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for Environment
Food & Rural Affairs

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Supporting document to the National Pollinator Strategy: for bees and other pollinators in England

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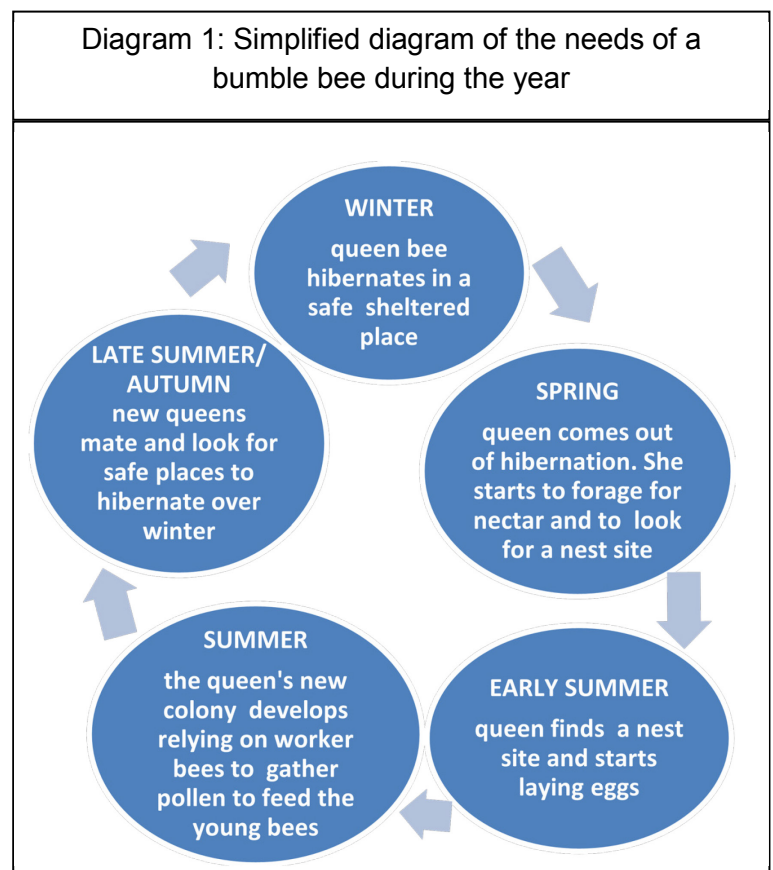
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1 - A brief overview on pollinators, pressures, current policies and how we developed the Strategy

What are insect pollinators and what do they need

1. Many of our food crops such as apples, pears, strawberries, raspberries, tomatoes and field beans, as well as many wild flowers need visits by insects to transfer the pollen between plants leading to fertilisation and the production of seeds and fruits¹. For some crops, insect pollination leads to higher yields and improved quality of the fruit or seeds. Many other plants, trees and wild flowers also rely on insect pollinators to produce seeds and fruit, emphasising the vital role of pollinators in underpinning the health and function of many ecosystems.
2. The UK has at least 1500 species of insect pollinators including bumble bees, the honeybee, solitary bees, hoverflies, wasps, flies, beetles, butterflies and moths. All have complex life cycles. Their essential needs for survival vary depending on species. For example, bumble bees have specific needs for food (i.e. pollen and nectar), shelter and nest sites during the year, as shown in Diagram 1. Many bees only live from spring until autumn and then die leaving their eggs, other inactive life stages or hibernating queens in sheltered places to over winter before emerging the following spring². The number of insect pollinators is highest in summer coinciding with peak plant growth and supplies of pollen and nectar.



¹ Note: our main food crops such as cereals and potatoes rely on wind pollination, self-pollination or vegetative growth for production and yield. Oil seed rape relies on wind pollination and insect pollination.

² Some species of bee in south east England remain active during the winter; for example buff tailed bumble bees.

3. The majority of pollinator species live in the wild. In contrast, a few species are 'managed' such as the honey bee which is managed by beekeepers for honey and wax production, and, in some cases, for commercial pollination of orchard fruits. In addition, UK farmers and growers use commercially-bred bumble bees in glasshouses and poly-tunnels for pollination of crops such as strawberries and tomatoes, and solitary bees in orchards. The abundance of these managed species is therefore determined by the number of people who want to keep them or to use them for commercial pollination.

What are the main pressures and the impacts on bees and other insect pollinators?

4. Pollinators can face many pressures: intensification of land-use leading to habitat loss and/or a decline in its quality and a reduction in their sources of food and shelter; pests and diseases; competition from invasive species; use of pesticides (including potential impacts from long-term, low level exposure); and, climate change. Some of these pressures are historic, particularly intensification of land use related to agricultural and urban development, and have produced economic benefits. However, there are growing concerns that these many pressures are leading to declines in the number, diversity and geographical ranges of individual species. These pressures are described in more detail in the independent report on the 'Status and value of pollinators and pollination services' ('the Status Report') which Defra commissioned in 2013 to help inform development of the Strategy. The Status Report is published with the Strategy.
5. The Status Report describes the uncertainties about the importance of these pressures and the ways in which they interact to influence pollinator populations. It also summarises current understanding of the abundance of pollinator species in England and highlights crucial gaps in this understanding. While the evidence shows that declines for some groups are slowing, we accept that bees and insect pollinators in general have experienced an overall decline in diversity³ in recent decades and that many species of butterflies and moths, the only major pollinator group for which we have evidence, have declined in abundance over the last 35 to 40 years.
6. A summary of this evidence and the key gaps in our understanding is given in section 2 of this document; the Strategy sets out our plans to address these gaps.

³ As measured by number of species per unit area.

Current policies and initiatives to support pollinators

7. The Strategy builds on, and complements a range of current government-led policies which are relevant for, and beneficial to pollinators⁴. For example: protection of priority habitats and species including commitments under Biodiversity 2020; pest and disease control in honey bees; management of pesticide risks; stewardship schemes on agricultural land which incentivise farmers to improve the environmental management of their land; land use planning policy; and, investment in science such as the Insect Pollinators Initiative⁵. Many of these policies include mandatory or statutory elements. For example: beekeepers are required to report certain honey bee diseases to government so that we can take appropriate control actions⁶; and, public bodies have a statutory duty to have regard to conserving biodiversity in exercising their functions⁷.
8. Other initiatives to support pollinators include actions by local authorities such as Bristol City Council, Chesterfield Borough Council, Gloucestershire Council, Kent County Council and Wyre Forest District Council⁸. In addition, many other organisations, including businesses and civil society, have their own initiatives to help bees and other pollinators and have been effective in raising public awareness about the risks to these insects.⁹ Other related initiatives, such as the NHS Forest Project run by the Centre for Sustainable Health Care are providing green spaces to support the well-being of patients and local communities, and are also providing essential resources for pollinators.

How the Strategy was developed

9. The Government developed this collaborative Strategy with non-government organisations (NGOs), retailers, professional bodies, farmers, growers, businesses, the

⁴ Further details are in Defra's report 'Bees and other pollinators: their value and health in England. Review of policy and evidence. July 2013' <https://www.gov.uk/government/publications/bees-and-other-pollinators-their-health-and-value>.

⁵ A £10 million jointly funded research programme by the Biology and Biotechnology Research Council, the Natural Environment Research Council, the Wellcome Trust, Defra and the Scottish Government.

⁶ The Bee Diseases and Pests Control (England) Order 2006 <http://www.legislation.gov.uk/ukxi/2006/342/contents/made>

⁷ Section 40 of the Natural Environment and Rural Communities Act 2006
<http://www.legislation.gov.uk/ukpga/2006/16/contents>

⁸ Annex A of this document shows examples of the actions being taken by local authorities to support pollinators

⁹ For example: the Co-operative's Plan Bee, Buglife's B-lines, the Bumblebee Conservation Trust's advice to gardeners and land managers, the Friends of the Earth's Bee Cause, the Soil Association's Keep Britain Buzzing, Syngenta's Operation Pollinator, the National Federation of Women's Institute's SOS for Honey Bees, Garden Organic's Bee Heard Campaign and the British Beekeepers Association's advice on habitats and planting for pollinators to the public and local authorities.

science community and delivery agencies. We are committed to working in partnership with these interested parties through the Strategy to unify and build on the many current activities supporting pollinators and to draw on the skills, experience and enthusiasm of all. We have finalised the Strategy following public consultation and also in the light of the recommendations from the Environmental Audit Committee¹⁰.

