THE ALL-PARTY PARLIAMENTARY GROUP
appg Bees, Pollinators and Invertebrates

Securing the future for UK pollinators:

Preparing against the threat of invasive species



INQUIRY REPORT

Carder Bee
(c) Adam Lawson 2021

This report by the All-Party Parliamentary Group for Bees, Pollinators and Invertebrates considers how the UK can secure the future for pollinators and key beneficial insects by preparing against the threat of invasive species.

It makes recommendations for a more effective system to identify and respond to invasive species to protect biodiversity and food security.

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Ashy mining bee on an old dandelion head
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Foreword



Barry Gardiner MP

I was nine years old.

My mother had an old Austin 1100.

It was a terrible car. But she was very proud of it and she paid me half-a-crown every week to wash it for her. And every week I used to leave a little 6 inch patch unwashed. I would then bring her outside and proudly show the contrast between the little unwashed patch and the rest of the car all clean and shiny. I cheated! Because the filthy patch that I left unwashed was at the front, where all the insects had been squashed. The rest of the car was not nearly that dirty. But the contrast was great and it worked every time. And that is how I know that our insects are in trouble. The front of my car no longer looks like an insect graveyard!

There are many reasons why Britain's insects are in trouble: habitat loss, climate change, chemicals and pesticides. Our Inquiry chose to investigate the impact that invasive non-native species are having on our pollinators, because it is one of the pressures that is most often underestimated.

Pollinators are the quiet infrastructure behind our crops, our hedgerows and our rural economy. When they decline, the effects spread through the whole ecosystem, from arable farming to the resilience of the countryside itself.

As an island nation, we are more exposed than most. Insects on islands have isolated ranges and find it harder to recolonise after losses. Recent global analysis found that invasive species, when present, reduce the abundance of terrestrial insects by 31% and species richness by 26%. Climate change compounds the problem, making it easier for new arrivals to survive our winters. The yellow-legged (Asian) hornet, first recorded here in 2016, was not seen successfully overwintering until 2023/24.

Our inquiry heard that the system can work well. In 2023, 72 hornet nests across 56 locations were found and destroyed quickly. Yet more than 2,000 non-native species are now established in Britain, around 12 more establish each year, and only four have been eradicated since 2008. Those figures cannot be reconciled for long. Invasive species already cost the UK economy an estimated £4 billion per year.

We found the 2023–2030 Invasive Non-Native Species Strategy to be broadly right in direction. Our concern is delivery: an inspectorate too small for the task, slow decision-making, patchy surveillance, and weak links between the parts of the system. Our ten recommendations seek to build on the Strategy, not replace it. They would measure success by ecological outcomes, give inspectors proper powers, embrace tools such as environmental DNA, and set a clear timetable for ministerial decisions.

I am grateful to everyone who gave written and oral evidence, and to fellow parliamentarians who questioned witnesses so rigorously. I commend this report to the Government and hope it will act on it promptly. Prevention is far cheaper than cure, and the window for acting is narrowing.

Barry Gardiner MP
Chair of the Bees, Pollinators and Invertebrates APPG

Executive Summary

THE THREAT

The continuing significant decline in insects in the UK is extremely concerning. There are multiple reasons for this, but research shows that one is the arrival of invasive species that can disrupt ecosystems by competing with, predating and spreading novel diseases among native species, including pollinators.

Pollinators are animals (usually insects) that move pollen from the male part of a flower to the female part, thereby allowing plants to reproduce. These plants provide sustenance and habitats for most animal species.

Declining numbers of pollinators and other beneficial insects have detrimental effects on arable farming, rural communities and environmental resilience.

Insects on islands such as Great Britain and Ireland are more negatively affected by invasive species than other countries as the insects have isolated ranges, and it is harder to recolonise after extinction. **This situation presents a growing challenge to the health and survival of UK-based pollinators.**

Without pollination by insects, many of the crops humans and animals need to survive will suffer substantially reduced yields. An effective system to identify and respond to invasive species would help our biodiversity and food systems to avoid experiencing significant disruption.



Yellow-legged (Asian) hornet (*Vespa velutina*)

THE CURRENT STRATEGY

The 2023-2030 Great Britain Invasive Non-Native Species Strategy prioritises prevention, detection, assessment, rapid response and long-term management. Delivering these aims involves a range of organisations.

The Animal and Plant Health Agency (which includes the National Bee Unit) undertakes inspections and controls related to imported plants, animals and other goods that may provide pathways for non-native species.

The Non-Native Species Inspectorate monitors compliance, checks businesses and has a broader coordinating role but its team, which is responsible for carrying out checks remains extremely small. This limits its reach and makes it less effective in identifying emerging threats.

