HOUSES OF PARLIAMENT
PARLIAMENTARY OFFICE OF SCIENCE & TECHNOLOGY

National Pollinator Strategy

28th October 2014, 4-6pm, Jubilee Room, Parliamentary Estate

Food security and environmental resilience are threatened by the decline of pollinator species, such as bees. This event followed up on last year's seminar on halting insect pollinator declines and provided the opportunity for parliamentarians to discuss with academics the evidence base for Defra's approach to the problem: the National Pollinator Strategy.

In England, there are approximately 1,500 insect species including bees, flies, butterflies, beetles and moths, which pollinate food crops and wild plants. Many of these are declining from multiple pressures, such as the intensification of land-use and habitat loss. England's National Pollinator Strategy aims to address these and other pressures by providing advice on pollinator conservation, improving the evidence base for conservation and implementing a monitoring scheme. The draft Strategy was assessed by the Environmental Audit Committee, which has suggested that to be effective, it needs further clarity in the approach to Integrated Pest Management, greater integration with the Common Agricultural Policy, and transparency of research into pesticide impacts. A delivery plan is due to be published within six months of the Strategy. The strategy has now been published. This seminar considered the evidence used to inform measures likely to be set out in the delivery plan.

The event was chaired by Sarah Newton MP for Truro and Falmouth. In the opening statement, the Chair highlighted the need for a better evidence base in order to protect and enhance the wellbeing of bees and our ecosystems. Attendees, including MPs, peers and parliamentary staff, then heard from four speakers:

- **Dr. Adam Vanbergen,** Invertebrate Ecologist, Centre for Ecology & Hydrology
- **Prof. Simon Potts,** Professor of Biodiversity and Ecosystem Services, The University of Reading
- **Prof. Jane Memmott,** Professor of Ecology, University of Bristol
- **Dr. Christopher Connolly,** Reader in Neuroscience, University of Dundee

Slides from each presentation are available on the POST website here

Summary of Presentations

Dr. Adam Vanbergen, Invertebrate Ecologist, Centre for Ecology & Hydrology

Dr. Adam Vanbergen provided background on the importance and current status of pollinators. Insect pollinators are ecological keystone species, with 78-94% of wild plant species and 75% of crop species pollinated by animals. In addition, animal pollinated crops are important for human health as they provide dietary diversity and important nutrients. The monetary value of insect pollinators varies between studies; globally, they are valued at approximately $215 billion (2005 US$) per annum. People care about the status of pollinators. One study (Biesmeijer et al 2006 Science) has showed in a survey of UK landscapes that bee diversity declined by about 52% since 1980, but another (Carvalhiero et al 2013 Ecol. letters) has shown that there are indications of a recent slow-down in the decline of species richness for certain pollinator groups. Another study by Potts *et al* (2010) also revealed that there has been a decline in both bees and beekeepers in Europe. FERA

shows an upswing since 2007, perhaps due to increasing public interest, but genetic data shows that the wild honeybees may be declining.

In general, studies show that wild bumblebee diversity and honeybee numbers are mostly declining, while the changes in diversity of solitary bees and hoverflies are more variable. These studies use the best available data on wild pollinators (haphazardly collected species records), but there is no systematic or standardised monitoring of wild bee or hoverfly abundance. There are standardised monitoring data available for abundance and diversity of butterflies and moths. Altogether these sources of information reveal range contractions for specialist species and a homogenisation of pollinator communities. There are multiple impacts on pollinators across biological scales. It is likely that there are combined effects of pressures and some research is beginning to show this. In one study of land-use impacts (Vanbergen et al. 2014), it has been shown that grazing in woodlands fundamentally rewired and diversified the network of plant-pollinator interactions, which were dominated by fly species, and reduced the inbreeding rate of a thistle . There are also changes to the functional diversity of communities under human impacts. For instance, Woodcock *et al* (2013) showed that in the UK landscape there are areas of low functional diversity of wild bee communities that are associated with Oil Seed rape. Current information on pollinators is often based on sparse, haphazardly collected data at a coarse spatial resolution. To understand better any changes in wild pollinator communities and the pollination service they provide we need systematic, standardized monitoring of wild bee and hoverfly abundance and diversity.

Prof. Simon Potts, Professor of Biodiversity and Ecosystem Services, The University of Reading

Professor Simon Potts discussed issues around safeguarding the value of British pollinators. 84% of European crops are pollinated by animal pollinators. The value of pollinators equates to approximately £691 million per annum in 2011, but this doesn't account for the value from gardens and allotments, and for the provision of forage for livestock and dairy farming. In addition, honey has a value of £10-30 million per year. There are many things missing from these valuations, however, including cultural, aesthetic value as well as contributions to soil and ecosystem stability. In the UK, there are honey bees and bumblebees, as well as 220 species of solitary bees, 300-400 hoverflies, and several hundred species of flies. Each crop is pollinated by a different suite of pollinators, so each pollinator has its own value. For instance, in apples, solitary bees contribute £7.5k per ha of value. Pollinators can enhance the value of crops by increasing both the yield and quality of crops. In apples, the number of seeds is an indication of the amount of sugar and sweetness, and therefore the quality. Pollinators increase the quality of apples but hand pollination increases the quality substantially more, indicating that by enhancing pollinator communities, we have the opportunity to enhance value.