10. The case for Government intervening to safeguard our pollinators is based on a market failure. For example, a landowner or land manager who provides the conditions for bees to prosper and provide crop pollination services, cannot exclude others from also benefitting. Pollination services therefore often have a 'public good' characteristic, because others can benefit from the landowner or manager's efforts, which may mean too many will rely on others to take action and therefore an undersupply of pollination services. Government is also intervening as a facilitator and coordinator.

¹⁰ A summary of the responses to the consultation has been published with this Strategy. Defra's response to the EAC report was published on 15 October 2014 <http://www.parliament.uk/eacom>

2 - Our current understanding and the gaps

1. This section sets out our current understanding of the status of insect pollinator populations in the UK, the drivers of population change and the implications of those changes for the pollination of crops and wild plants. To understand whether our estimated 1500 or more species of insect pollinators are thriving, we need to:
 - Identify which insects or groups of insect species are important pollinators across different habitat types;
 - Collect and analyse data on:
 - occurrence and distribution of species across the UK; realising that resources and capabilities do not exist to do this at a high resolution for all species;
 - distribution, abundance or activity of insect pollinators, as a proxy for pollination services;
 - the state of pollination services for targeted plant species, particularly species grown as crops or those of conservation importance;
 - Better understand the relationship between pollinators and pollination services for crops and wild flowers.
2. We have some information on changes in **occurrence and distribution** of many insect species in the wider environment, but we lack information on trends in **abundance**, except for moths and butterflies. Knowledge of the status of pollinators on cropped land is especially sparse. We are therefore not able to state categorically whether there is a decline overall across the UK and the associated implications for the pollination of wild plants and crops.
3. How we value the benefit that society gains from pollination is another area of uncertainty. Aside from honey and wax production, the honey bee together with wild insect pollinators have a commercial value because they can boost crop yield and quality. Insects also have a value in wild plant pollination and an intrinsic or cultural value¹¹ simply because we enjoy sharing our environment with them. More research is needed to determine the value of insect pollination to crops in the UK with greater accuracy. But research has estimated it at several hundred million pounds¹² (and this does not include social and environmental value).

¹¹ Social or cultural value refers to non-market value – the quantifiable benefit to people, who enjoy owning or seeing bees and other insects although there is no direct economic benefit. Intrinsic value also refers to less quantifiable moral values.

¹² The Decline of England's Bees (Breeze et al. 2012) provides a value of £510m per year; this updates the UK National Ecosystem Assessment 2011, which originally estimated the value at £430m

4. Given the incomplete picture of the status of our pollinators, the impacts on pollination and the value of pollination services, a key aim of the Strategy is to address these gaps in our understanding (see evidence actions in the Strategy).

The status of pollinating insects

Managed pollinators

5. UK honey bee colony numbers fell between 1985 and 2005 (Potts *et al* 2010b), following the arrival of the *Varroa* mite in the early 1990s. Over the last few years the number of colonies has increased in response to recent awareness campaigns run, for example, by the British Beekeepers Association. In 2013, over 29,000 beekeepers managing around 126,000 colonies, were registered in England on the National Bee Unit's BeeBase database, compared with 15,000 beekeepers managing just under 80,000 colonies in 2008.
6. The number of bumble bees managed for commercial pollination of high value crops, notably soft fruits and tomatoes in greenhouses or in poly-tunnels, has increased over the last 20 years. During 2013, Natural England licensed the following for this purpose:
 - 1) 16,443 hives of non-native bumble bees (*Bombus terrestris terrestris* and *Bombus terrestris dalmatinus*; and,
 - 2) 5,356 hives of native bumbles bees (*Bombus terrestris audax*).

Wild pollinators

7. Although there has been no systematic monitoring covering all major wild pollinating insects in the UK, the Status Report sets out evidence for changes to populations of many wild insect species, based on analysis of data collected by thousands of expert volunteer recorders. Information on long-term changes in **abundance** of insect pollinators is limited to butterflies and moths. Although recording is not uniformly distributed across the UK, so that there is, at least for butterflies, a bias towards high value sites, the data strongly suggest a directional change in the last 35-40 years, with a greater number of species showing significant declines in abundance compared to those showing significant increases. Analysis of distribution data for butterflies show that declines have been coupled with losses of diversity in some areas. While butterflies and moths are pollinators of wild plants, they are unlikely to be important crop pollinators in the UK. The extent to which they can be used as indicators of trends for other insects is not well understood.
8. Information on abundance is not generally available for other insect species, although trends in **distribution and diversity** have been extracted from records of occurrence for bumble bees, other bees and hoverflies. These show:

- Of the 26 species of bumble bees recorded in the UK, two are no longer present and another six are now found in a much smaller area of the country. However, since around 2000, one new species has arrived and another one is being re-introduced.
 - The number of bee species has fallen in many parts of the UK over the last 40 years, mainly because the range of many species that require semi-natural or flower-rich habitat has declined¹³, while the range of some generalist species has increased.
 - The diversity of hoverflies has declined in some local areas, with some evidence of increasing dominance of a few more common species.
9. Loss of richness and diversity is an important issue in itself, and species that have contracted in range are also likely to have reduced in number, but the extent to which impacts on pollination service have been offset by increases in range or abundance of more common species of bee or hoverfly is unknown.
10. Reduced abundance or diversity of insects is often correlated with higher land-use intensity. This is sometimes used to infer declines, given that there has historically been a process of agricultural intensification in England which coincided with extensive home and road building activities (1930 – 1990). However, the extent to which this is driven by loss of semi-natural habitat or other agricultural practices and its relevance to more recent trends is largely unknown with some evidence that declines in certain groups have halted or are starting to reverse (Carvalho *et al.*, 2013).

The drivers of observed or inferred trends

11. Wild and managed pollinators face a number of environmental pressures, which are set out in the Status Report. These include agricultural land use change, pesticide use, urbanisation, pests and pathogens, invasive non-native species and climate change. We have limited understanding of the relative importance of these pressures and how impacts vary between different pollinator groups. Improved monitoring, as part of this Strategy, and emerging results from the Insect Pollinators Initiative will further inform our understanding of drivers of change. It is clear that the more we can improve the diversity of pollinators the more resilient they will be to environmental pressures, this will be particularly important in mitigating any impacts from drivers that this Strategy cannot directly address, such as climate change.

¹³ Declines in diversity (the number of different species per unit area) are likely to be correlated with significant range contractions for specialist species associated with natural or semi-natural habitat or narrow forage requirements;

12. Within this overall context of uncertainty, there are things we do know. There is strong evidence that reduction in habitat quality and increases in habitat fragmentation in our countryside and urban areas have driven declines in abundance or range of many species over many years (Winfree *et al.* 2009; Warren *et al.* 2001; Fox 2013). Increasing the proportion of semi-natural habitat within the farmed landscape can increase insect abundance and diversity within the crop (Pywell *et al.* 2012). We also know that managed honey bees face continued threats from pests and diseases, and exotic threats such as the Asian hornet. Policies that provide restoring nesting and foraging habitat in the countryside and urban areas for wild and managed pollinators, and responding to honey bee pests and diseases are therefore important for sustaining pollinators.
13. There is good evidence that agri-environment schemes benefit pollinators (Scheper *et al.*, 2013; Batary *et al.*, 2011; Potts *et al.*, 2009). However, whether this is just that pollen and nectar sources are attracting existing populations of pollinators into the crop or whether there is an impact on the wider population is uncertain. There is some emerging evidence of population effects for bumble bees and solitary bees (Heard *et al.*, 2007; Heard *et al.* 2008; Kleijn *et al.*, 2011), and although this is an area that would merit further study, it seems prudent to continue to carefully target land-management schemes.
14. There is also evidence that species richness is greater on organic farms than on conventional farms, with pollinator species being particularly affected (Tuck *et al.*, 2014). Assuming that this is a real effect, it is most likely to be due to increased floral resources on organic farms compared to conventional farms. Monocultures and simplified rotation systems are recognised in the Status Report as drivers of diversity declines, although impacts from insecticides are possible in some circumstances. As noted above, there is uncertainty about whether the effects are due to the concentration of existing pollinators at the time of monitoring or whether generation of pollinators is enhanced.
15. The Campaign for the Farmed Environment promotes a voluntary approach to environmental land management, with 22 management measures designed to protect wildlife, water and soil. In 2014, over 450,000 hectares were managed under the unpaid environmental measures listed¹⁴. Although there has been no specific monitoring of pollinators, uptake of habitat that provides resources for pollinators has been substantial. For example, over 160,000 hectares fertilizer-free permanent pasture were recorded, over 6,700 hectares of unsprayed and/or unfertilized cereal headlands, and over 5,600 hectares of wildflower mixes.

