downward trend, attributing this to growing interest in the best-known pollinator, the bee.[127]

85. In her evidence to us, Minster Pow agreed that studying entomology should be encouraged[128] and highlighted the need for non-academic routes into jobs in this field. In a letter to this committee, Minister Pow stated that evidence collected by stakeholders, including the Chartered Institute of Ecologists and Environmental Managers (CIEEM), on the skills and workforce issues will form the Green Jobs Plan, scheduled for release in early 2024.[129] The Minister confirmed that CIEEM, with the support of the Institute of Apprenticeships and Technical Education, will convene employers to investigate possibilities for creating non-degree entry pathways into ecological positions to tackle recognised workforce and skills challenges.[130]

86. **Raising awareness of the importance of various insect species must be nurtured early to avoid the aversion that many people have to insects. The scarcity of experts, both professional and amateur, underscores the importance of cultivating a greater public passion for entomology, starting from an early age. The commendable efforts made by institutions such as the Natural History Museum and the Royal Botanical Gardens Kew, demonstrate promising avenues for engaging the public both online and in person.**

87. ***In its response to this report, the Government should set out how it intends to facilitate nationwide access to external teaching resources offered by public bodies. This access, available through online platforms and educational visits, can significantly enhance the educational experience. The Government should also outline details of how it can make it easier to enter specific careers in entomology whether through vocational routes including collaborations with the Chartered Institute of Ecology and Environment Management or through academic streams.***

88. **The existing biology and core sciences GCSE curriculum inadequately addresses crucial aspects of insect study and focuses on a limited selection of ecological roles. We applaud the introduction of the new Natural History GCSE, which aims to not only encompass scientific knowledge but also lay the foundations of skills necessary for pursuing a career in entomology and other nature-related subjects.**

89. ***The Government should ensure that it promotes access to the new Natural History GCSE when it is launched, with particular focus on schools that may not currently have easy access to the natural environment.***

126 Q14
127 Qq48–49
128 Q306
129 Rebecca Pow MP (Minister for Nature at Department for Environment Food and Rural Affairs) (INS0049)
130 Rebecca Pow MP (Minister for Nature at Department for Environment Food and Rural Affairs) (INS0049)

The Importance of amateurs

90. The UK boasts a robust tradition of amateur natural science, providing historical records on insect numbers. The Dipterists Forum, the UK umbrella organisation for all Diptera (flies) recording schemes, highlights that the majority of skills in invertebrate identification are found within the amateur community.[131] The oral evidence indicated a profound respect among the witnesses for the "amateurs" in entomology, recognising them as often the foremost experts in specific insect groups.[132]

91. As implied by the name, amateur entomologists are unpaid for their work; nevertheless, the insect monitoring records they maintain are used by funded research programmes like the Drivers and Repercussions of UK Insect Decline (DRUID) project (see chapter 2).[133] In its written evidence, the Dipterist Forum recommended that support should be made available for amateurs to attend international conferences, often the preserve of professional academics, to foster collaborations and to disseminate amateur research among the entomology community.[134] This support could be in the form of opening the application of grant funding provided by learned societies to amateurs who have made substantial contributions to their respective fields.

92. Concerns were raised that the number of highly accomplished amateur naturalists was diminishing in the UK. Mr Packham told us:

> When it comes to our formal interest in natural history, whether that is through an educational facility or self-taught, we see fewer people now who have the naturalist's capabilities of even people of my generation.[135]

Citizen Science

93. Citizen science is a scientific method in which volunteers collect data to help answer research questions. Citizen science has been used to monitor insects for many years, and it is becoming increasingly important as insect populations decline. Examples of citizen science projects for insect monitoring include:

- **Big Butterfly Count:** launched in 2010, over 107,000 citizen scientists took part in 2021, submitting 152,039 counts, using smart phone apps or printed charts, of butterflies and day-flying moths from across the UK;[136]
- **BeeWalk:** volunteers are asked to go to a specific location near to them, identified on the project's website, and count the number of bees and what species are there during spring and summer;[137]

131 Dipterists Forum (INS0030)
132 Q33
133 Qq93–94
134 Dipterists Forum (INS0030)
135 Q174
136 Big Butterfly Count, About, Accessed 20 December 2023
137 Darryl Cox (Senior Science and Policy Officer at Bumblebee Conservation Trust) (INS0034)

- **UK Pollinator Monitoring Scheme (UK PoMS)**: A Defra funded project established in 2017 and is the first scheme in the world to have begun generating systematic data on the abundance of bees, hoverflies and other flower-visiting insects at a national scale;[138] and

- **Bugs Matter Survey:** volunteers are asked to count the number of 'splats' on their car number plates after a registered journey (see chapter 2).[139]

94. Much of the written evidence detailed the many benefits to using citizen science to monitor insects.[140] This method can be used to collect data over large areas and over long periods of time, with data being reported from volunteers on butterfly numbers since the 1970s.[141] Citizen science can also be used to collect data from areas that would be difficult or expensive to access by scientists.

95. However, Professor Stevenson of Royal Botanical Gardens Kew argued that such projects were a necessity due to what he regards as underfunding in entomology research:

> Citizen science approaches to data generation have become a thing of necessity, even to the point where it is being funded by UKRI. I think that it is seen as an easy and economical cop-out when actually we need more investment and more people who are paid professionally to undertake this kind of work, because it is so important.[142]

96. Some experts also questioned the quality of the data collected by citizen scientists. We heard that in some cases volunteers, who may lack expertise in insect identification, could introduce errors in data collection, or data can exhibit bias, with volunteers more inclined to collect information on easily visible or interesting insects.[143] Unlike formal scientific research, negative datasets are rare in citizen science because volunteers are unlikely to submit zero counts, potentially skewing the data.[144]

Benefits of citizen science

97. Despite potential limitations in data quality, involving the public in citizen science projects brings community benefits, particularly in raising public awareness, which is essential for addressing the issue of insect decline.[145]

98. A key benefit highlighted by witnesses was the wellbeing associated with participation. Dr Claire Carvell, leader of UK Pollinator Monitoring Scheme (UK PoMS) told us:

138 UK Centre for Ecology & Hydrology (INS0022)
139 Buglife (INS0038)
140 Dr Alexander Waller (Visiting Professor of Environmental Ethics and Science Education at American University of Sovereign Nations) (INS0005); Mr James Heyburn (Policy & Engagement Officer at Imperial Policy Forum); Dr Richard Gill (Senior Lecturer, Department of Life Sciences at Imperial College London) (INS0012); Butterfly Conservation (INS0018); Rothamsted Research: Rothamsted Insect Survey (INS0020)
141 Butterfly Conservation (INS0018)
142 Q16
143 Dipterists Forum (INS0030); Mr James Heyburn (Policy & Engagement Officer at Imperial Policy Forum); Dr Richard Gill (Senior Lecturer, Department of Life Sciences at Imperial College London) (INS0012); Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023)
144 Q176
145 Queen Mary University of London (INS0033)

> We also know that getting involved in citizen science and getting up close to nature has a significantly positive impact on people's wellbeing. There is increasing discussion in the sphere of green prescribing to help bring people in.[146]

99. Encouraging participation in citizen science, especially among groups not traditionally associated with engaging in or with limited access to nature, can broaden the opportunities for individuals to experience the positive impact that access to nature provides. Broadening participation also has the added benefit of filling data gaps in insect research by collecting data from underrepresented locations such as urban environments or in an arable crop field.[147]

Access to Nature

100. Throughout the Inquiry we heard examples from witnesses about the limited experience many children have with the natural environment such as an 8-year-old never having touched soil,[148] or the overzealous use of personal protective equipment when children are exposed to nature.[149]

101. During this Inquiry the Government announced the provision of £2.5 million in funding to give more children from under-represented groups, access to nature.[150] This was in response to its own research that found that "18% of children living in the most deprived areas never visit nature at all".[151]

102. Whilst clearly beneficial, exposure to the natural world at a young age does not necessarily need to be limited to being outside. Mr Packham drew attention to the many ways that schools can bring nature into the classroom such as piping birdsong into school libraries, using wildlife images as holding slides or using screens to stream online wildlife cameras.[152]

103. **We commend the often-overlooked contributions of amateur entomologists, ranging from unpaid species experts to members of the public involved in citizen science initiatives. While the collection of insect monitoring data remains invaluable for entomology, citizen science projects serve a broader purpose. We agree with the perspective of conservation experts, acknowledging that participation in such projects not only aids insect research but also enriches the lives of participants by fostering a deeper connection with the natural world. Citizen science projects allow researchers access to insect data from broad geographic areas that they may not have the resources to sample themselves. However, this type of survey must supplement, not replace, expert-led academic research projects.**

104. ***Citizen science projects, especially those supported by public funding, should implement strategies to enhance inclusivity, ensuring the involvement of people from***

146 Q106
147 Q99
148 Q8
149 Q181
150 Department for Environment, Food and Rural Affairs, Government pledges to boost Britain's access to nature ahead of COP28, 29 November 2023
151 Department for Environment, Food and Rural Affairs, Landscape Review, 21 September 2019, p68
152 Q181

urban and disadvantaged backgrounds. This broader participation not only facilitates the collection of data from areas such as urban environments but also allows more people to experience the mental health benefits associated with engaging with nature.