Our inquiry heard that connections between different parts of the system are not always sufficiently strong. This risks creating a system that responds effectively when strong institutional arrangements already exist but is less prepared for threats that fall between established responsibilities. The legal and decision-making processes are also too slow.

REFORMING THE SYSTEM

The mitigation system needs to demonstrate coordination, proactivity, adaptability and resilience.

The emphasis on resilience is consistent with the World Health Organisation's concept of One Health, which recognises that the health of humans, animals and plants are closely linked and interdependent. One Biosecurity is a related inter-disciplinary framework integrating human, animal, plant and environmental health to prevent and mitigate the impacts of invasive species.

CONCLUSIONS AND RECOMMENDATIONS

The evidence considered in this report suggests that the overall direction of the 2023-2030 Great Britain Invasive Non-Native Species Strategy is broadly the right one.

The recommendations seek to build on the existing strategy to ensure that it enhances coordination, monitors multiple potential routes of entry into the UK, responds to detections of invasive species at pace and delivers healthier and more varied plant pollination networks and larger populations of pollinator species.

The report's ten recommendations for an improved system, drawn from oral and written evidence, are:

1. Measure success primarily through ecological outcomes rather than operational outputs.
2. Grant the Non-Native Species Inspectorate statutory powers to inspect trade consignments.
3. Deploy new technologies to predict and monitor the highest risk trade routes.
4. Integrate novel approaches, such as environmental DNA, bioacoustic monitoring and pathogen screening, into existing surveillance programmes.
5. Assess threats systematically rather than in isolation and prioritise climate risk modelling.
6. Improve understanding of, and data on, the relative impacts of different invasive species on pollinators.
7. Make it clear to the public which species present the greatest risk, and how they can report sightings.
8. Ensure monitoring and responses to different invasive species operate under a common framework.
9. Introduce a time-bound process for government decisions on species identified as presenting a significant invasive risk.
10. Integrate citizen-science records with expert validation and spatial modelling so that sightings feed directly into risk mapping and response planning.

THE INQUIRY

To produce this report, the Bees, Pollinators and Invertebrates APPG inquiry gathered insights in the form of both written and oral evidence from a range of organisations and experts.

Two oral evidence sessions were held for cross-party parliamentarians to question expert witnesses on the threat posed by invasive species to UK pollinators and other beneficial insects. The first session on 7 July 2026 explored the different invasive threats facing pollinators, with the second on 15 September turning to how effectively the UK's current system prevents, detects and responds to them, and how this system could be strengthened to prepare for future threats.

Written evidence was gathered examining similar themes, including invasive predators, parasites and pathogens; pathways through which invasive species reach the UK; surveillance and early detection; risk assessment; climate change; biosecurity; and the evidence needed to understand and respond to emerging threats.

We would like to thank the following organisations and individuals for submitting written evidence: Agri-Food and Biosciences Institute, British Beekeepers' Association, British Pest Control Association, Buglife, Bumblebee Conservation Trust, Cambridgeshire Beekeepers' Association, Fera Science, Royal Botanic Gardens, Kew, Royal Horticultural Society, UK Centre for Ecology and Hydrology, Wildlife and Countryside Link, Professor Simon Potts (University of Reading), Professor Jane Stout (Trinity College Dublin), Professor Phil Donkersley (Lancaster University) and Professor Jeff Ollerton.

The inquiry has been coordinated on behalf of the Bees, Pollinators and Invertebrates APPG by the Royal Entomological Society.

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The threat posed by invasive species to UK pollinators

INSECT DECLINE

Insects continue to undergo significant declines in the UK and across the rest of the world[1]. Whilst this headline obscures a more nuanced picture, with numbers of some species having stabilised or even improved[2], the overall trend is nevertheless extremely concerning.

There are multiple drivers of this decline, including land use change, habitat loss, pollution, agricultural intensification and pesticide usage, and there is increasing evidence for the impact of climate change. However, research has shown that another cause is the arrival of invasive species, particularly those that compete with, predate or spread novel diseases among native, beneficial species, including pollinators. Invasive plants can also disrupt ecological networks by changing pollinator behaviour.

WHY POLLINATORS MATTER

Pollinators are animals, usually insects, that move pollen from the male part of a flower (anther) to the female part of a flower (stigma), thereby allowing plants to reproduce. A wide range of insects are pollinators, including bees, social wasps, hoverflies, moths and butterflies.

Pollinators, and diverse plant-pollinator networks, are crucial for maintaining biodiversity, as plants provide a wide range of ecosystem services, including sustenance and habitats for most animal species. Other beneficial insects can take on roles including nutrient cycling in soil, decomposition and natural pest control.

This means that declining numbers of pollinators compromise animal and plant health across the entire ecosystem, with associated detrimental effects on arable farming, rural communities and environmental resilience.