¹⁴ www.gov.uk/government/uploads/system/uploads/attachment_data/file/207446/landenvmanagement-statsnotice-18jun13.pdf

16. Habitat requirements to support pollinator populations in urban areas have been identified as a key knowledge gap (Dicks *et al.*, 2012). As with agri-environment schemes, there is some evidence of benefits for pollinators through improved management of gardens (Osborne *et al.*, 2008; Dicks *et al.*, 2010; Samnegard *et al.*, 2011). Further research is underway, and will allow us to modify to the management practices as new research on best approaches emerges.
17. Pesticides¹⁵ may have direct and indirect effects on wildlife and the wider environment and hence are tightly regulated under EU law. They may only be sold and used if they have been authorised, based on risk assessment [further details in Section 4 of this document]. As described in the Strategy and in the Status Report, laboratory-based studies have shown effects on honey bees and bumble bees from pesticides, most recently using neonicotinoids. While there is an increasing body of laboratory evidence of potential effects from neonicotinoids on bees, the available albeit limited field evidence tends to suggest an absence of effects. A 2014 scientific assessment of the state of evidence in this area can be found in Godfray *et al.*, “A restatement of the natural science evidence base concerning neonicotinoid insecticides and insect pollinators” (<http://rspb.royalsocietypublishing.org/content/281/1786/20140558.full>). One of the immediate research challenges is to determine the dose, exposure and impact of neonicotinoids and other pesticides on different kinds of pollinators at field-scale.
18. Given current restrictions on the use of some neonicotinoid insecticides, it should be recognised that the onus is on the pesticide industry to demonstrate the safety of these pesticides under the European regulatory regime enforced in the UK by Defra. Any further work by the industry to demonstrate safety would be conducted according to EU rules and independently scrutinised.

The implications for pollination services

19. The implication of changes in pollinator populations for the pollination of crops and wild plants is a final source of uncertainty. For wild plants we know that there has been a greater decline in the occurrence of insect pollinated plants compared to other plants, but it is not clear whether this is a causal relationship (loss of insects driving loss of plants) or correlative (with other factors, such as reduced habitat extent or condition, driving both). We need to maintain surveillance of key species of wild plants and better

¹⁵ “pesticides” refers only to plant protection products defined under Regulation (EC) 1107/2009 ie, those pesticides used to protect plants and plant products from pests, diseases and weeds (essentially agricultural, amenity and home garden pesticides).

understand the nature of the relationship between wild plant and pollinator trends to help us conserve wild plants.

20. For crops, we do not fully understand how pollinator abundance, composition and diversity regulate crop yield or quality. We do know that low levels of pollination can result in a loss of yield or quality. For example in fruit crops or oil seed rape, but we do not have a good understanding of the scale or magnitude of any risk as there have been few studies that have, as yet, explored only a limited range of pollination service scenarios (e.g. Garratt *et al.*, 2014). Some areas of the country show patterns of depressed functional diversity of insect groups (Woodcock *et al.*, 2013)¹⁶ and this may guide targeting of measures to manage any risk.

Summary

21. In summary, we know that there has been a decline in the abundance of some pollinating insects over the last 50 years, and that others have contracted in range. We suspect that wild bees and other pollinators are generally less abundant and widespread in the landscape than they were a few decades ago, but we need to do more to establish recent and ongoing trends with greater confidence. We know that habitat loss has been a key driver of change to pollinating insect populations, and that restoring habitat features works well to support pollinators. Other drivers of change may be becoming more important, and this is an area of active research. The emerging results from the Insect Pollinator Initiative will help inform our understanding of drivers of change.
22. We need to do more to better understand the relationship between pollinators and pollination, and design effective monitoring. We need to understand what more we can do to efficiently manage the risk to pollination services for wild plants and crops. The evidence actions outlined in the Strategy will help us develop an improved understanding, based on which we may be able to target and refine existing and new policies to enhance outcomes for pollinators in their own right as well as mitigating risks to the pollination of wild plants and crops.
23. The gaps in our understanding highlighted in this section are broadly consistent with those identified in the November 2013 report by the European Food Safety Authority (EFSA) 'Towards holistic approaches to the risk assessment of multiple stressors in bees'. This was a report from an EFSA scientific colloquium in May 2013 attended by 115 international scientists and stakeholders from 23 countries, including from outside the European Union.

¹⁶ In simple terms, functional diversity refers to how diverse a particular population is in relation to its pollination service (for example a more diverse community will have a greater number of species that are on the wing at different periods, providing a longer-term pollination service)

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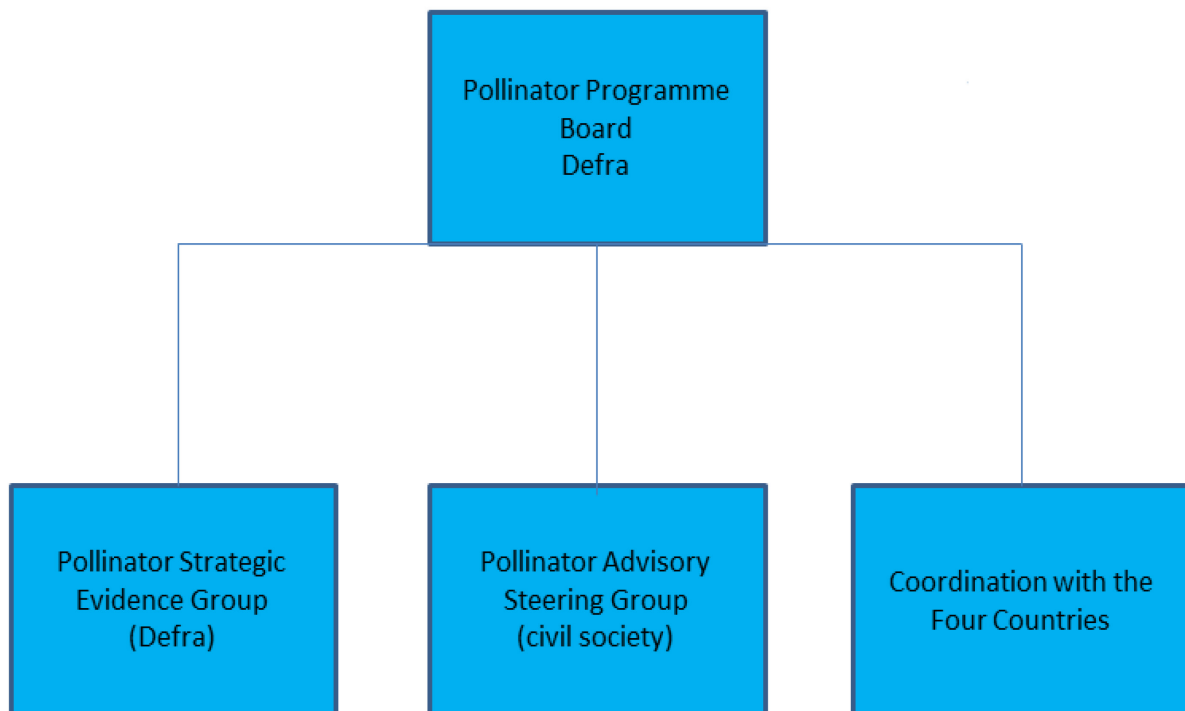
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3 - Governance of Strategy implementation