4 Pesticides and agri-environmental policies

105. Through its agri-environmental polices the Government has shown that it recognises the pivotal role that farmers and land managers will play in halting the decline of species, including insects, by 2030.[153] Evidence to our Inquiry provides grounds for believing that land management practices are a significant driver of insect decline in the UK.[154] Consequently, agri-environmental schemes, aiming to enhance both the natural environment and food production, can be a valuable approach.[155]

Environmental Land Management Schemes (ELMS)

106. The Environment Land Management Schemes (ELMS) consist of farm subsidies that reward landowners in England for their environmental work. ELMS replaces the EU's Common Agricultural Policy (CAP) Basic Payment Scheme as part of the Agriculture Act 2020.[156] ELMS is made up of three main schemes:

- The Sustainable Farming Initiative (SFI) which contains the Integrated Pest Management (IPM) schemes.[157] The first applications for the Sustainable Farming Incentive scheme were made in 2022;[158]
- an enhanced Countryside Stewardship;[159] and
- Landscape Recovery (LR).[160]

107. The Government has set a target for ELMS to have 70% of farmers adopting the Sustainable Farming Incentive (SFI), covering a minimum of 70% of farmland.[161]

Stakeholders' response to ELMS

108. Contributors to this Inquiry broadly welcomed the introduction of ELMS. Mr Henry Edmunds, Owner of the Cholderton Estate, Hampshire, praised the Government's approach to supporting sustainable farms saying:

153 Department for Environment, Food and Rural Affairs, Environmental land management schemes: outcomes, 6 January 2022
154 Q50
155 Royal Entomological Society (INS0025); Fera Science Ltd. (INS0010); Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023)
156 Agriculture is a devolved policy, and the Environment Land Management Schemes are England only schemes. For a summary of agricultural payments policy in Wales, Scotland and Northen Ireland see Farm funding: Implementing new approaches, Research briefing CBP 9431, House of Commons Library, 15 March 2023. See also: Welsh Government, Sustainable Farming Scheme, (23 February 2024); Scottish Government, Sustainable and regenerative farming - next steps: statement, (2 March 2022); Department for Agriculture, Environment and Rural Affairs, Future Agricultural Policy for Northern Ireland, (24 March 2022)
157 Department for Environment, Food and Rural Affairs, Sustainable Farming Incentive guidance, updated 8 December 2023
158 Farm funding: Implementing new approaches, Research briefing CBP 9431, House of Commons Library, 15 March 2023
159 Department for Environment, Food and Rural Affairs, Countryside Stewardship: get funding to protect and improve the land you manage, updated 3 January 2024
160 Department for Environment, Food and Rural Affairs, Landscape Recovery: round one, 18 May 2023
161 Department for Environment, Food and Rural Affairs, Environmental land management schemes: outcomes, 6 January 2022

> I would also like to applaud Defra for the ELMS countryside stewardship. These are excellent schemes. I am and have been a participant in stewardship for many years. I could not do what I do without the support I have had through stewardship, so I have a lot to be grateful for there.[162]

109. However, concerns have been raised by some, including the National Farmers' Union, on the delays to its introduction.[163] The Bumblebee Conservation Trust in its evidence expressed concern that the 2023 update to ELMS removed the more ambitious aspects of the enhanced Countryside Stewardship. It also said that these schemes needed to be more integrated with other biodiversity initiatives such as the National Pollinator Strategy.[164]

110. In his oral evidence, Craig Bennett, Chief Executive of the Wildlife Trusts, said that Defra (Department for Environment, Food & Rural Affairs) needed to be more ambitious with the Sustainable Farming Incentive (SFI) rather than taking a cautious approach to attract more farmers:

> Curiously, Defra's view over the last couple of years is that it has been very worried that there are not enough farmers going into the scheme. There was, at one point, a narrative that it did not want to make it too ambitious because it might put farmers off. I think it has done exactly the opposite. The more schemes you can put within SFI and offer generous payments to farmers to do them, the more farmers will [take it up]. I speak to many farmers who say there are almost not enough standards within SFI to tempt them into it. So I think holding back on the ambition has been a problem.[165]

111. A key difference between the previous agri-environmental schemes and the new ELMS is the ability for farmers to 'bundle' together measures from different parts of the scheme based on the farmers' desired outcomes. However, John Holmes, Director of Strategy, Natural England, said that individual measures would not achieve the desired outcomes to benefit insects, for example "If you do an [Integrated Pest Management] strategy but then don't put into place some flower meadows, it does not work".[166] He expected the flexibility and the ability to bundle measures together within ELMS would provide better outcomes than the previous schemes.[167] However, Vicki Hird, former lead of sustainable agriculture, at Sustain, disagreed:

> I would not have made the scheme pick-and-mix. I would have made it much more integrated and coherent so that farmers would need to do something and then need to do something else, so it is a logical step. At the moment, they can just pick and do things and not go to the next step, and that is not going to give us what we need.[168]

112. In its written evidence, Natural England said that because measures could be bundled together "their effectiveness will depend on both overall patterns of uptake and the balance of uptake across the different measures".[169]

162 Q224
163 Farming subsidies trigger row over future of British countryside, Financial Times, 27 September 2023
164 Darryl Cox (Senior Science and Policy Officer at Bumblebee Conservation Trust) (INS0034)
165 Q127
166 Q292
167 Q292
168 Q232
169 Natural England (INS0037)

113. Monitoring the effectiveness of ELMS is the responsibility of Natural England, which has over 30 years of evidence regarding the effectiveness of agri-environmental schemes. However, it warned that it is too early to assess whether ELMS is more effective at halting insect decline than the previous schemes.[170]

114. In its 2023 Soil Health Report, The Environment, Food and Rural Affairs Committee called for the Government to produce a set of measurable targets and an evaluation programme for ELMS to ensure it is delivering on its aims of improving the health of the environment.[171]

115. **Witnesses to this Inquiry have told us that within the UK, land use change, land management practices and pesticide usage are amongst the largest contributing factors to insect decline. Consequently, the largest influence on achieving the biodiversity targets for insect species outlined in the 2021 Environment Act, could lie in the implementation of agri-environmental policies.**

116. **Evidence from this Inquiry supports the conclusions from the Environment, Food and Rural Affairs Committee that the impact of Environment Land Management Schemes (ELMS) should be monitored and adapted as needed throughout its implementation, to gain the benefit of an iterative approach to policy development. ELMS should also show that it delivers better environmental outcomes than previous agri-environmental schemes. However generous and efficient the payment system is, the actions being rewarded need to have their impacts monitored and assessed to ensure specific outcomes like improved insect populations are delivered by ELMS and that public money is well spent. Successful execution of this monitoring, coupled with feedback from farmers and land managers, will give a more comprehensive overview of the individual and collective effects of ELMS implementation.**

117. ***The Government, in response to this report, should outline its plans to establish a monitoring and evaluation programme for ELMS. Such a programme should incorporate mechanisms to feed data on specific outcomes—such as insect abundance—back into long-term monitoring programmes. The Government should publish annual reports detailing:***

a) ***ELMS uptake levels, including a breakdown for each standard within the Sustainable Farming Incentive and how the schemes are combined by participants;***

b) ***implemented actions following scheme uptake;***

c) ***the influence of farmers' feedback on ELMS development; and***

d) ***the environmental impacts of the schemes including impact on beneficial insect species.***

170 Natural England (INS0037)

171 Environment, Food and Rural Affairs Committee, First Report of Session 2023–24, Soil Health, HC245, p50 para 16

Integrated Pest Management

118. Integrated Pest Management (IPM) is a methodology focused on suppressing pest populations by encouraging their natural enemies or other ecological and technical means, treating chemical pesticides as a last resort.

119. The Government's new farm funding schemes, the Environmental Land Management Schemes (ELMS), contains payments for Integrated Pest Management as part of the Sustainable Farming Incentive. The actions for Integrated Pest Management focus on:

- increasing knowledge and identifying opportunities for an integrated pest management approach;
- creating habitats for natural crop pest predators;
- using 'companion cropping'[172] to suppress weeds, reduce diseases and provide protection from crop pests; and
- minimising use of insecticides.[173]

120. As with the whole of ELMS, Integrated Pest Management is a voluntary scheme and payments are based on four tiers of implementation, with the first being £989 per year for 'assessment and planning'.[174] Minette Batters, President of the National Farmers' Union, told us that as of October 2023, 4,400 Integrated Pest Management plans had been submitted.[175]

121. Contributors to this Inquiry broadly supported Integrated Pest Management,[176] and Professor Alistair Griffiths, Director of Science and Collections, Royal Horticultural Society told us that Integrated Pest Management was being more widely adopted by the horticultural industry.[177] However some contributors, including Natural England, said it required more consistent approaches while farmers needed more Government support to implement measures.[178] Vicki Hird, former Head of Sustainable Farming, Sustain, said the measures needed to be "bigger, stronger and more ambitious"[179] and the Bumblebee Conservation Trust said:

> The inclusion of IPM in ELMS is welcome, but paying farmers to simply have a plan will not equate to a reduction in pesticide use.[180]

172 Companion crops are [a pair of] plant species sown together to gain some advantage in yield or protection from pests from complementary [physical, chemical or biological] features.