In order to identify good areas for the production of specific crops, the supply of pollinators and demand for crops needs to be mapped. Honeybees are actually a scarce commodity and so cannot supply all our needs; wild pollinators are carrying most of the load at the moment. So, how can pollination services be safeguarded? Agri-environment schemes can help. Individual studies show that flower margins help to maintain pollinator communities, but are they an efficient use of money? Scheper *et al* (2013) attempted to identify which agri-environment options work best: sown flower strips, organic farming, low input meadows, or grass or naturally regenerating strips. The study found that all options work, but organic farming doesn't provide additional benefits in grazed grasslands. In addition, the benefits of agri-environment schemes depend on where we place them. In landscapes with no semi-natural features (e.g. hedgerows, woodlands and meadows) field margins do not appear to work, but the benefits are high in simple landscapes with some semi-natural features, and reasonable in complex landscapes with lots of semi-natural features. This

offers opportunities for the National Pollinator Strategy to ensure relevant agri-environment scheme options are implemented effectively in different landscapes.

Prof. Jane Memmott, Professor of Ecology, University of Bristol

Professor Jane Memmott spoke about the Urban Pollinators Project. 7% of the UK area consists of urban habitats, 25% of which are gardens. In comparison, 10% of the UK area is nature reserves. There is huge diversity in urban habitats; 35% of British hoverfly species have been found in one back garden. However, urban studies are often not replicated and there are no city-wide surveys of all urban habitats. Consequently, there is limited understanding of the ecological networks in urban areas and the resilience of these networks. Little is known about where pollinators are in urban landscapes: are they in cities, nature reserves or farms? In cities, where are the hotspots? To answer these questions, the plants and pollinators in 12 cities, 12 farms and 12 nature reserves were studied. The city areas were surprisingly good for pollinators and more bee species were found in cities than on farms, and a number of rare species were found in the cities.

Four of the cities were then studied in detail and all the habitats in each sampled for pollinators. Within these cities, gardens tend to be the best habitats for pollinators, as they comprise a large overall area and maintain high abundances of pollinators. However, allotments are also very good for maintaining pollinator diversity (as well as being important for people and food sustainability), but they cover only a small area in cities. Parks and other green spaces are not particularly good for pollinators, but they could be improved. As part of the project, 15 flowering margins were planted per city (60 margins in total, equating to 300m^2 area). More floral diversity could enhance pollinator diversity if pollinators are limited by food rather than nesting sites. The data from this project are still being analysed, but there has been significant support from local Councils and public interest. A LWEC policy and practice note will be produced from this project, and a follow-up is underway; the Norwood Farm project, which showed that plant-pollinator networks was one of the most fragile parts of the entire ecological community.

Dr. Christopher Connolly, Reader in Neuroscience, University of Dundee

Dr. Christopher Connolly discussed issues around the impact of neonicotinoids on pollinator communities. There are field-relevant impacts of neonicotinoids. When exposed to neonicotinoids, bees learnt floral scents less quickly and forgot more quickly. This means that while the bees don't die, they forage less effectively and so the performance of the colony is reduced. Three hundred and fifty pesticides are used in the UK, but none of them have been tested to the same extent as neonicotinoids. The amount of land treated with pesticides has increased by 22%, but the load used has decreased by 55%. However, load for load and weight for weight comparisons can't be made; comparisons need to be based on potency, which may have increased. In addition, the combined effects of pesticides are unknown. In clinical medicines, it is known that the active compounds in medicines can interact to harm patients.

There could be additive toxicity in the case of organophosphates and neonicotinoids, but the extent of the risk from use of pesticide mixtures is unknown. There are 42 million potential combinations of three pesticides; this is an overestimate, as many pesticides are not widely used, but these effects could contribute to local pollinator declines. Farmers are required to keep three years of records on what pesticides are applied to their land. If this data was available, the impacts could be monitored and the risks identified. Without such data, it is difficult to establish the effects of the neonicotinoid ban and increased use of other pesticides that have not had such rigorous testing, either individually or in combination with other pesticides.

A number of points were raised in the discussion between attendees and academics:

- Matthew Dray from University of Cardiff asked what the priority is for conserving pollinator communities, and the panel answer was unanimous: systematic monitoring of insect pollinator communities and pollination services to understand the impacts of pesticides and land-use. Prof. Memmott added that we need to gather data across the country and work out the minimum sampling effort required to pick up the patterns in pollinator abundances and diversity.
- Another question from a representative from the Society of Biology asked what the role of citizen science is. Prof. Potts was optimistic that citizen science could have a big role, but people need support and training to ensure that the data is of a high enough quality to complement the work of professionals; citizen scientists cannot be presumed upon but need recognition for their contributions. Dr. Vanbergen pointed out that the UK Butterfly Monitoring Scheme provides a good model for citizen science programmes, while Dr. Connolly added that there are already important citizen science projects underway, which collect data that there is no other way of obtaining; the Scottish beekeepers record infected colonies and have been trained to do a microscopic analysis of bees. In addition, there are good citizen science data on bumblebee nesting.
- Alison Austin, an independent consultant then asked: what are the top three things for businesses to do. Dr. Vanbergen suggested that we need continued publicity for pollinators and academics need funding to understand the relationship between pollinator diversity and crop productivity, while Prof. Memmott suggested that enhancing the green space outside businesses could aid pollinator communities. Prof. Potts suggested that embracing sustainability is important, as businesses need to appreciate the risk to the food supply chain. Dr. Connolly concentrated on agrochemical industry: he called for them to pay others to do safety testing and then release the data.
- Nick Reid, a member of Lord Feldman of Elstree's staff, then asked for an explanation of Colony Collapse Disorder (CCD). Prof. Potts suggested that there are multiple drivers of CCD, but there are lots of smoking guns and that while CCD is generally recognised in the United States, he does not find it a particularly useful term for the UK and Europe. Dr. Vanbergen reiterated that there are likely multiple drivers of CCD which are complex, although disease is probably particularly important. Dr. Connolly pointed out that one study did link pesticides to CCD, but they used unrealistic doses. Sarah Newton MP added that we import honeybees and all their problems, but there is some resistance in our local bees. The Cornish black bee has developed grooming behaviour to avoid the varroa mite, which can be a disease vector contributing to CCD. Tim Lovett then added that we are living with the varroa mite and that beekeepers need industry and researchers to find a solution. Dr. Vanbergen explained that varroa transmits a strain of deformed wing virus, but that research is ongoing, while Dr. Connolly added that pesticides could provide a solution if one is found that targets the varroa mite but not the bee. Prof. Memmott pointed out that although the varroa mite and CCD are important issues for honeybees, it is dangerous to focus on one pollinator as many others are important.
- Andy Lewis from the commercial sector then asked if the panel felt that the National Pollinator Strategy concentrates enough on the processes of enhancing crop pollination rather than on natural pollinators. Prof. Potts suggested that we need to use 'all the tools in our box', protecting both wild and managed pollinators as pollinator diversity provides insurance for losses. There is increasing demand for oil seed rape and high quality fruit and vegetables along with changing land-use, climate and markets; we need to know when we have to help managed pollinators, when to help wild pollinators and when to do both.
- Andrew Riggs MP pointed out that it's hard to get data from farmers. For instance, the soil review is being scrapped because of poor data collection, so manufacturers and salespeople are probably best placed to supply necessary data. He also added that agri-environment schemes are getting better and wildlife is benefitting from activities such as set-asides and fallow land, asking Prof. Potts if he could comment on beetle banks, which are low-cost but high-benefit for

biodiversity. Prof. Potts agreed that beetle banks are indeed easy to implement, but they don't have the longevity and diversity of flowers that flower margins give you; seeding beetle banks could be very effective though.

- Aislinn Pearson from Rothamsted Research then moved the subject towards communication, asking how best to communicate such complex information to farmers and the public. Dr. Vanbergen pointed out that the National Pollinator Strategy helps with this, as it includes clear recommendations; there is complexity, but some conservation actions can be taken immediately. Prof. Potts added that first we need to identify what the end-users actually want to know, and then communicate that in multiple ways, such as through blogs, while Prof. Memmott emphasised the importance of people skills. A key point raised was that it is important to talk to the right people and the information will then spread peer-to-peer.
- Prof. Jeff Ollerton at the University of Northampton then spoke about engaging businesses with pollinator conservation and raised awareness of an online tool called the Biodiversity Index, which was developed to enable businesses to manage biodiversity around their landholding and improve it, but commented that it is difficult to engage with businesses. Prof. Ollerton asked Prof. Memmott what data we need to identify the population-level effect of planted flower strips. Prof. Memmott answered that a similar experiment (flower strips in urban habitats) needs to be undertaken but for longer. A year-long study only shows the behavioural response; at least two years of data are required to get at the population level effects, which may vary between species. There is also relatively little knowledge about bumblebee nesting sites, although researchers can look at both nesting and floral resources for solitary bees; in urban areas, this is particularly important as floral resources are not particularly limiting.
- Gill Perkins from the Bumblebee Conservation Trust asked whether there is a case for rearing bumblebees in the UK rather than importing them. Prof. Potts pointed out that it is an open market but that incentives for local rearing would be welcome.
- Eli Leadbeater from Royal Holloway questioned whether the 'replacement' pesticides are causing similar sublethal effects to neonicotinoids. Dr. Connolly replied that the work has not been done, but there is a risk that if neonicotinoids are removed they may be replaced with a pesticide that could be far worse for pollinators.
- Jonathan Carruthers from Rothamsted Research then asked whether there is direct competition between honeybees and wild bees. Prof. Potts responded saying that this is a question that has been outstanding and not fully answered for decades. There isn't enough evidence yet but if honeybee colonies become more widespread, this is something that should be monitored. Professor Bill Kunin highlighted that data from an IPI project indicated that bee hives are currently located in areas with abundant pollination resources such that competition did not occur.