1. The governance structure for implementation has been established in consultation with stakeholders and builds on the one in place during development of the Strategy. Implementation of the National Pollinator Strategy will rely on strong partnership and communication between multiple groups both inside and outside of Government. Only by working together across policy areas and with our different key stakeholders can we deliver at a local and national level for pollinators. The diagram in this section summarises the key groups involved.
2. Delivery of the Strategy will be overseen by the **Pollinator Strategy Implementation Board** (PSB) which is chaired by Defra and includes lead officials from a wide range of relevant policy areas within Defra. The PSB will support the development of a delivery plan and monitor implementation. It will address emerging issues through exception reporting from the project team, manage the Risk Register for the project and be involved with the communications plan for the Strategy. Each of the policy leads will work with their own policy networks to deliver the different aspects of the Strategy.
3. The **Pollinator Strategic Evidence Group** is based in Defra and oversees the evidence requirements for pollinators and evaluating the quality of this evidence. To do this, the Group coordinates with the relevant policy areas and evidence groups both inside and outside of Defra, and consults with Department's Chief Scientific Advisor.
4. The **Pollinator Advisory Steering Group** (PASG) is the core leadership group of stakeholders working with Government officials to steer implementation and delivery of the Strategy. The Group will work with Defra on the Strategy's delivery plan and respond to emerging evidence from commissioned research. It will review lessons learned from initial policy actions and from partnership working, and how to adapt and improve the Strategy as necessary. In addition, the Group will play an important role in engaging their own members and the public in the work of the Strategy and the 'Call to Action' message.
5. PASG members are: Bee Farmers' Association, British Beekeepers' Association, Buglife, Bumblebee Conservation Trust, Campaign for the Farmed Environment, Country Land and Business Association, Friends of the Earth, National Farmers' Union, National Federation of Women's Institutes, Natural England, National Trust, Pesticide Action Network UK, Royal Horticultural Society, Soil Association, Waitrose, The Wildlife Trusts. Academic partners include the University of Cambridge and the Centre for Ecology & Hydrology.
6. Coordination with the Department for Communities and Local Government will be through the long-established Defra/DCLG coordination group at official level and meetings as necessary at Ministerial level.

7. Coordination across the UK will continue through a number of existing arrangements on pollinator-relevant issues. For example, Healthy Bees Plan implementation across GB, Scotland and England jointly funding the Insect Pollinator Initiative (with other funders), and coordination on the National Action Plan on pesticides across the UK. In addition, we are discussing with colleagues whether pollinators should be added to other existing policy coordination groups, such as the Four Countries' Biodiversity Group.

National Pollinator Strategy – governance structure for implementation



4 - Background on the regulatory regime on pesticides and current policies

1. A tough regulatory regime governed by EU law is in place to ensure that potential harmful effects from pesticides (plant protection products) on human health and unacceptable effects to the environment do not occur. UK legislation requires that only plant protection products authorised by Ministers shall be sold, supplied, used, stored or advertised¹⁷.
2. The regulatory regime recognises that pesticides deliver substantial benefits for society, for example plentiful and affordable food, but that the potential risks from pesticides need to be carefully managed. The regime is based on the evaluation of comprehensive scientific data to enable the assessment of risks. The system considers new evidence as it emerges and the approach to risk assessment can also be updated as knowledge develops. The EU risk assessment process for bee species is currently being updated.

Current policies and initiatives

3. In addition to policies on the authorisation process for plant protection products, there are a range of supporting policies to manage the risks. The Code of Practice for all professional users of plant protection products in England and Wales seeks to help farmers, growers and suppliers understand how they can comply with their legal obligations and follow good practice. The current Code includes measures to minimise the risk to pollinators from the use of pesticides. Following the implementation of the EU Directive on the sustainable use of pesticides into UK law, the Health and Safety Executive, on behalf of Defra, is reviewing this Code of Practice and aims to publish in 2015. The updated version will include renewed emphasis on the importance of minimising risks to pollinators. It will support the role that suppliers and advisers have in informing farmers of the steps they should take and the importance of taking full account of the information on product labels and the manufacturers' Environmental Information Sheets. Pesticide product labels already include cautionary advice against using the product where a specific risk to bees is identified in the risk assessment.

¹⁷ See further details <http://www.pesticides.gov.uk/guidance/industries/pesticides/topics/pesticide-approvals/pesticides-registration/General/faq-on-registration-of-pesticides.htm>

Integrated pest management

4. Integrated Pest Management (IPM) draws on a full range of tools and techniques to control pests, weeds and diseases, ensuring targeted use of pesticides to minimise risks to the environment. It does not prohibit pesticide use, however use of IPM may lead to a decrease in the volume of pesticides used by farmers and growers. The Strategy's actions build on Defra's current policies and plans on IPM and the sustainable use of pesticides, giving them an increased focus on pollinators. Current policies and initiatives include:

- Implementation of Directive 2009/128 (establishing a framework for Community action to achieve the sustainable use of pesticides). The Directive seeks to promote low pesticide-input pest management including use of IPM and alternative approaches or techniques such as non-chemical alternatives to pesticides and organic farming. The Directive is being implemented through the UK's National Action Plan for the sustainable use of pesticides (plant protection products) 2013. We are bound by the requirements of this Directive; our approach to implementing EU legislation means that we are unable to use other sources of guidance or standards on IPM to influence policy, as this could lead to additional or different requirements and burdens;
- Ensuring that the general principles of IPM are implemented by all professional pesticide users by 1 January 2014;
- Working with training providers (such as City & Guilds and BASIS) to ensure that all training and continuous professional development courses for users and agronomists includes advice on integrated approaches. All users of professional pesticides have to be trained and hold the relevant specified certificate or work under the supervision of a certificate holder. Only courses which provide training on integrated approaches will receive accreditation. Training requirements also apply for advisors. All advisors must be suitably qualified and BASIS Professional Register members. This is a requirement of the UK Crop Assurance Schemes, which cover the majority of crops grown in the UK.
- Encouraging development of biopesticides through research and development a special Biopesticides Scheme. Biopesticides are important in IPM but may be more expensive and less effective than conventional chemical pesticides. They also tend to be specific in their action and so a given product will only address a small market. Ten biopesticide active substances have been approved since the Scheme started in 2006.
- Funding of research and development to provide the scientific basis to enable industry to develop further measures for integrated or biological control in arable and horticultural commodities. This will encourage sustainable crop protection and also potentially benefit other systems like organic production. Technologies being

developed for controlling insect pests typically involve disruption of natural processes of feeding, reproduction and development, as well as work on alternative control methods. Other work involves more specific targeting of pesticides to the problem being controlled.

- Supporting the work of industry stakeholders to develop an IPM self-assessment tool for farmers and growers (“IPM Plan” – an extension of the existing Crop Protection Management Plan). This continuous ‘awareness raising’ will encourage producers to look into using new approaches as they develop their knowledge of IPM tools and techniques such as decision support systems and pest and disease monitoring systems. This tool has been rolled out through the Voluntary Initiative¹⁸.

5. A range of non-regulatory initiatives and incentives are also seeking to improve uptake of IPM:

- 1) Assured Food Standards Schemes require growers to adopt practices which are consistent with the general principles of IPM. Specific standards are set for individual crops. Assurance schemes are a strong driver for uptake of particular standards. Retailers may add additional requirements of their own or may adopt even more demanding systems such as the LEAF Marque.
- 2) The Amenity Forum is developing guidance on the use of integrated approaches within the different parts of the amenity sector. The IPM tool will also be developed in a way which enables use by amenity pesticide users.
- 3) In woodland, initiatives such as the UK Woodland Assurance Scheme and the Forestry Commission’s Practical Guide to Reducing Pesticide Use in Forestry promote practices consistent with the aims of the Directive and national policy, but specifically require owners/managers to implement effective IPM strategies.

Setting targets

6. In relation to setting targets there are particular challenges. For pesticide use, it is not the amount of pesticide used that is important but the risks this carries – for the pollinators as well as for people and all non-target species. We consider that use reduction targets are not effective in reducing risk, nor do they provide meaningful evidence of progress. They can be counterproductive, for example by driving users towards more active pesticides used in lower quantities. In addition, the amounts of pesticides used in any year will be dependent on factors such as the degree of pest pressure (which can be dictated by factors such as the weather) and the demands of

¹⁸ The Voluntary Initiative was set up in 2001 and is an industry-sponsored programme of measures promoting responsible pesticide use.

the market (e.g., customer preferences, prices). The Government therefore aims to keep risks as low as possible through regulation of the pesticides and through requiring and encouraging best practice in their use.