173 Department for Environment, Food and Rural Affairs, SFI actions for integrated pest management, updated 18 September 2023

174 Department for Environment, Food and Rural Affairs, SFI actions for integrated pest management, updated 18 September 2023

175 Q256

176 BASF (INS0015); Sustain the Alliance for Better food and Farming (INS0019); The Pesticide Collaboration (INS0021); UK Centre for Ecology & Hydrology (INS0022); Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023); Royal Entomological Society (INS0025); Game & Wildlife Conservation Trust (INS0026); Queen Mary University of London (INS0033)

177 Q158

178 Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023); Royal Entomological Society (INS0025); Natural England (INS0037)

179 Q225

180 Darryl Cox (Senior Science and Policy Officer at Bumblebee Conservation Trust) (INS0034)

Impact of Integrated Pest Management on tackling insect decline

122. In its 2019 National Pollinator Strategy Evidence Update, the Government concluded that there was limited data quantifying the effects of Integrated Pest Management and other changes to the pesticide regime on pollinator diversity, abundance and health of the farmland. It also stated that there is no current review being undertaken on the effects of Integrated Pest Management, at scale, on insects.[181]

123. Natural England is exploring the efficacy of Integrated Pest Management as an agricultural control method, through its Biodiversity Enhancement study.[182] Provisional results from the study were included in the submission Natural England provided, which highlighted that there was currently limited evidence that Integrated Pest Management (IPM) benefited insect populations or biodiversity more generally:

> The finding of substantial evidence gaps for the impact of IPM techniques on biodiversity is pertinent, as the SFI (Sustainable Farm Incentive) IPM Standard is being introduced with the aim of paying farmers for delivering a public good. However, this report shows that there is a lack of evidence for what impact these practices will have.[183]

124. When questioned on these results, John Holmes, Director of Strategy, Natural England, told us that Natural England was delaying the publication of its conclusions so that it could collect more evidence on the impact of Integrated Pest Management. However, he believed that:

> IPM clearly has a good place in the future of farming for biodiversity. It is a question of tweaking the way we do it for maximum outcome, but also to make sure it fits in profitable farming.[184]

Integrated Pest Management methods and technologies

125. The main premise of Integrated Pest Management is using alternatives to chemical pesticide applications wherever possible to protect crops from insect pests. Professor Toby Bruce of Keele University and Professor Linda Field of Rothamsted Research, gave us various examples of current and developing Integrated Pest Management strategies including the use of semiochemicals[185], biopesticides[186] and precision spraying technologies to target pesticides more accurately.[187]

126. Integrated Pest Management techniques can also include growing crops that are more resistant to pests whether through ensuring they are as healthy and robust as possible or by introducing resistant genes to crop varieties (see Box 1).

181 Department for Environment, Food and Rural Affairs, NPS Evidence Update, 3 January 2019
182 Natural England (INS0037)
183 Natural England (INS0037)
184 Q291
185 Semiochemical are hormones or pheromones used to either repel pests or attract them away from a crop.
186 Biopesticides are a type of pesticide made from natural materials such as animals, plants, bacteria, and certain minerals or their derivatives including genetic material or metabolites.
187 Q200

Box 1: Gene-editing to protect crops from pests.

The Genetic Technology (Precision Breeding) Act 2023 removed plants and animals produced through precision breeding technologies, such as genome editing from regulatory requirements applicable to the environmental release and marketing of Genetically Modified Organisms (GMOs). Gene editing is different to producing GMOs as the technique does not introduce new 'alien' DNA into an organism. Instead, it recreates genetic changes that could occur naturally or through conventional breeding methods but at an accelerated pace.

Gene-editing could be used to produce pest resistant crop varietals. For example, British Sugar is working with the biotechnology company TROPIC to genetically edit sugar beet's innate defence mechanisms (known as gene silencing or RNA interference) to better target Yellow Virus.[188]

Alternatively, instead of genetically editing a crop, researchers are working on genetically editing the insect pest. A startup company Biocentis, founded by researchers from Imperial College London, are working on using gene-editing to spread female sterility among pest insect populations by disrupting the sex determination gene (doublesex) in certain insects. This aims to reduce successful breeding in the targeted population across multiple generations, leading to a localised reduction in population size. One of the first target species for this technology is the invasive pest of berries and other soft-skinned fruits Drosophila suzukii.[189]

127. Mr Henry Edmunds, the owner of the Cholderton Estate, described how he successfully managed his estate organically and remained commercially successful. Mr Edmunds told the Committee that his technique of 'properly' rotating where he sows his arable crop allowed him to produce high yields of barley without the need for any additional inputs such as fertilisers or pesticides. He explained that improving the organic matter in his soil meant his crops could resist diseases and grow successfully among wild plants.[190]

128. However, Mr Edmunds acknowledged that transitioning to fully organic practices takes time as it requires large populations of natural pest predators:

> You cannot suddenly have masses of beneficial insects overnight; it takes time for populations to build up and to get the habitat right. It does not happen overnight.[191]

New technologies for Integrated Pest Management

129. Whilst introducing Integrated Pest Management into the Sustainable Farming Incentive scheme was widely seen as a positive step, some contributors to this Inquiry highlighted that challenges still need to be addressed in this developing area of research.

130. One such challenge is communicating advice on how to implement techniques that are most suited to each specific farming environment. Professor Bruce explained that:

188 British Sugar (INS0006)
189 Imperial College London, Imperial startup Biocentis to develop genetic tech to control harmful insects, 1 February 2023
190 Qq215–216
191 Q221

> One of the problems with integrated pest management is that it is too complicated and difficult for farmers to use. Some of the alternative approaches depend on the weather or need to be done at a particular time.[192]

131. Advice to farmers can be provided by the Voluntary Initiative, an industry led programme which aims to be the UK's primary mechanism for promoting best practice in the use of chemical pesticides and enhance the adoption of Integrated Pest Management.[193] The chemical company BASF said in its evidence that it was:

> …committed to Integrated Pest Management and support the Voluntary Initiative to reduce the impact of crop protection and indeed crop production, on the environment, including use of digital and precision agriculture to achieve more efficient and targeted use of crop protection products.[194]

132. Some contributors highlighted the fact that the advice made available to farmers was not independent of agrichemical companies.[195] Ms Hird suggested that farmers who were successfully implementing Integrated Pest Management should be encouraged to advise others:

> We have said that there should be an independent, affordable or free advisory network available for all farmers to access. I think some of the best advisers would be people like Henry [Edmunds]. You could pay farmers who are already doing it to provide that advice and demonstration to all farmers so they can understand what IPM really means. It is not just cutting out insecticides or herbicides; it is about a whole-farm approach with chemicals as a very last resort.[196]

133. A second challenge highlighted was the lack of translational research in this field—studies seeking to produce more meaningful, applicable results that directly benefit human welfare more quickly—in this instance, specifically geared towards practical pest solutions as opposed to the more well-funded "curiosity-driven scientific research".[197]

134. The Government has committed £270 million as part of its farming innovation programme, which is a partnership between Defra and UK Research and Innovation (UKRI), to applying science and agricultural research to challenges in agriculture to provide benefits for farmers and develop practical solutions.[198] The programme began in 2021. However, Professor Bruce was still concerned, saying:

> We need better interventions—better things that farmers can do that can be put together in the integrated pest management packages. At the moment there are not enough robust, field-applicable solutions that can be used, so we need research geared towards generating practical solutions.[199]

192 Q196
193 Voluntary Initiative, About Us, accessed 1 February 2024
194 BASF (INS0015)
195 Mr Norman Guiver (INS0003); Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023); Game & Wildlife Conservation Trust (INS0026); Q199;Q225
196 Q225
197 Q196
198 UKRI, Farming innovation: find out about funding, Accessed December 2023
199 Q197

135. **Integrated Pest Management (IPM) is an important component of sustainable crop protection; however, it requires more knowledge than traditional pesticide applications. To enhance the successful implementation of IPM, it is imperative to adopt innovative approaches and new tools, such as integrating resistant plant varieties, the use of biopesticides or new pheromones, artificial intelligence decision support systems, and advances in agronomy as and when they are developed. For widespread adoption within the farming community, effective and sustainable crop protection strategies should be demonstrated at a commercial scale.**

136. ***We support the work of the Voluntary Initiative in disseminating advice to farmers on implementing Integrated Pest Management strategies. However, there is scope to extend the scheme to incorporate a peer-to-peer advisory network to provide farmers with access to a range of advice for developing and implementing their own strategies. The Government should also support the development of new IPM technologies through research funding and other mechanisms. Once these technologies are demonstrated as effective, the Government should encourage farmers to implement them by incorporating their use as specific actions into the Environmental Land Management Schemes (ELMS).***

Biodiversity indicators and Sites of Special Scientific Interest (SSSIs)

137. In accordance with the Environment Act 2021, The Environmental Targets (Biodiversity) (England) Regulations 2023 contain legally binding targets for both species abundance and extinction risk in England.[200]

Species extinction

138. The regulations set the target of reducing the risk of species extinctions by 2042, when compared to the risk of species extinctions in 2022. The baseline value of species extinction risk for this comparison was created by Natural England in the 2022 Red List for England (also known as the D5 Conservation status of our native species).[201] Whilst 49% of the species included in the 'Red List' metric are invertebrates, the list does not include some major insect groups such as bees, wasps, ants or moths.