INVASIVE SPECIES IN CONTEXT

The spread of species around the world is inevitable, constant, and not necessarily damaging to native wildlife. Species occurring in a part of the world where they did not originate from are termed non-native species.

The GB Non-Native Species Information (NNSI) Portal has recorded more than 2,000 established non-native species in the UK, highlighting the increase in the number of these species across marine, freshwater, and terrestrial environments[3].

Invasive species, by contrast, are species that are introduced outside of their natural range and then **cause ecological damage**. It is important to differentiate between non-native species and the smaller group of invasive species (a subset of non-native species) that this report focuses on.

This damage done by invasive species usually involves preying on native species, competing with them for resources, or by spreading disease, leading to reductions in the abundance of native species.

Plants and insects represent the two largest groups of invasive species recorded on the GB NNSI Portal.

INVASIVE SPECIES AND POLLINATION - HOW BIG IS THE PROBLEM?

On a global scale, recent analysis assessing the impact of invasive species on several insect orders found that when invasive species are present, they reduce the abundance of terrestrial insects by 31% and species richness by 26%.[4]

Looking at the local context, it is well established that insects on islands such as Great Britain and Ireland are more negatively affected by invasive species than other countries as the insects have isolated ranges, and it is harder to recolonise after extinction[5].

This situation presents a growing challenge to the health and survival of UK-based pollinators, and evidence collected by the inquiry demonstrates that this risk is further exacerbated by global climate change. In part, this is because a warming UK climate makes it easier for these species to survive the winters once they arrive here (overwintering).

Climate change may also favour the survival and transmission of pathogens (bacteria or viruses causing disease in pollinators) as well as the insect species that carry them to the UK.

Furthermore, if pollinators are stressed by drought, heatwaves, habitat loss or poor nutrition, they may become more susceptible to these diseases.

Therefore, the drivers of pollinator decline compound one another; the combined effects of land use change, climate change, habitat degradation, agricultural intensification and invasive species are more complex and significant than any single driver acting alone.

Threats from specific species, and the damage done to pollinators by their presence in the UK, is examined later in this section.

WHY INVASIVE THREATS MATTER FOR POLICY - AND SOCIETY

Pollination by insects is much more than a quirk of biology; without it, many of the crops that humans and animals rely on would suffer significant reductions in yield.

This makes it clear that a strong agricultural sector and food market rely heavily on the maintenance of a resilient ecosystem. The cost of invasive species to the UK economy has been estimated by the Centre for Agriculture and Bioscience International to be £4 billion per year[6].

The potential threat to UK pollinators and other beneficial insects posed by invasive species, then, requires significant attention and monitoring. An effective system to identify and respond to invasive species would help our biodiversity and food systems to avoid serious disruption.

Our report details the most prominent invasive species affecting UK pollinators, the UK's system for mitigating threats from these species, and recommendations for future-proofing this system.

Types of invasive species affecting pollinators / Table 1

Evidence received by this inquiry references a wide range of invasive species that impact pollinators. Impacts vary widely, and the species referenced in written evidence have been grouped by impact.

Group	Impact on UK pollinators	Examples
Invasive predators	These species prey on and consume pollinators and other beneficial insects. While some are well established, others are an increasing risk.	Yellow-legged (Asian) hornet, Harlequin ladybird
Invasive parasites, pathogens and vectors	Parasites can live inside or on pollinators, killing or weakening them in the process. Some invertebrates can also act as a vector for pathogens (such as viruses and bacteria) that cause disease in pollinators.	Varroa mite, Nosema ceranae, Deformed Wing Virus
Pests of pollinators	These species invade and consume the honey, pollen, eggs, larvae and pupae within hives.	Small hive beetle
Invasive plants	Invasive plants, when established and spread, can outcompete native plants that provide food for pollinators, and/or represent unpalatable or inaccessible food sources for pollinators and other beneficial insects.	Himalayan balsam, Japanese knotweed
Other invasive invertebrates	Species which impact the wider ecosystem but have an indirect negative impact on pollinators as a result.	Invasive garden ant

[1] P Eggleton (2020)
[2] ibid
[3] GB Non-native Species Secretariat, 2023
[4] G Skinner et al, 2026
[5] H Roy et al (2024)
[6] Centre for Agriculture and Bioscience International, 2023