7. In relation to IPM uptake, as this is a toolkit with many options, it needs to be considered and tailored on an individual basis. Given the wide choice of options, setting targets for uptake would not be particularly meaningful. In addition, annual variation in the degree of pest pressure and the demands of the market, is likely to influence the choice of tools in any year, and would impact on uptake data. Nevertheless, Defra will assess progress with the uptake of IPM by farmers and growers, drawing on the knowledge of the Voluntary Initiative and also assurance schemes which are pursuing the development of IPM plans by farmers and growers.

Work in the EU and UK to develop understanding of the effects of neonicotinoids on pollinators and to generate the data required for regulatory decision-making.

The EU evidence process

8. Commission Regulation 485/2013, which imposed restrictions on the use of three neonicotinoids with effect from 1 December 2013, requires pesticide companies to submit confirmatory information as regards:
 - (a) the risk to pollinators other than honey bees;
 - (b) the risk to honey bees foraging in nectar or pollen in succeeding crops;
 - (c) the potential uptake via roots to flowering weeds;
 - (d) the risk to honey bees foraging on insect honey dew;
 - (e) the potential guttation exposure and the acute and the long-term risk to colony survival and development, and the risk to bee brood resulting from such exposure;
 - (f) the potential exposure to dust drift following drill and the acute and the long-term risk to colony survival and development, and the risk to bee brood resulting from such exposure; and
 - (g) the acute and long term risk to colony survival and development and the risk to bee brood for honeybees from ingestion of contaminated nectar and pollen.
9. Companies are required to submit this information to the Commission, the Member States and the European Food Safety Authority (EFSA) by 31 December 2014. The Regulation also states that “Within two years from the date of entry into force of the present Regulation [26 May 2013] the Commission will initiate without undue delay a review of the new scientific information which it has received.”

10. The initial evaluation will be carried out by the Rapporteur Member State for each active substance: Belgium (clothianidin); Germany (imidacloprid); and Spain (thiamethoxam). Their assessments will be reviewed by EFSA and the other Member States.
11. Normally, data are generated according to defined standards set out in guidance documents. However, the guidance document covering the risk assessment for bees is not yet agreed. EFSA therefore agreed a process by which protocols for studies starting in 2014 can be reviewed. Companies submitted a number of study plans for consideration. The final reports for each set of protocols were published on 3 June and can be accessed at the [EFSA website](#). The reports list the studies, comments made by Member States and the views of the company and Rapporteur.

The UK evidence process

12. Defra has an ongoing programme of work relevant to developing our understanding of the effects of neonicotinoids and other pesticides on pollinators. Projects currently under way or recently completed (but not yet published) are listed below. Further details of these and of previous projects can be obtained from the [Defra research webpages](#).

Project code	Project title
PS2035	Pilot study to measure drift of dust containing neonicotinoid compounds from seed treatments during drilling of autumn sown crops in the UK
PS2036	Collection of data relating to seed drilling methodologies as part of the outdoor vegetable, grassland & fodder crop pesticide usage surveys
PS2370	Interpretation of pesticide residues in honeybees
PS2372	Quantifying exposure of bumblebees to neonicotinoids and mixtures of agrochemicals
PS2374	RFID assessment of the effects of pesticides on foraging bees
PS2376	Evaluation of procedures to improve estimates of exposure of pollinators to neonicotinoid Insecticides
PS2556	Development and improvement of methods for the Wildlife Incident Investigation Scheme

13. As mentioned in paragraph 4, there is a substantial amount of research under Defra's pesticides programme and other research programmes to support sustainable farming. Funding on alternatives has remained a significant proportion of the Defra pesticides research and development expenditure. There is also work in the Defra Crops

programme relevant to the development of integrated approaches such as work on identification of genetic resistance and tolerance to pests and diseases and work to inform and develop integrated control systems.

14. There is clear evidence that neonicotinoids can have a range of lethal and sub-lethal effects on bees. Defra's earlier assessment was that unacceptable effects are not likely to occur in the field. However, further research is needed to address this key question of real world exposures and effects – which is the focus of the EU data requirements. Such research does, of course, need to be well designed and likely to give reliable scientific evidence. There is also great advantage in the research being transparent, so that independent experts and stakeholders have the chance to comment on the study design and to see the results.
15. A field study of the scale and design necessary is a substantial undertaking. It would need to run for several years and would cost several million pounds. Defra does not see its role as carrying out such a study. In part this is because it would require the use of public money to generate data of commercial value. But it is also arguably inconsistent with the Government's role as the regulator.¹⁹
16. Defra has therefore held discussions with the key companies to understand their plans to generate evidence. This includes the governance arrangements as well as the content and design. The companies are planning studies to begin in 2014 (on top of earlier work) and provided their detailed plans to be examined by our own experts and by the independent Pollinators Expert Advisory Group. We also took views from the Pollinator Advisory Steering Group.
17. In looking at the industry plans we will consider whether it would be appropriate for Defra or the Research Councils to supplement the work.

¹⁹ The Centre for Ecology & Hydrology (CEH) has recently been commissioned by the companies to undertake research to quantify the impact on honeybees of two commercial neonicotinoids seed treatments in commercially grown crops of oilseed rape ('Clothianidin' Bayer CropScience and 'Thiamethoxam' Syngenta). CEH researchers have designed, and are overseeing the delivery of this pan-European, field experiment to take place during 2014-2015.
<http://www.ceh.ac.uk/science/impacts-neonicotinoids-honeybees-largescale-field-experiment.html>

5 - Current policies and initiatives relevant to supporting pollinators in towns, cities and the countryside

As highlighted in the Strategy, actions to support pollinators in towns, cities and the countryside build on a wide range of current policies and initiatives which are directly or indirectly relevant for pollinators. These include:

- Government policies on habitat and species conservation which are directly and indirectly beneficial for pollinators. As part of Biodiversity 2020, we are improving existing and creating new priority habitat to benefit species and helping vulnerable species with particular needs through more targeted action. We are also seeking to establish a coherent and resilient ecological network across the country which will be beneficial for all wildlife. The 12 government-funded Nature Improvement Areas (NIA) are examples of this approach and our plan is for more locally identified NIAs to become established.
- The Government's Forestry and Woodlands Policy Statement (January 2013) outlines plans to protect, improve and expand England's woods and forests. This includes actions by the Forestry Commission (FC) to benefit wildlife and the natural environment, such as improving and restoring our native and ancient woodlands and open habitats, and encouraging Local Nature Partnerships to identify forestry as a local priority. For example, about 10% of England's 340,000 ha of ancient woodland are being restored to working native woodlands, thus encouraging brambles and wild flowers, and some 11,000 ha currently under plantation on the FC managed Public Forest Estate are being returned to open habitat, such as heathland which will bring considerable benefits for wildlife including pollinators.
- Public authorities have specific duties to support species and habitats through the biodiversity duty under section 40 of the Natural Environment and Rural Communities Act (2006). In addition specific commitments under the Natural Environment White Paper (2011) are also potentially beneficial for pollinators, such as establishing green corridors along roads and railways.
- Government policy on planning. The National Planning Policy Framework (2012) requires planning authorities to promote the preservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species populations. It prescribes that local plans should have a clear strategy for enhancing the natural, built and historic environment and supporting wider biodiversity networks, including planning at a landscape scale across local authority boundaries and supporting Nature Improvement Areas.