139. The reasons behind the exclusion of many invertebrate species from the 'Red List' was due to the lack of evidence of whether a species is vulnerable, endangered, near threatened or any of the other official conservation categories.[202] To be included, species' 'Red List Data' requires formal approval by one of the Statutory Nature Conservation Bodies[203] to ensure the reliability of the data.[204] The Minister told us that whilst there is a lot of data on some excluded species such as bees and moths the data was not " … exactly the right

200 The Environmental Targets (Biodiversity) (England) Regulations 2023 (SI 2023/91)

201 Natural England, Outcome Indicator Framework for England's 25 Year Environment Plan: D5 Conservation status of our native species, 19 October 2022

202 Q266

203 The Statutory Nature Conservation Bodies' (SNCBs) are Natural England, Natural Resources Wales, NatureScot, the Northern Ireland Environment Agency, the Joint Nature Conservation Committee, and DAERA's statutory advisory body, the Council for Nature Conservation and the Countryside.

204 Rebecca Pow MP (Minister for Nature at Department for Environment Food and Rural Affairs) (INS0049)

data for them to get on to that red list".[205] The Minister told us that "big talks" were had about the absence of bees specifically from the 'Red List' when the targets were discussed, however Minister Pow did not refer to any actions to resolve their absence.[206]

Species abundance

140. A separate list of species, or 'biodiversity indicators', is used as the baseline metric to measure changes in species abundance. The second set of statutory targets requires that the decline in "overall relative species abundance index" should be halted by 2030 and then reversed so that species abundance is higher in 2042 than in 2022. The abundance of species included in the 'biodiversity indicators' is measured each year and compared to the previous year's figures to establish the trend.[207] Writing to us following her oral evidence, Minister Pow told the Committee that the 'biodiversity indicators':

> … includes 11 bumblebee species, 55 butterflies, and 452 moths and utilises data from third-party monitoring schemes including the Rothamsted Insect Survey, UK Butterfly Monitoring Scheme, and BeeWalks.[208]

141. However, compared to the numbers of invertebrate species in the UK the 'biodiversity indicators' is a very limited list. For example, the UK has over 270 species of bee and yet only 11 species of bumblebee are included. Other insect groups that are important for UK food security are completely absent, including beetles and wasps, which highlights major gaps in the 'biodiversity indicators'.

142. Excluding these species from the 'biodiversity indicators', which is used to determine whether legally binding targets are achieved, means that the indicators lack sensitivity to changes in the populations of these invertebrates.[209] This could lead to a situation in which the abundance targets are considered met, even if there is a significant decline in the abundance of invertebrate species not included on the list such as beetles.

143. **The statutory targets to halt and reverse species extinction and decline in abundance are ambitious and welcome. However, the exclusion of numerous invertebrate species and in some cases entire groups from the baseline metrics, particularly those vital for UK food security such as predatory beetles, is concerning. Including only 11 species of bumblebee is not an adequate abundance indicator for all 270 (at least) unique UK bee species. We are concerned that a significant number of insect or invertebrate species could go extinct or significantly decline in abundance, and yet the statutory targets could still be met by law.**

144. ***Revised versions of Natural England's 'Red List' and the 'biodiversity indicators' used to measure changes in abundance should include a minimum of one species per family, which would result in a significant increase in invertebrate representation. In response to this report, the Government should set out what steps it is taking to gain approval from members of the Statutory Nature Conservation Bodies, so that data from species excluded from the 2022 Red List can be included in future iterations. Additionally, a detailed breakdown of how current data from the monitoring of excluded***

205 Q303
206 Q303
207 The Environmental Targets (Biodiversity) (England) Regulations 2023 (SI 2023/91), Schedule 2
208 Rebecca Pow MP (Minister for Nature at Department for Environment Food and Rural Affairs) (INS0049)
209 Q268

invertebrate species influence both the interim and final statutory biodiversity targets, should be published routinely. This should be in the form of an alternative 'Baseline List' to include species where the availability of data does not pass the threshold for inclusion in the 'Red List', but where evidence is available to determine a baseline conservation status. This 'Baseline List' should include as many excluded insect species as possible, to act as baseline statistics from which all future interim and final progress reporting for the biodiversity targets will be made.

Sites of Specific Scientific Interest (SSSI)

145. Sites of Specific Scientific Interest (SSSI) are a formal conservation designation officially made by Natural England (England); Natural Resources Wales (Wales); Scottish Natural Heritage (Scotland) or the Northern Ireland Environment Agency (Northern Ireland).

146. There are almost 7000 SSSIs across the UK and designation means that landowners must manage the site appropriately to conserve its special features. These features currently include the presence of rare flora or fauna or important geological or physiological features that may lie within its boundaries.[210]

147. Evidence submitted to this Inquiry states that some SSSIs are failing to conserve invertebrate biodiversity, and Natural England said they are "… often in unsatisfactory condition".[211] In her oral evidence, Professor Lynn Dicks of the University of Cambridge, told us that with regard to insects: "The common species are actually declining faster in protected areas than outside protected areas".[212]

148. Naturalist Chris Packham CBE gave the Committee an example of how the Cholderton Estate, run by Mr Edmunds, had better biodiversity than a neighbouring SSSI and suggested that budget cuts to Natural England were a reason behind the unsatisfactory condition of protected sites.[213] In its 2019/20 Annual Report and Accounts, Natural England said that "It has been well-documented that Natural England's government funded Grant in Aid budget has declined by 49 percent in six years and almost two-thirds over a decade".[214]

149. However, Mr Holmes of Natural England told us that the problem was not the budget cuts but rather that isolated SSSIs were surrounded by unprotected and degrading countryside:

> The reason for decline is that these SSSIs are really islands of habitat for species in a highly degraded fabric of the countryside. An SSSI notified for a butterfly species on its own is unlikely to be able to support a butterfly species, even if you do all the habitat management. They are islands that need a wider countryside fabric that is accessible and in good condition. They also suffer from the same things as the wider countryside: pesticide

210 Woodland Trust, SSSI Definition, 1 March 2019
211 Natural England (INS0037)
212 Q110
213 Q178; Q183
214 Natural England, Annual Report and Accounts 1 April 2019 to 31 March 2020, Session 2019–20, HC712, 17 September 2020

> impacts and fragmentation impacts affect SSSIs. That fragmentation has gone on for so long, we do not know what extinction debt, if you like, is carried.[215]

150. The 2023 Environment Improvement Plan has the following commitments regarding SSSIs:

- All SSSIs will have an up-to-date condition assessment by 31 January 2028;
- 50% of SSSIs to have actions on track to achieve favourable condition by 31 January 2028; and
- delivering the £5.6 million Conservation and Enhancement Scheme to improve and maintain the condition of those SSSIs not currently eligible for existing agri-environment schemes, for example because they are not agricultural holdings.[216]

151. As of November 2023, just under 19% of SSSIs had an up-to-date condition assessment, and around 12% have actions on track to achieve favourable condition.[217]

152. Professor Dicks, however, warned that even the improvements to these protected sites may not be enough to prevent the reductions in insect abundance in these areas:

> We have two statutory headline targets from the Environment Act. One is about halting species extinction. The protected areas network, as it is, especially if we improve the condition of the sites we have, will do that for insects. But I do not think it will do the other target—the other statutory thing we are trying to meet—which is to halt [decline in] species abundance.[218]

153. **Witnesses to our Inquiry estimate that approximately half of the Sites of Special Scientific Interest (SSSIs) are not in a good state and are failing to conserve invertebrate biodiversity.[219] Protected sites do not exist in isolation and are therefore influenced by the quality of nature in the surrounding environment. Whilst we welcome the statutory improvements to SSSIs set out by the Environment Improvement Plan, which will go some way to prevent more insect species extinctions, our Inquiry heard it is unlikely that these improvements will be sufficient to halt decline in species abundance. This is particularly the case for more common species, where large numbers of individuals in a population are needed to play pivotal roles such as pollination effectively.**

154. ***The Government should invest in the monitoring of landscapes surrounding protected areas to collect evidence on how these areas impact the quality of protected sites. This data should be included in the Sites of Special Scientific Interest (SSSI) condition assessments. Details of how to mitigate external influences on SSSI conditions should also be considered as an 'action to achieve favourable conditions', which in accordance with the Environment Improvement Plan should be reported in 2028.***

215 Q278
216 Department for Environment, Food and Rural Affairs, Environment Improvement Plan 2023, 31 January 2023
217 Rebecca Pow MP (Minister for Nature at Department for Environment Food and Rural Affairs) (INS0049)
218 Q110
219 Q111

The Role of Pesticides in UK Food Security

155. Pesticides are chemical and biological products used to kill, control or prevent harmful organisms and plant diseases. Insecticides (insect specific pesticides) can be broad-spectrum, meaning they can control a wide range of insects, including beneficial insects. Examples of broad-spectrum insecticides include pyrethroids, organophosphates and neonicotinoids (see section on Neonicotinoids below). Selective insecticides are active on specific pest species but have minimal impact on non-target organisms.

Impact of pesticides on insect decline

156. Whilst chemical pesticide use is recognised as a key driver of insect decline there was disagreement among contributors to this Inquiry about the extent to which insecticides play a role in insect decline in the UK.