- Defra and Natural England are working closely with the Department for Transport and High Speed 2 (HS2 Ltd) to look for opportunities to address the effects of loss of habitat during construction of the new line. Compensatory habitat created will seek to maintain and enhance existing ecological networks, by enhancing existing core areas, providing new core areas, and/or promoting links between remaining areas of habitat. This will include compensatory habitat that will be suitable for a range of pollinator species including butterflies and bumble bees.
- The creation and management of pollinator habitats along the 109 km of High Speed 1's railway line from St Pancras Station through Kent to the Channel Tunnel. This includes 45ha of grass and wild flower meadow, 1.2 million native trees and shrubs and 40km of new hedgerow among other plantings.
- Initiatives taken by government departments in the management of their premises and wider estate, such as the Ministry of Justice whose Ecology Team has implemented a number of pollinator actions including at their custodial sites.
- Thames Water's partnership with the Bumblebee Conservation Trust to introduce bee friendly planting and habitat at water treatment works and other operational sites.
- A wide range of initiatives by the food retailers. For example, the Coop's Plan Bee which includes community engagement and free packs of wild flower seeds; Tesco's and Morrison's labelling of bee-friendly plants for sale; Sainsbury's 'Bee Happy' programme and their beekeeper who advises fruit growers on attracting bees into their orchards; Waitrose's Seven Point Plan for Pollinators; Marks and Spencer's partnership with Butterfly Conservation and the RSPB to raise awareness of the importance of butterflies and moths, and to encourage sustainable agricultural practices.
- The Woodland Trust is providing free packs of trees and shrubs for planting including species which provide nectar and pollen, and is promoting these packs to schools and community groups including parish councils, allotment groups, transition towns and beekeepers across the UK. Since 2010, they have sent out over 10,000 free packs and over the next four years, they plan to send out around 4 million native saplings through the free trees scheme.
- The Centre for Sustainable Healthcare, in particular through NHS Forest, is encouraging NHS estates to increase access to green space and thereby improve the health and wellbeing of staff, patients and local communities.
- A range of initiatives and ongoing campaigns by national and local groups to promote pollinator-friendly planting in our towns, cities and wider environment, such as Friends of the Earth, the Soil Association, the Wildlife Trusts, the RSPB and others such as Garden Organic's emerging work with Sustain to promote pollinator friendly spaces in London boroughs. The Bumblebee Conservation Trust has, amongst other initiatives

issued a local authority pack to help local authorities take action to support pollinators. http://bumblebeeconservation.org/images/uploads/Local_authorities_pack_full.pdf. Examples of actions being taken by local authorities to support pollinators is at Annex A of this Supporting Document.

6 - Supporting pollinators across towns, cities and the countryside – examples of agreed actions by land managers

In the Strategy we reported that several businesses and organisations have agreed to take actions to support pollinators. Details of these actions are set out in this section.

Large-scale land owners

1. The **Forestry Commission (England)** (FC), which manages 258,000 ha of public forest estate in England), has agreed the following action plan to expand habitat for pollinators across woodlands and forests:
 - FC will work with Defra and Fera to develop the Bees' Needs Information Sheet on Woodland (<https://www.bumblebeeconservation.org/bees-needs/>) and also to update it to reflect emerging evidence and knowledge exchange on the role of woodlands in supporting insect pollinators, including research commissioned by FC. Aiming to update by end of 2015.
 - FC will promote the Woodland Information Sheet and the importance of pollinators to woodland and forestry owners, managers, contractors and advisers including private woodlands and forests and the public forest estate. Promote the version which Defra has published with the National Pollinator Strategy from 2014.
 - FC will raise further the profile of pollinators as part of the next revision of the UK Forestry Standard (UKFS) and the Standard's Biodiversity Guidelines and Practice Guides; timing of revision to be confirmed. The UKFS sets out the UK approach to sustainable forest management, and already requires that biodiversity is addressed in all woodland management plans approved by FC (England). It currently promotes a range of stand structures, species and open space, and requires that a minimum of 15% of the forest area is managed with biodiversity as a major objective. Compliance with the UKFS is a condition of grants provided by FC (England).
 - FC (Enterprise) will continue to provide habitats that support pollinators and the ecosystem services they deliver on the public forest estate, and to seek further opportunities as far as practicable and within operational constraints, to expand pollinator-friendly planting and management based on the Bees' Needs advice and the Woodland Information Sheet.
 - Defra will integrate FC's action plan into the Strategy's implementation plan for delivering the Strategy. FC will provide Defra with regular reports on progress.
2. The **National Trust** (NT) which owns 250,000 ha of land in England including gardens, forests, farmland, moorland and nature reserves, has agreed the following action plan to support pollinators:

- NT will raise awareness of Bees' Needs through their organisation via their network of Farm Advisers and Wildlife and Countryside teams.
- NT will also raise awareness amongst their farm tenants through their 'Landmatters' publication.
- Across their gardens and land around their properties, NT will continue to incorporate plants to support Bees' Needs. Where possible the Trust will implement grass cutting regimes which allow plants in the sward to flower and produce nectar and pollen.
- At their 'countryside' sites, they will aim to promote and implement Bees' Needs advice to improve the quality of their flora and to create pollinator habitats.
- NT Farm Advisers will promote the National Pollinator Strategy to tenants and use opportunities to encourage them to take up new agri-environment schemes to support pollinators and/or the voluntary measures promoted by the Campaign for the Farmed Environment.
- NT have agreed their action plan can be referenced in the Strategy's implementation plan and will report back on progress.

3. The **Ministry of Defence Estate Managers** have agreed to build on their existing vegetation management practices across their 238,500 ha estate (30% of which has formal designations under environmental protection legislation such as Sites of Special Scientific Interest), including expanding pollinator-friendly planting and habitat improvement (as far as practicable and within operational constraints). Their actions to support pollinators include the following:

- Land management to support pollinators is fully incorporated into recent regional Next Generation Estate Contracts for delivery through a Prime Contractor.
- Where woodland has to be cut down, they will proactively promote replacement with orchard species where possible.
- Supporting the Bees' Needs campaign and raising awareness of, and encouraging pollinator initiatives amongst their farm tenants, many of whom are already signed up to Higher Level Stewardship agreements.
- Introducing flexibility into historically rigid MOD grass cutting contracts across their many sites, to help facilitate local changes to grass cutting to support pollinators.
- Continuing to support local beekeepers by allowing access to their sites, working closely with site Conservation Groups which include entomologists and beekeepers as active members. Examples of hives on sites include RAF Stations at Honington, Shawbury and Cosford; on Thorney Island; and, on the Salisbury Plain Training Area.
- Collaborating with Plantlife to create a wildflower meadow at Yoxter Training Camp and Range in Somerset, and new meadows have been sown in Donnington and RAF Bulmer. In addition, a Coronation Meadow has been established at Barrowburn Meadows in Northumberland and also at a farm in Somerset, on MOD land but managed by Somerset Wildlife Trust. MOD is also considering the feasibility of a meadow at Sutton Coldfield.

- Supporting the Centre for Ecology & Hydrology to use areas of Defence land, notably fields, for the benefit of research into pollinators.
 - Supporting community initiatives across the Defence Married Quarter estate, including allocation of allotments for growing pollinating flowers in addition to vegetables and also memorial gardens where butterfly and insect friendly flowers have been planted.
4. In addition, the **Country Landowner and Business Association (CLA)** is working with Defra to explore specific actions to support the Strategy through their members.

Transport operators

5. The **Highways Agency (HA)** has agreed to the following action plan to support pollinators across their soft estate taking into account the Bees' Needs advice:
- The HA will undertake a programme of works to restore and enhance the grassland component of the soft estate to achieve a significant area of species rich grasslands estimated at 3500 hectares by 2021.
 - In selected areas such as the Nature Improvement Areas, the HA will work with partners to support landscape scale improvements where insect pollinator friendly planting will be a feature.
 - The HA will continue to plant trees, shrubs and wild flowers as part of all their major schemes and other improvements using insect pollinator friendly plants wherever practical.
 - The HA will review and republish the guidance in the Design Manual for Roads and Bridges (DMRB) that supports the design and implementation of species rich grassland, that is the Wildflower Handbook(HA 67/93) and HA 56/92 Grassland and Heathland to take account of advances in knowledge and techniques.
6. **Network Rail** will look for opportunities to incorporate pollinator-friendly good practice in its line-side management based on Bees' Needs. Subject to an agreed monitoring and sampling protocol, Network Rail and the Highways Agency have agreed that their estates could be considered for sample plots as part of any coordinated monitoring programme on pollinators.
7. As part of the pilot transport green corridors project in two Nature Improvement Areas in Northern England, **Network Rail, the Highways Agency and Natural England** will look at the potential for managing and enhancing the soft estate to benefit pollinators and their supporting habitats within the pilot areas.

Local and national government

8. **Defra** is committed to making a positive contribution to the natural environment by supporting biodiversity enhancement and natural habitat protection on its own estate.

Measures in place that support this commitment and demonstrate management regimes and activities already supporting the Strategy include:

- Maintaining a number of sites as nature reserves, for example WatchTree Nature Reserve in Cumbria, with pollinator friendly planting and management practices in place;
- Grounds and land management regimes at Defra properties which take into consideration biodiversity including elements that are supportive of the need for food and shelter for pollinators (by reducing the frequency of mowing regimes, letting patches grow wild, shrubs/trees that support pollinators);
- Risk-based and targeted use of pesticides as necessary;
- The ongoing maintenance and care of wild flower meadows/areas at Sand Hutton and Alnwick;
- Defra's Sand Hutton campus already being home to 20-30 honey bee colonies;
- The roof of Defra's HQ at Nobel House in London is now home to 2 honey bee colonies.

9. Defra's Network Estates team are currently investigating opportunities for extending the existing good practice to properties across its estate.

10. **Natural England** is supporting the Strategy by:

- participating in five of the policy actions, including advice to farmers on existing and new schemes encouraging take up of options which support the Strategy;
- providing planning advice on all major infrastructure projects – making landscape scale connections for pollinators alongside highways, roads and major energy developments;
- improving the condition of their National Nature Reserve estate (they directly manage and maintain 143 National Nature Reserves across England of which around 64,000ha are directly managed by them).
- working with Defra on implementation of the Strategy and reviewing progress, as part of the governance arrangements for implementation.

11. The **Environment Agency** is aiming to establish pollinator-friendly vegetation management and cutting regimes as operational policy across all its assets, such as sea walls and flood defences, based on the Bees' Needs advice.

12. The **Association of Local Government Ecologists (ALGE)** and the Local Government Association will circulate the Bees' Needs advice and guidance to local government groups and to other specific local government groups with an interest in biodiversity and the natural environment.

13. **ALGE** has also agreed to identify a suitable clause on pollinator-friendly vegetation management and habitat improvement/establishment for inclusion in local authority contracts, and will circulate to ALGE members across local authorities for inclusion in these contracts.

Other organisations

14. The **Landscape Institute** (the Royal Chartered institute for landscape architects which is a professional body and educational charity with 6000 landscape architects as members – a profession which includes landscape designers, scientists, managers and planners. It works to protect, conserve and enhance the natural and built environment for the public benefit) has agreed to share the Strategy and the Bees' Needs advice with its members including through their journal and fortnightly e-news, as well as through their Twitter account which currently has followers from the fields of landscape, ecology, planning and architecture.
15. **KPMG's** Director of Facilities has commissioned all of their UK offices (22 in total) to support pollinators and they are engaging their employees on what they can also do to help. In Canary Wharf, they are seeking to influencing the Canary Wharf gardeners on this issue and are working collectively with other businesses on the Wharf and with Tower Hamlets with a biodiversity plan for the area.
16. The **Royal Parks** are working with Defra to develop an action plan to support pollinators across their eight parks in London, guided by the Bees' Needs advice. Their action plan will be ready by March 2015.

7 - Additional background information on the evidence actions

Developing a fit-for-purpose and sustainable long term monitoring programme

1. In developing a monitoring scheme, we will take into account the programmes already well served by many active and skilled volunteers in the UK, although most voluntary schemes are not pollinator-specific and tend to focus on occurrence of species (not abundance). Most occurrence records are collected by skilled and dedicated volunteers through recording schemes such as the Bees, Wasps and Ants Recording Society and the Hoverfly Recording Scheme. Some additional records are also collected through Local Record Centres funded by Local Authorities, Wildlife Trusts and Government Agencies. The Biological Records Centre (BRC), provides technical support and advice to many national schemes and societies, funded primarily by the Natural Environment Research Council and JNCC. The BRC also promotes and enables non-native species recording and testing of systematic monitoring approaches.
2. In addition, the National Biodiversity Network provides a national network for the collection, management and sharing of data on species occurrence and abundance. On honey bees, the British Beekeepers Association carries out a winter survival survey every year as an indicator of the health of honey bee colonies, and the National Bee Unit (NBU) carries out an annual husbandry survey which includes questions on colony losses. The NBU's inspection programme provides surveillance data on honey bee health.
3. Nationwide surveys, such as the Countryside Survey and Environmental Change Network, provide information on change in abundance and prevalence of pollinator food plants and pollinators in the wider countryside.
4. As part of implementing Biodiversity 2020 and assessing its impacts, Defra has been working over recent years with key organisations from the volunteer and professional monitoring community to identify shared priorities and to ensure better coordination of action and investment in data collection, management and assessment. The next stage will be to consider how to work with the community to refine current schemes to provide a greater focus on pollinators.

Factors to consider in designing a monitoring programme

5. In designing a pollinator monitoring programme to assess current status and how it is changing, it is important that we build on current programmes to support an approach that combines voluntary (citizen science) and systematic monitoring if it is to cover the breadth and depth needed and be sustainable. Additional questions to consider in designing a sustainable programme are:
 - Which are the most important metric(s) for assessing the status of pollinator service provision? A sustainable programme cannot monitor all of the 1500 or so species of pollinators in a meaningful way. Therefore, on the grounds of cost effectiveness, it is important to identify the subset of insect species or other metrics, such as diversity or total abundance, relating to the pollination service.
 - What do we want monitoring to tell us about the current status of pollinators and changes in status over time, and hence which parameters of pollinator populations to monitor? It is easy to think of abundance, i.e. simple numbers of insects, but this might tell us little when comparing areas around the country if the species make up of one area differs significantly from another and a given number of one species cannot directly substitute for the same number of another, i.e. 20 honey bees may not be equivalent to 20 hoverflies in terms of pollination service. Consequently, it is necessary to consider other metrics that may be correlated with abundance but give a better measure of pollination value. Such metrics may include frequency of flower visits, diversity, species abundance and functional diversity.
 - How best to ensure that voluntary contribution to monitoring and built up and supported as a valuable part of the flow of high quality information about the status and trends in pollinators over the longer term? This recognises that voluntary monitoring will have an important role sitting alongside some systematic monitoring on an ongoing basis. There are a number of areas where taking a pollinator-centric view could have a significant impact on the usefulness of the data from voluntary citizen-based recording schemes, and these are described in the next section.
6. We recognise that we need to anticipate new developments in identification technology as this could lead to reductions in the costs of monitoring in the longer term. It is not currently cost effective to screen large numbers of insect specimens using molecular techniques such as DNA analysis. However, such technologies are constantly being improved in terms of throughput rate and lower costs per sample. It is likely that over the next 10-15 years such approaches will be viable for making species determinations from large-scale mixed-catch samples. In anticipation of these developments, we are collaborating with the Natural History Museum and the members of the Insect Pollinator Initiative to support long-term preservation and stable storage for specimens. Where

possible we will support and encourage innovations in new technology and in rapid methods for insect identification in collaboration with other funding bodies.

Developing citizen-based approaches to monitoring insect pollinators

7. To design a sustainable monitoring programme we need to look at how best to bolster the contribution of citizen-science. There are a number of areas where taking a pollinator-centric view could have a significant impact on the usefulness of the data from citizen-based recording schemes:
 - Validating models that predict abundance from the occurrence data (of which there is a wealth). The Biological Records Centre is currently implementing a programme of work on this topic and we will look for opportunities to accelerate this work.
 - Improving scheme coordination. There is an ongoing programme of work on on-line data capture and consolidation into a single data infrastructure. We will continue to encourage uptake among recording schemes. Additionally, as the technology improves for web-posting of images to receive either an automated or expert determination, a single entry point will facilitate triaging of submissions to maximise the efficient use of taxonomic expertise.
 - Building and maintaining expert taxonomic capability. We are taking a tiered approach to taxonomic capability with activities to impact each part of the structure. At the pinnacle are professional experts, these will always be relatively few in number, but in collaboration with other funding bodies we will seek to sponsor taxonomic studentships to ensure succession planning as well as widening of expertise. The next tier will consist of volunteer expert taxonomist “champions”. For this group we will look to supporting the provision of training and identification materials to improve and broaden their skills. The champions will be expected to engage the foundation tier, the interested amateur, to develop their skills and ultimately move up through the tiers.
 - Developing understanding of the citizen-science resource base. Different types of monitoring require people with different motivations. For example, volunteers may wish to monitor a species-rich semi-natural area to make the first records of particular species, whilst others may be prepared to survey more degraded habitats as part of the contribution to an overall picture. It is important to understand this diversity of drivers for citizens and to use this knowledge to ensure all monitoring requirements that can be covered by citizens are supported.