157. Some contributors to this Inquiry have cited multiple studies where the specific use of insecticides has been linked to decline in non-target insects such as butterflies and pollinators.[220]

158. However, some academics, Natural England and industry stakeholders have said that the role pesticides play in insect decline trends remains unclear.[221] For example, the National Farmers' Union said in its evidence:

> The evidence base shows some neonicotinoid insecticides are a high risk to bees and can have negative sub-lethal impacts on bees. But there is still no clear or compelling weight of evidence showing that neonicotinoids are a cause of widespread declines in pollinator or other insect populations.[222]

159. A key reason for the uncertainties around the impact of pesticides on many insect species is the lack of data on pesticide accumulation in the environment.[223] Mr Holmes of Natural England told the Committee that terrestrial monitoring of pesticides is not currently comprehensive, and that in order to make interventions more impactful a new monitoring system needs to be implemented.[224] In June 2023, Natural England published 'A proposal for terrestrial environmental monitoring of Plant Protection Products' which outlines suggested improvements to fill the gaps in our current knowledge.[225]

160. Currently, pesticide usage is estimated by the Food and Environment Research Agency's (Fera) Pesticide Usage Survey, where a random sample of farms is surveyed every two to four years depending on the crop.[226] This survey is not compulsory and is

220 Dr Alexander Waller (Visiting Professor of Environmental Ethics and Science Education at American University of Sovereign Nations) (INS0005); Dr James Hodge (Associate Professor at University of Bristol); Dr Kiah Tasman (Lecturer at University of Bristol) (INS0007); Fera Science Ltd. (INS0010); Dr Harry Siviter and Professor Jane Memmott (Dr Harry Siviter and Professor Jane Memmott at Buglife - The Invertebrate Conservation Trust) (INS0050)

221 CropLife UK (INS0035); BASF (INS0015); National Farmers' Union of England and Wales (NFU) (INS0024); Natural England (INS0037); Professor Toby Bruce (Professor of Insect Chemical Ecology at Keele University) (INS0014); Fera Science Ltd. (INS0010)

222 National Farmers' Union of England and Wales (NFU) (INS0024)

223 Natural England (INS0037)

224 Q269; Q284

225 Natural England, A proposal for terrestrial environmental monitoring of Plant Protection Products, 14 June 2023

226 Fera, Pesticide Usage Survey, accessed 2 January 2024

reliant on farmers recording data accurately. According to the Science Advice for Scottish Agriculture (SASA) Pesticide Survey Unit: "There are no alternative methods of pesticide usage estimation that could attain greater precision within the resource available".[227]

Neonicotinoids

161. One of the most widely used classes of insecticides around the world is neonicotinoids accounting for over 24% of the global insecticide market.[228] In the EU (and therefore the UK at the time), the use of neonicotinoids was restricted in 2013 to prevent their use on flowering crops that are attractive to bees. In 2018, the EU banned three of the most used neonicotinoids (clothianidin, imidacloprid and thiamethoxam) on all outdoor crops.[229]

162. However, temporary emergency exemptions have allowed some growers to continue using these pesticides. The UK Government grants emergency authorisation to use neonicotinoids on the non-flowering sugar beet crop in England based on forecast models provided by Rothamsted Research using Rothamsted Insect Survey data. Such exemptions were granted in February 2023 and again in January 2024.[230] Vicki Hird in her written evidence told us that for all three exemptions granted between 2020 and 2023, this was done against the advice of the UK Expert Committee on Pesticides and the Health and Safety Executive which were consulted by the Secretary of State for Defra prior to the decision being made.[231]

163. British Sugar said in its evidence that the use of neonicotinoids was required to protect the sugar beet crop as there were no viable alternatives currently available.[232] Despite this, some academics and charities called for a complete ban on neonicotinoid use due to the pesticide's negative impact on bees, in particular the sub-lethal effects on reproduction and foraging.[233] Professor Field told us that "there began to be evidence that insects that feed on nectar and pollen—specifically bees—were being affected with sub-lethal effects".[234] Professor Field, and others, called for more research to be carried out, especially in field experiments, on the long-term impact of neonicotinoid exposure on many insects, and said that there are extensive knowledge gaps in this area.[235]

227 Science Advice for Scottish Agriculture , Pesticide Survey Unit – Methods of Data Collection, Statistical Estimation and Quality Assurance Procedures, 2022

228 Dr James Hodge (Associate Professor at University of Bristol); Dr Kiah Tasman (Lecturer at University of Bristol) (INS0007)

229 Understanding insect decline: data and drivers, POSTbrief 36, Parliamentary Office for Science and Technology, March 2020, p22

230 Department for Environment, Food and Rural Affairs, Neonicotinoid product as seed treatment for sugar beet: emergency authorisation application 2023, 16 February 2023; Department for Environment, Food and Rural Affairs, Statement of reasons for the decision on the application for emergency authorisation for the use of Cruiser SB on sugar beet crops in 2024, 18 January 2024

231 Vicki Hird (Former Head of Sustainable Farming at Sustain) (INS0048)

232 British Sugar (INS0006)

233 Dr James Hodge (Associate Professor at University of Bristol); Dr Kiah Tasman (Lecturer at University of Bristol) (INS0007); Buglife (INS0038); Butterfly Conservation (INS0018); The Pesticide Collaboration (INS0021)

234 Q187

235 National Farmers' Union of England and Wales (NFU) (INS0024); Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023); Q192

National Action Plan for Sustainable Pesticide Use

164. Having taken evidence during this Inquiry from industry stakeholders, academics, charities and farming representatives, there was no suggestion that chemical pesticides should be completely banned within agricultural settings.

165. There was a consensus that pesticides, even if only used as a last resort, are needed for UK food production. However, some witnesses called for a more sustainable approach to insecticide use to reduce their environmental impact.[236]

166. The 15th Conference of the Parties to the United Nations Convention on Biological Diversity saw the adoption of the Kunming-Montreal Global Biodiversity Framework. Target 7 includes the commitment of parties, including the UK, to reduce the overall risk from pesticides and highly hazardous chemicals by at least half by 2030.[237]

167. The strategy of the UK Government to mitigate the adverse effects of pesticides is outlined in the National Action Plan for Sustainable Pesticide Use. The **first** National Action Plan for Sustainable Pesticide Use (NAP) was published in 2013 and was expected to be reviewed every five years. The overarching objective of the NAP is to minimise the risks and impacts associated with pesticides on human health and the environment, all the while ensuring effective management of pests and pesticide resistance.[238]

168. In 2020, Defra, the Scottish Government, the Welsh Government, and the Department of Agriculture, Environment, and Rural Affairs (DAERA) in Northern Ireland collectively formulated a revised National Action Plan for the Sustainable Use of Pesticides (NAP). This **draft** updated plan **was published for consultation and** designed to replace the 2013 NAP and outlines a 5-year strategy aimed at enhancing the sustainability of pesticide usage across the UK.

169. Conservation and environmental charities recommended in written evidence to this Inquiry that the revised NAP should contain ambitious targets for the reduction in pesticide use and expressed frustration at the delay in its publication.[239] Evidence submitted to the Environment, Food and Rural Affairs Committee's Soil Health Inquiry also called for the updated National Action Plan to be published as soon as possible.[240]

170. As of 28 February 2024, the revised National Action Plan for Sustainable Pesticide Use remains unpublished, a delay of over six years.

236 BASF (INS0015); Sustain the Alliance for Better food and Farming (INS0019); The Pesticide Collaboration (INS0021); UK Centre for Ecology & Hydrology (INS0022); Norwich Research Park, John Innes Centre, The Sainsbury Laboratory, Earlham Institute, University of East Anglia (INS0023); National Farmers' Union of England and Wales (NFU) (INS0024); Royal Entomological Society (INS0025); Game & Wildlife Conservation Trust (INS0026); Queen Mary University of London (INS0033)

237 The 15th Conference of the Parties Convention on Biological Diversity, Kunming-Montreal Global Biodiversity Framework, 19 December 2022

238 Department for Environment, Food and Rural Affairs, Consultation outcome: Summary of responses, 15 December 2021

239 The Pesticide Collaboration (INS0021);Darryl Cox (Senior Science and Policy Officer at Bumblebee Conservation Trust) (INS0034)

240 Environment, Food and Rural Affairs Committee, First Report of Session 2023–24, Soil Health, HC245, p17 para 36

Response to Delays in publication

171. Vicki Hird, former lead of sustainable agriculture, Sustain, told the Committee that the lack of an action plan was 'disastrous' for farmers.[241] Minette Batters, President of the NFU, agreed and described the delay as "frustrating".[242] When pressed for her opinion on why there has been such a delay, Ms Batters said:

> We have had three Prime Ministers in 12 months. They have had very different approaches to what they want to achieve. In that time, we have had different Secretaries of State who have had very different approaches to what they want to achieve.[243]

172. However, Dr Rachel Irving, Deputy Director for Chemicals, Pesticides and Hazardous Waste at Defra told our Committee that the reasons behind the delay was the 38,500 responses to the 2021 consultation and that it was "a really complex area that the Government are keen to get right".[244]

173. **The UK has made international commitments to reducing the overall risk caused by pesticides by at least half by 2030. Whilst we acknowledge that updating the National Action Plan for Sustainable Pesticide Use, the UK implementation plan to achieve these commitments, is a substantial task for the Government, this does not excuse the six-year delay in the publication of this crucial policy.**

174. ***We echo the Environment, Food and Rural Affairs Select Committee's recommendation that the Government should publish the National Action Plan for Sustainable Pesticide Use no later than May 2024.***

175. **The impact of pesticides on insect species that are not pollinators remains not fully known due to the lack of data on pesticide accumulation in terrestrial environments and specific details of pesticide applications on managed land.**

176. ***The Government should outline how the 'Proposals for Terrestrial Environmental Monitoring of Plant Protectant Products' will be incorporated into the National Action Plan for Sustainable Pesticide Use. Furthermore, the Government should consider how it could use its powers to increase respondents to the Fera's pesticide usage survey.***

Urban and suburban pesticide use

177. Residential gardens comprise 29.5% of Great Britain's total urban area and up to 400,000 different varieties of plants grow in UK gardens.[245] According to the Royal Horticultural Society (RHS), these gardens and other urban green spaces such as parks and allotments are critically important refuges which help pollinators and other invertebrates thrive.[246]

241 Q235
242 Q245
243 Q247
244 Q316
245 Royal Horticultural Society, The RHS Sustainability Strategy: Net Positive for Nature and People by 2030, 12 November 2021
246 Q144

178. Insects are experiencing a decline in urban and suburban areas as well as rural areas. This decline can be attributed to various detrimental management practices, such as the replacement of lawns and gardens with paved surfaces, the adoption of artificial grass, and excessive use of agrochemicals in gardens.[247]

179. Matt Shardlow, Chief Executive Officer of Buglife, reasoned that, as domestic pesticide use was not essential for food production, the UK Government should follow other European countries such as France and Luxembourg,[248] and ban the use of pesticides in non-agricultural settings.[249]

180. Professor Alistair Griffiths, Director of Science and Collections at the Royal Horticultural Society, told this Committee that the majority of gardeners did not use chemicals for pest control. In its own gardens, such as RHS Wisely, the RHS was working to reduce its pesticide use by 100% by 2025 except in specific cases of invasive species where pesticide use is judged by experts as essential for biodiversity net gain.[250] However, when asked if pesticides could be removed from the garden horticulture sector completely, Professor Griffiths said that the complete removal of pesticides from events such as the Chelsea Flower Show would be difficult.[251]

181. The Minister for Nature, Rebecca Pow MP, told the Committee that a ban on urban or suburban pesticide use would not be necessary, but that the Government supports the encouragement of gardeners to "go chemical-free".[252]

Sustainable pesticide use in urban areas

182. Whilst accounting for only 15% of overall pesticide use in the UK, provisions for urban and suburban usage are contained in the National Action Plan for Sustainable Pesticide Use (NAP). Dr Irving told the Committee that the lack of data for use in these areas was one of the reasons behind the delay in publishing the updated NAP, and that the department was looking into how it can improve on pesticide usage data in these areas.[253]

183. Furthermore, some contributors to this Inquiry were concerned that agrichemicals could be purchased for domestic application with no requirement for training in safe usage or storage.[254] The current 2013 National Action Plan said that users of pesticides for the maintenance of public spaces such as parks or recreational facilities and amateur users "are not operating to the same high standards as is generally found in agriculture".[255]

184. **Pesticide use by amenity and amateur sectors in urban and suburban areas does not benefit UK food production and can have adverse effects on many insect species.**

247 Dr. Siobhan Maderson (Research Associate at Cardiff University) (INS0016)
248 Luxembourg and France passed total bans on all non-agricultural pesticides from 1 January 2016 for the former and 1 January 2017 for the latter. These bans cover pesticides' used in private gardens as well as in urban public spaces such as pavements, playgrounds, green spaces, cemeteries, sports facilities, allotments and more. Pesticide Action Network Europe, Pesticide Free Towns: A Diversity of European Approaches, 27 March 2022
249 Q152
250 Qq154–157
251 Q158
252 Q320
253 Q307
254 Dr. Siobhan Maderson (Research Associate at Cardiff University) (INS0016)
255 Department for Environment, Food and Rural Affairs, National Action Plan for Sustainable Pesticide Use, February 2013, Para 7.2 p5

185. ***The updated National Action Plan for Sustainable Pesticide Usage should include targets for reducing pesticide use in urban and suburban areas and to improve best practice for use by amateurs. The Government should work with stakeholders such as the Royal Horticultural Society, to stimulate the phasing down of pesticide use in the domestic horticultural sector.***

New plant protection products and regulation

186. Contributors to this Inquiry, including British Sugar, called for the Government to work with academia and industry to accelerate the development of replacements for neonicotinoids and other pesticides.[256]

187. There was concern that restricting the availability of numerous pesticides might lead to an overreliance on a limited set of existing products, thereby heightening the risk of pests developing resistance. Professor Bruce warned that:

> If pesticides are just banned, without enough new solutions being made available, there will be intense selection pressure for resistance, given the limited number of pesticides that are considered less harmful that are still available. Without a range of options, those interventions will be over-used and insects will evolve resistance. We will lose those more benign products as well.[257]

188. Professor Field explained that as researchers learn more about the genetics of pest species, there is potential to create more precise chemistries targeting specific insects, minimising the impact on non-target beneficial insects. However, she suggested that motivating the industry to develop these new pesticides would require legislative encouragement.[258]

189. Professor Bruce believes that streamlining the regulatory processes for both new chemical pesticides and alternative plant protection products such as biopesticides would speed up the transition away from the more harmful broad-spectrum conventional insecticides.[259]

190. Industry contributors to this Inquiry were keen to improve commitments to research and development of new and alternative plant protection products. British Sugar highlighted its long-term plans, together with the NFU and the British Beet Research Organisation to tackle Yellow Virus spread by aphids, including non-chemical treatments and gene-editing (see Box 1).[260]

191. **While a contentious debate exists between nature conservation groups and agriculturalists regarding the use of conventional pesticides, both sides acknowledge the importance of developing new solutions, emphasising the need for increased investment in practical research and development. The regulatory system's failure to distinguish between conventional chemicals and alternative plant protection products**

256 British Sugar (INS0006)
257 Q198
258 Q193
259 Professor Toby Bruce (Professor of Insect Chemical Ecology at Keele University) (INS0014)
260 British Sugar (INS0006)

such as biopesticides, coupled with high costs and lengthy approval processes, pose a barrier to innovation. Streamlining this process is essential for advancing environmentally sustainable alternatives in agricultural practices.

192. ***The Government should adopt an evidence-based strategy in formulating pesticide legislation, promoting the development of new plant pesticides with heightened target specificity. This approach would aim to mitigate the dual risks of pest resistance development and adverse off-target effects on beneficial insects. Any alterations to the regulatory framework should include ongoing monitoring of the impact on non-target species in field environments, where approved active substances are employed. Moreover, there should be an expansion in the range of non-target species for which data is collected to assess a chemical's impact prior to regulatory approval.***

The Government should outline in its response to this Report, how it intends to support the development, regulation and practical application of pesticide alternatives, including, but not exclusive, to biopesticides, hormones and mRNA technologies. The Government should set out how it intends to adapt the current regulatory systems to accommodate innovative pesticide alternatives so that regulatory approval for these technologies can, where possible, be expedited.

Conclusions and recommendations

Insect population trends

1. During this Inquiry it has become evident that substantial knowledge gaps persist in our understanding of insect populations. Despite the UK being a leader in this field of research, there remains a scarcity of comprehensive and comparable data which poses a significant challenge in accurately assessing the extent and underlying causes of insect decline. (Paragraph 34)

2. The lack of long-term monitoring programmes for many insect species, and inconsistent data collection methods, hampers the ability to discern trends over time. (Paragraph 35)

3. *The Government and its agencies like UKRI should produce a clear strategy for sustaining long-term insect monitoring research. This involves not only maintaining existing projects but also initiating new studies that can address insect data gaps. Funders should commit to the longer term funding which is needed for insect monitoring projects, extending beyond the usual five-year cycle of research grants and ensure that these studies have clear channels for the incorporation of data collected by amateur groups.* (Paragraph 36)

4. Effective communication of the reality of insect decline needs to be accompanied by communication of actions that can address it. A fatalistic approach risks reducing the chances of changes being made to policy, behaviour and practices that can make a real difference to stopping and reversing insect decline. Empowering both the public and policy makers is a more effective tool for change than implying hopelessness. (Paragraph 41)

5. *The Government and its agencies should consider ways in which to communicate not only the reality of insect decline but also the attainable steps that can be taken to tackle it.* (Paragraph 42)

The importance of insects for UK Food Security

6. While pollinators play a crucial role in ensuring UK food security, it is essential to recognise that insects and invertebrates play more than this one role in supporting food production. Diverse species are essential for preserving ecosystems, and their populations require careful nurturing and maintenance to support sustainable and resilient food production. (Paragraph 57)

7. *We commend the success of the National Pollinator Strategy and eagerly await the 2025–2035 update that we expect to be published by September 2024. There is scope to build on the work of the strategy by creating a complementary 'National Invertebrate Strategy' that would include provisions for invertebrates that carry out other important ecological roles. As seen in the creation of the National Pollinator Strategy, the National Invertebrate Strategy should include the publication of an implementation plan, containing accountability targets, linked to the strategy every five years for non-pollinating, agriculturally beneficial, invertebrates.* (Paragraph 58)