Improving our understanding of the benefits from pollinators

8. Pollinators are valued for a wide range of reasons (environmental, economic, cultural and social or intrinsic value to the public), however, the relationships between these values and the status of pollinator populations are poorly understood and in many cases the magnitude of the value is unknown or at best highly uncertain. In relation to economics, we currently have no evidence of a deficit in pollination services or in crop yields.
9. The relationship between the economic benefits from pollination and the status of pollinators is likely to be highly variable depending on the prevailing conditions in any area/time period and will be confounded by a large number of factors. In practice, it may not be possible to define the relationship between pollinators and their economic impact precisely enough to be of practical use. Similarly, even if it is scientifically possible to describe the relationship, the costs of acquiring the necessary data may far outweigh the benefits that can be gained from the information produced. Consequently, we will undertake a feasibility study to investigate the practicality and cost-benefits of primary research to generate data in this area. This work will contribute to our further understanding of valuing how changes in pollinating services impact on changes in production. The role of pollinators (e.g., hoverflies) as predators of insect pests would also need to be considered to help us improve our understanding of their economic benefit.
10. The overall aim of the feasibility study is to identify what approaches could be used to assess the relationship between pollinators and the economic benefits that they provide. These could be theory based, involve monitoring at specific sites or carrying out manipulative studies (or combinations of these). The study will compare alternative approaches and highlight the advantages and disadvantages of each approach. For field-based studies, this would include a consideration of the scale of the study, the level of detail required and how easy it would be to evaluate their impact on pollination services in a robust manner. Depending on the outcomes of the feasibility study we will aim to either commission follow-on research or reassess how we can proceed in the absence of the data.
11. Given the difficulty in determining the relationship between crop outputs and pollination service it is not surprising that the analogous gaps in knowledge about pollination service and effects on wild plants are even greater. It is likely that other major factors, such as habitat loss, are driving changes in populations much more than pollination deficit. However, there is a fundamental lack of knowledge on the basic ecology of wild plants and their interactions with pollinators. We will therefore look at undertaking a scoping study to elucidate the precise nature of the evidence gaps and whether basic research on the ecology of the relationships between pollinators and wild plants might be warranted.

12. Valuing pollinators must be about more than simple economics and the indirect benefits that citizens gain from pollinators and their contribution to natural ecosystems needs to be better explored. Again, this is not a simple question as it ranges from pollinators' contributions to pollination of fruits and berries (including wild species), which can help with providing a healthy balanced diet, to the benefits that are not typically valued by the market, including aesthetically pleasing landscapes that are important in the general wellbeing of humans.
13. To identify these indirect benefits and to consider methodologies for assessing their relative, if not absolute, worth, we will undertake a scoping study and develop a framework for assessing the socio-cultural value of pollinators. By developing such values, this will help us to understand how value may be changing naturally. It will also provide a tool that allows for assessing changes in value resulting from different pollinator actions. This will enable a comparison of changes in value to be considered alongside the costs across society of different actions – and will therefore act as a useful tool to prioritise actions.

Annex A

Local authorities: examples of actions being taken to support pollinators (October 2014)

Local Authority	Source of information	Examples of actions to support pollinators
Eastbourne Borough Council	Responses to the public consultation on the draft National Pollinator Strategy (March 2014)	<ul style="list-style-type: none"> • Where suitable, all Council-owned parks and gardens are planted to support pollinators • Have reduced mowing on downland areas and field margins • Only use pesticides when absolutely necessary
Herefordshire Council	The Bumblebee Conservation Trust's survey 2014	<ul style="list-style-type: none"> • Reduced by 50% their grass cutting operations • Replaced bedding plants with perennials • Introduced more community self-management • As a result of these 3 actions, they expect to save £300,000 per year
Peterborough City Council	(Survey of 172 GB councils; 70 responses)	<ul style="list-style-type: none"> • Introduced 9 biodiversity areas which are cut once per year • Reduced grass cutting frequency across all other open spaces, including 57km of protected road verges • Are creating suitable conditions for wild flowers in woodlands • Are working in partnership with Bog Life on a community project to sow wild flowers in open spaces owned by the Council
Kent County Council	Ad-hoc survey by the Association of Local Government Ecologists October 2014	<ul style="list-style-type: none"> • Working with local businesses, environmental groups, farmers and land owners to develop Kent's Plan Bee • Planners set pollinator habitats as conditions for planning approval e.g, requiring pollinator planting as part of solar farm developments • Projects in Dover (to be extended to Thanet) to enhance feeding/nesting opportunities for priority species of bumble bees
Wyre Forest District Council		<ul style="list-style-type: none"> • 4 year Pollinator Project in place since 2012 in their Parks Department to increase supply of nectar for pollinators within Kidderminster: <ul style="list-style-type: none"> ○ Replaced summer/autumn bedding and areas of amenity grassland with a wildflower seed mix; ○ Since 2012, they have sown wildflower seeds on 13 roundabouts, 6 parks and approx. 50% of the town ring road verges, and in 2015 will expand to 2

Local Authority	Source of information	Examples of actions to support pollinators
		<p>more parks and 75% of ring road verges.</p> <ul style="list-style-type: none"> the Council has made cost savings from reduced maintenance costs in the pollinator scheme areas
Leighton Linlade Town Council (and Leighton Buzzard Friends of the Earth)	Friends of the Earth (see case study on the Bees' needs website)	<ul style="list-style-type: none"> Good example of a community that has successfully mobilised to support pollinators. Their 'keep the buzz' project involves the local FoE group with support from the Town Council and other NGOs. They have planted wild flower areas along the River Ouzel, the local train station, war memorial, playing fields, community orchard.
Bristol City Council	Information they have provided to Defra	<ul style="list-style-type: none"> Use invertebrate friendly plants in new planting schemes wherever feasible Leave patches of land to grow wild, and have several natural meadows Issues wildlife gardening advice to encourage gardeners to manage their gardens to support pollinators and other wildlife (and includes similar advice as 5 simple steps under our Bees' Needs call to action)
London Borough of Richmond	Information they have provided to Defra; and their website	<ul style="list-style-type: none"> Use invertebrate friendly plants in new planting schemes wherever feasible Leave patches of land to grow wild, and have several natural meadows Issues wildlife gardening advice to encourage gardeners to manage their gardens to support pollinators and other wildlife (and includes similar advice as 5 simple steps under our Bees' Needs call to action)
South Gloucestershire Council	Information they have provided to Defra	<ul style="list-style-type: none"> Are converting annual flower beds to more pollen/nectar rich perennials Are reducing frequency of grass cutting Have created a new meadow Allow areas to grow wild on their nature reserves Have stopped using pesticides and have reduced herbicide use by 50% (were unsuccessful in their application for a Coronation Meadow, but are considering further nominations)
Solihull Metropolitan Borough Council	Information they have provided to Defra	<ul style="list-style-type: none"> Manage their nature reserves to support habitat for hibernating insects Re-planting schemes in Council-controlled parks and open spaces now include nectar-rich species Specific areas of parks and open spaces are reduced to one cut per year to encourage wild

Local Authority	Source of information	Examples of actions to support pollinators
		flowers areas <ul style="list-style-type: none"> • Wild flower meadows on road verges
Chesterfield Borough Council	Information they have provided to Defra	<ul style="list-style-type: none"> • For the last 4 years, a programme of limited mowing of verges • Creation of 'wild areas' habitats for pollinators in high density housing areas • Have provided information boards for community/local schools.
London Borough of Sutton	Information they have provided to Defra	<ul style="list-style-type: none"> • Have increased the number of meadows in the borough • Have changed from annual bedding plants to perennial plants • They manage their nature reserves to provide habitats to support a wide range of species with benefits to pollinators.