8. The United Kingdom relies significantly on the global production of various horticultural crops, including fruits and salad vegetables. These imported foods may be subject to vulnerabilities, such as wars, which can see significant price increases. Approximately 50% of the food consumed in the UK comes from overseas. Therefore, it is integral to UK food security that the issues regarding insect decline and food production are also addressed at an international level. *The UK Government should use its position in international forums to advocate for and address the issues highlighted in this report on a global scale. Collaborative efforts are essential to mitigate the challenges posed by insect decline and to secure sustainable and resilient food systems worldwide.* (Paragraph 59)

9. Charismatic insect species, of which the honeybee is a prime example, serve as invaluable ambassadors for the field of entomology, rendering the subject more accessible to the public and bringing to public attention this often-overlooked animal group. The concentrations of high numbers of hives in a small number of specific geographical areas may have detrimental effects on wild pollinator species due to resource competition. Consequently, there is a need to extend the range of conservation efforts to include the over 270 wild species of bees in the UK, acknowledging the importance of preserving the entire spectrum of biodiversity for a more balanced and resilient ecosystem. (Paragraph 72)

10. *Defra should expand the remit of the National Bee Unit, to include a focus on wild bee health. This should include both developing internal expertise and fostering collaboration with entomology experts and producing biennial reports, as part of the National Pollinator Strategy update previously recommended in this report. The Unit should also produce guidance to keepers about the potential impacts of over densification of hives on wild pollinator species.* (Paragraph 73)

11. Raising awareness of the importance of various insect species must be nurtured early to avoid the aversion that many people have to insects. The scarcity of experts, both professional and amateur, underscores the importance of cultivating a greater public passion for entomology, starting from an early age. The commendable efforts made by institutions such as the Natural History Museum and the Royal Botanical Gardens Kew, demonstrate promising avenues for engaging the public both online and in person. (Paragraph 86)

12. *In its response to this report, the Government should set out how it intends to facilitate nationwide access to external teaching resources offered by public bodies. This access, available through online platforms and educational visits, can significantly enhance the educational experience. The Government should also outline details of how it can make it easier to enter specific careers in entomology whether through vocational routes including collaborations with the Chartered Institute of Ecology and Environment Management or through academic streams.* (Paragraph 87)

13. The existing biology and core sciences GCSE curriculum inadequately addresses crucial aspects of insect study and focuses on a limited selection of ecological roles. We applaud the introduction of the new Natural History GCSE, which aims to not only encompass scientific knowledge but also lay the foundations of skills necessary for pursuing a career in entomology and other nature-related subjects. (Paragraph 88)

14. *The Government should ensure that it promotes access to the new Natural History GCSE when it is launched, with particular focus on schools that may not currently have easy access to the natural environment.* (Paragraph 89)

15. We commend the often-overlooked contributions of amateur entomologists, ranging from unpaid species experts to members of the public involved in citizen science initiatives. While the collection of insect monitoring data remains invaluable for entomology, citizen science projects serve a broader purpose. We agree with the perspective of conservation experts, acknowledging that participation in such projects not only aids insect research but also enriches the lives of participants by fostering a deeper connection with the natural world. Citizen science projects allow researchers access to insect data from broad geographic areas that they may not have the resources to sample themselves. However, this type of survey must supplement, not replace, expert-led academic research projects. (Paragraph 103)

16. *Citizen science projects, especially those supported by public funding, should implement strategies to enhance inclusivity, ensuring the involvement of people from urban and disadvantaged backgrounds. This broader participation not only facilitates the collection of data from areas such as urban environments but also allows more people to experience the mental health benefits associated with engaging with nature.* (Paragraph 104)

Pesticides and agri-environmental policies

17. Witnesses to this Inquiry have told us that within the UK, land use change, land management practices and pesticide usage are amongst the largest contributing factors to insect decline. Consequently, the largest influence on achieving the biodiversity targets for insect species outlined in the 2021 Environment Act, could lie in the implementation of agri-environmental policies. (Paragraph 115)

18. Evidence from this Inquiry supports the conclusions from the Environment, Food and Rural Affairs Committee that the impact of Environment Land Management Schemes (ELMS) should be monitored and adapted as needed throughout its implementation, to gain the benefit of an iterative approach to policy development. ELMS should also show that it delivers better environmental outcomes than previous agri-environmental schemes. However generous and efficient the payment system is, the actions being rewarded need to have their impacts monitored and assessed to ensure specific outcomes like improved insect populations are delivered by ELMS and that public money is well spent. Successful execution of this monitoring, coupled with feedback from farmers and land managers, will give a more comprehensive overview of the individual and collective effects of ELMS implementation. (Paragraph 116)

19. *The Government, in response to this report, should outline its plans to establish a monitoring and evaluation programme for ELMS. Such a programme should incorporate mechanisms to feed data on specific outcomes—such as insect abundance—back into long-term monitoring programmes. The Government should publish annual reports detailing:*

20. *ELMS uptake levels, including a breakdown for each standard within the Sustainable Farming Incentive and how the schemes are combined by participants;*

    a) implemented actions following scheme uptake;

    b) the influence of farmers' feedback on ELMS development; and

    c) the environmental impacts of the schemes including impact on beneficial insect species. (Paragraph 117)

21. Integrated Pest Management (IPM) is an important component of sustainable crop protection; however, it requires more knowledge than traditional pesticide applications. To enhance the successful implementation of IPM, it is imperative to adopt innovative approaches and new tools, such as integrating resistant plant varieties, the use of biopesticides or new pheromones, artificial intelligence decision support systems, and advances in agronomy as and when they are developed. For widespread adoption within the farming community, effective and sustainable crop protection strategies should be demonstrated at a commercial scale. (Paragraph 135)

22. *We support the work of the Voluntary Initiative in disseminating advice to farmers on implementing Integrated Pest Management strategies. However, there is scope to extend the scheme to incorporate a peer-to-peer advisory network to provide farmers with access to a range of advice for developing and implementing their own strategies. The Government should also support the development of new IPM technologies through research funding and other mechanisms. Once these technologies are demonstrated as effective, the Government should encourage farmers to implement them by incorporating their use as specific actions into the Environmental Land Management Schemes (ELMS).* (Paragraph 136)

23. The statutory targets to halt and reverse species extinction and decline in abundance are ambitious and welcome. However, the exclusion of numerous invertebrate species and in some cases entire groups from the baseline metrics, particularly those vital for UK food security such as predatory beetles, is concerning. Including only 11 species of bumblebee is not an adequate abundance indicator for all 270 (at least) unique UK bee species. We are concerned that a significant number of insect or invertebrate species could go extinct or significantly decline in abundance, and yet the statutory targets could still be met by law. (Paragraph 143)

24. *Revised versions of Natural England's 'Red List' and the 'biodiversity indicators' used to measure changes in abundance should include a minimum of one species per family, which would result in a significant increase in invertebrate representation. In response to this report, the Government should set out what steps it is taking to gain approval from members of the Statutory Nature Conservation Bodies, so that data from species excluded from the 2022 Red List can be included in future iterations. Additionally, a detailed breakdown of how current data from the monitoring of excluded invertebrate species influence both the interim and final statutory biodiversity targets, should be published routinely. This should be in the form of an alternative 'Baseline List' to include species where the availability of data does not pass the threshold for inclusion in the 'Red List', but where evidence is available to determine a baseline conservation*

status. This 'Baseline List' should include as many excluded insect species as possible, to act as baseline statistics from which all future interim and final progress reporting for the biodiversity targets will be made. (Paragraph 144)

25. Witnesses to our Inquiry estimate that approximately half of the Sites of Special Scientific Interest (SSSIs) are not in a good state and are failing to conserve invertebrate biodiversity. Protected sites do not exist in isolation and are therefore influenced by the quality of nature in the surrounding environment. Whilst we welcome the statutory improvements to SSSIs set out by the Environment Improvement Plan, which will go some way to prevent more insect species extinctions, our Inquiry heard it is unlikely that these improvements will be sufficient to halt decline in species abundance. This is particularly the case for more common species, where large numbers of individuals in a population are needed to play pivotal roles such as pollination effectively. (Paragraph 153)

26. *The Government should invest in the monitoring of landscapes surrounding protected areas to collect evidence on how these areas impact the quality of protected sites. This data should be included in the Sites of Special Scientific Interest (SSSI) condition assessments. Details of how to mitigate external influences on SSSI conditions should also be considered as an 'action to achieve favourable conditions', which in accordance with the Environment Improvement Plan should be reported in 2028.* (Paragraph 154)

27. The UK has made international commitments to reducing the overall risk caused by pesticides by at least half by 2030. Whilst we acknowledge that updating the National Action Plan for Sustainable Pesticide Use, the UK implementation plan to achieve these commitments, is a substantial task for the Government, this does not excuse the six-year delay in the publication of this crucial policy. (Paragraph 173)

28. *We echo the Environment, Food and Rural Affairs Select Committee's recommendation that the Government should publish the National Action Plan for Sustainable Pesticide Use no later than May 2024.* (Paragraph 174)

29. The impact of pesticides on insect species that are not pollinators remains not fully known due to the lack of data on pesticide accumulation in terrestrial environments and specific details of pesticide applications on managed land. (Paragraph 175)

30. *The Government should outline how the 'Proposals for Terrestrial Environmental Monitoring of Plant Protectant Products' will be incorporated into the National Action Plan for Sustainable Pesticide Use. Furthermore, the Government should consider how it could use its powers to increase respondents to the Fera's pesticide usage survey.* (Paragraph 176)

31. Pesticide use by amenity and amateur sectors in urban and suburban areas does not benefit UK food production and can have adverse effects on many insect species. (Paragraph 184)

32. *The updated National Action Plan for Sustainable Pesticide Usage should include targets for reducing pesticide use in urban and suburban areas and to improve best practice for use by amateurs. The Government should work with stakeholders such as the Royal Horticultural Society, to stimulate the phasing down of pesticide use in the domestic horticultural sector.* (Paragraph 185)

33. While a contentious debate exists between nature conservation groups and agriculturalists regarding the use of conventional pesticides, both sides acknowledge the importance of developing new solutions, emphasising the need for increased investment in practical research and development. The regulatory system's failure to distinguish between conventional chemicals and alternative plant protection products such as biopesticides, coupled with high costs and lengthy approval processes, pose a barrier to innovation. Streamlining this process is essential for advancing environmentally sustainable alternatives in agricultural practices. (Paragraph 191)

34. *The Government should adopt an evidence-based strategy in formulating pesticide legislation, promoting the development of new plant pesticides with heightened target specificity. This approach would aim to mitigate the dual risks of pest resistance development and adverse off-target effects on beneficial insects. Any alterations to the regulatory framework should include ongoing monitoring of the impact on non-target species in field environments, where approved active substances are employed. Moreover, there should be an expansion in the range of non-target species for which data is collected to assess a chemical's impact prior to regulatory approval.*

    The Government should outline in its response to this Report, how it intends to support the development, regulation and practical application of pesticide alternatives, including, but not exclusive, to biopesticides, hormones and mRNA technologies. The Government should set out how it intends to adapt the current regulatory systems to accommodate innovative pesticide alternatives so that regulatory approval for these technologies can, where possible, be expedited. (Paragraph 192)

Formal minutes

28 February 2024

Members present

Greg Clark, in the Chair

Tracey Crouch

James Davies

Katherine Fletcher

Rebecca Long Bailey

Stephen Metcalfe

Graham Stringer

Draft Report (*Insect decline and UK food security*), proposed by the Chair, brought up and read.

Ordered, That the draft Report be read a second time, paragraph by paragraph.

Paragraphs 1 to 192 read and agreed to.

Summary agreed to.

Resolved, That the Report be the Second Report of the Committee to the House.

Ordered, That the Chair make the Report to the House.

Ordered, That embargoed copies of the Report be made available, in accordance with the provisions of Standing Order No. 134.

Adjournment

[Adjourned till Wednesday 6 March 2024 at 9.20am.]

Witnesses

The following witnesses gave evidence. Transcripts can be viewed on the inquiry publications page of the Committee's website.

Wednesday 07 June 2023

Dr Erica McAlister, Senior Curator of Diptera, Natural History Museum; **Professor Phil Stevenson**, Head of Trait Diversity and Function, Royal Botanical Gardens, Kew Q1–37

Professor Dave Goulson, Professor of Biology, University of Sussex; **Professor Simon Potts**, Director, Centre for Agri-environmental Research, University of Reading Q38–75

Professor William Kunin, Professor of Ecology, University of Leeds; **Dr James Bell**, Head, Rothamsted Insect Survey, Rothamsted Research; **Dr Claire Carvell**, Senior Ecologist, UK Centre for Ecology and Hydrology Q76–109

Wednesday 12 July 2023

Professor Lynn Dicks, Lead of the Agroecology Research Group, University of Cambridge; **Craig Bennett**, Chief Executive Officer, The Wildlife Trusts Q110–137

Professor Alistair Griffiths, Director of Science and Collections, Royal Horticultural Society; **Matt Shardlow**, Chief Executive Officer, Buglife Q138–166

Chris Packham CBE, Naturalist, conservationist and environmental campaigner Q167–186

Wednesday 18 October 2023

Professor Linda Field, Professor Emirita, Rothamsted Research; **Professor Toby Bruce**, Professor of Insect Chemical Ecology, Keele University Q187–213

Vicki Hird, Former Head of Sustainable Farming, Sustain; **Henry Edmunds**, Estate Owner, Cholderton Estate Q214–238

Minette Batters, President, National Farmers Union Q239–259

Wednesday 29 November 2023

John Holmes, Director of Strategy, Natural England Q260–298

Rebecca Pow MP, Parliamentary Under-Secretary, Department for Environment Food and Rural Affairs; **Dr Rachel Irving**, Deputy Director for Chemicals, Pesticides and Hazardous Waste, Department for Environment Food and Rural Affairs Q299–323

Published written evidence

The following written evidence was received and can be viewed on the inquiry publications page of the Committee's website.

INS numbers are generated by the evidence processing system and so may not be complete.

1 BASF (INS0015)

2 Bentley, Mr Dave (Entomological and Ecological Consultant, Dave Bentley Ecology Services/ Elton Reservoir Basin Countryside Warden Service) (INS0029)

3 British Sugar (INS0006)

4 Bruce, Prof Toby (Professor of Insect Chemical Ecology, Keele University) (INS0014)

5 Buglife (INS0038)

6 Butterfly Conservation (INS0018)

7 Cambridge Global Food Security Interdisciplinary Research Centre, Wolfson College Interdisciplinary Research Hub on Sustainability & Conservation, and the Cambridge Institute for Sustainability Leadership (INS0036)

8 Carvell, Dr Claire (Senior Ecologist, UK Centre for Ecology and Hydrology) (INS0045)

9 Cox, Darryl (Senior Science and Policy Officer, Bumblebee Conservation Trust) (INS0034)

10 CropLife UK (INS0035)

11 Dicks, Professor Lynn (Lead of the Agroecology Research Group, University of Cambridge) (INS0043)

12 Dipterists Forum (INS0030)

13 Edmunds, Henry (Owner, The Cholderton Estate) (INS0047)

14 Fera Science Ltd. (INS0010)

15 Ficker, Isabelle (Contributor, Starlit Skies) (INS0039)

16 Game & Wildlife Conservation Trust (INS0026)

17 Garland, Mr Steve (INS0004)

18 Goodacre, Professor Sara (Professor of Evolutionary Biology and Genetics, University of Nottingham) (INS0002)

19 Goulson, Prof Dave (Professor of Biology, University of Sussex) (INS0001)

20 Green Alliance (INS0017)

21 Griffiths, Professor Alistair (Director of Science and Collections, Royal Horticultural Society) (INS0042)

22 Guiver, Mr Norman (INS0003)

23 Heyburn, Mr James (Policy & Engagement Officer, Imperial Policy Forum); and Gill, Dr Richard (Senior Lecturer, Department of Life Sciences, Imperial College London) (INS0012)

24 Hird, Vicki (Former Head of Sustainable Farming, Sustain) (INS0048)

25 Hodge, Dr James (Associate Professor, University of Bristol); and Tasman, Dr Kiah (Lecturer, University of Bristol) (INS0007)

26 Kent Wildlife Trust (INS0013)

27 Lancashire Wildlife Trust (INS0031)

28 MP, Rebecca Pow (Minister for Nature, Department for Environment Food and Rural Affairs) (INS0049)

29 Maderson, Dr. Siobhan (Research Associate, Cardiff University) (INS0016)

30 Memmott, Dr Harry Siviter and Professor Jane (Dr Harry Siviter and Professor Jane Memmott, Buglife - The Invertebrate Conservation Trust) (INS0050)

31 National Farmers' Union of England and Wales (NFU) (INS0024)

32 Natural England (INS0037)

33 Norwich Research Park; John Innes Centre; The Sainsbury Laboratory; Earlham Institute; and University of East Anglia (INS0023)

34 Potts, Professor Simon (Director, Centre for Agri-environmental Research, University of Reading) (INS0041)

35 Queen Mary University of London (INS0033)

36 Rothamsted Research: Rothamsted Insect Survey (INS0020)

37 Royal Botanical Gardens, Kew (INS0044)

38 Royal Entomological Society (INS0025)

39 Save Greater Manchester's Green Belt (INS0008)

40 Shardlow, Matt (Chief Executive, Buglife) (INS0046)

41 Sustain the Alliance for Better food and Farming (INS0019)

42 The Pesticide Collaboration (INS0021)

43 The Wildlife Trusts (INS0027)

44 UK Centre for Ecology & Hydrology (INS0022)

45 University of Reading, School of Agriculture, policy and Development (INS0032)

46 Vertical Future (INS0028)

47 Wagner, David (Professor, University of Connecticut); Grames, Eliza (Assistant Professor, State University of New York, Binghamton); Ware, Jessica (Curator, American Museum of Natural History); Bahlai, Christie (Assistant Professor, Kent State University); and Elphick, Chris (Professor, University of Connecticut) (INS0011)

48 Waller, Dr Alexander (Visiting Professor of Environmental Ethics and Science Education, American University of Sovereign Nations) (INS0005)

List of Reports from the Committee during the current Parliament

All publications from the Committee are available on the publications page of the Committee's website.

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1st Special	The governance of artificial intelligence: interim report: Government response to the Committee's Ninth report of Session 2022–23	HC 248

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Number	Title	Reference
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3rd	My Science Inquiry	HC 618
4th	The role of Hydrogen in achieving Net Zero	HC 99
5th	Diversity and Inclusion in STEM	HC 95
6th	Reproducibility and Research Integrity	HC 101
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3rd	A new UK research funding agency	HC 778