Select examples / Table 2

Species (with Latin name)	Information as an invasive species	Image
Yellow-legged (Asian) hornet (*Vespa velutina*)	The Yellow-legged (Asian) hornet, originally from South East Asia, was first recorded in the UK in 2016[7]. Most sightings have been in southern England, particularly Kent and East Sussex. The species is not yet considered to have become established in the UK, but incursions occur regularly from continental Europe and have also been recorded in Northern Ireland. Identified by its dark body, yellow legs and orange stripe along its fourth abdominal segment, the hornet is a predator of honeybees as well as other pollinators such as wasps and hoverflies, thereby preventing pollination from happening. Repeated predation attempts by the species cause bees to reduce or cease foraging activity outside the nest or hive (foraging paralysis), also reducing pollination.	
Harlequin ladybird (*Harmonia axyridis*)	Harlequin ladybirds originate in East Asia[8]. Introduced in continental European countries as a way of controlling aphid populations, the species was first recorded in the UK in 2004 and has since become one of the most common ladybird species in the country. The ladybird has multiple damaging impacts on pollination. Firstly, it predates pollinating native insect species, feeding on the eggs and larvae of many pollinator species before they reach adulthood. It also outcompetes native ladybird species and other beneficial insects that feed on pest insects such as aphids.	
Varroa mite (*Varroa destructor*)	The varroa mite was first found in the UK in 1992[9] and has since spread through most UK honey-bee populations. The mite is parasitic, attaching to the bee's body and weakening them. The mite also acts as a vector for multiple pathogens which cause disease in honeybees. These diseases include deformed wing virus, the shrunken wings caused by which leave honeybees unable to fly from plant to plant. Varroa has been one of the most damaging invasive species with respect to their impact on pollinators in recent decades, as infestations can lead to colony collapse and have substantially changed beekeeper practices[10].	

[7] GOV.UK, 2024
[8] GB Non-Native Species Secretariat, 2019a
[9] Animal and Plant Health Agency, 2025b
[10] ibid

Species (with Latin name)	Information as an invasive species	Image
Himalayan balsam (*Impatiens glandulifera*)	The flowering plant Himalayan balsam was intentionally introduced to the UK in 1839[11] as an ornamental garden plant. While it can attract significant numbers of pollinators that have generalist feeding habits, it can also dominate habitats and outcompete native flowering plants. Over time, the replacement of diverse native plant communities with large stands of Himalayan balsam can reduce the variety of food sources available to pollinators throughout the year. This can inhibit pollination by disrupting established plant-pollinator networks.	

HOW DO INVASIVE SPECIES ARRIVE?

Invasive species arrive in the UK by several means:

International trade: Many invasive species are introduced to the UK accidentally when goods arrive from abroad, often as "hitchhikers" on cargo ships or lorries. On ships, ballast water and fishing equipment can act as harbourage (a place of hiding or attachment) for insects. It is also common for insects such as woodboring beetles to use timber as harbourage.

Horticulture: Specifically, the global trade in plants and soils facilitates the movement of insects, seeds, pathogens and other invertebrates such as roundworms. These species can be difficult to detect in soil or on root systems, and it is therefore difficult to prevent their transportation to the UK from abroad. This is the single most important pathway: the GB Non-Native Species Secretariat (NNSS) estimates that around 40% of the invasive species found in the UK arrive via this route[12].

Bee imports: Evidence given to the inquiry also shows that the importation of honeybees and commercially reared bumblebees for pollination can facilitate the spread of parasites and pathogens. These pathogens include Nosema ceranae and Deformed Wing Virus (DWV) and can spill over from managed bees into wild pollinator populations.

Natural spread from continental Europe: Some species, including the Yellow-legged (Asian) hornet, can fly from continental Europe across the Channel.

Climate change increasing establishment: Climate change will increase the likelihood that species arriving through international trade and transport survive and become established. Although the Yellow-legged (Asian) hornet was first recorded in the UK in 2016, for example, it was not recorded as successfully overwintering until 2023/24[13].

UNDERSTANDING TRANSMISSION

The wide range of potential transmission routes gives a sense of the challenge facing those trying to prevent the arrival and establishment of invasive species to the UK.

It should also be noted that the same species can arrive in the UK by multiple routes. For instance, the Yellow-legged (Asian) hornet sometimes arrives due to natural spread from Europe, but is also a hitchhiker through trade routes. In 2004, a single fertilised queen of the species arrived in France in a commercial consignment of pottery from China, which then caused a spread of the species through the continent[14].

Some species that have been introduced as biological control agents to European countries can fly to the UK even though they were never used as control agents here. This was the case with the Harlequin ladybird, introduced to Europe in the 1980s to manage aphid populations.

These routes, then, are best viewed as an overlapping patchwork of entry points that can facilitate one another, rather than wholly distinct categories.

[11] GB Non-Native Species Secretariat, 2019b
[12] GB Non-Native Species Secretariat, 2023
[13] GOV.UK, 2024
[14] National Bee Unit, 2026



Harlequin ladybird, Harmonia axyridis
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The UK's current strategy for mitigating invasive species

WHAT IS THE CURRENT STRATEGY?

The inquiry heard that the threat from invasive species to pollinators is multifarious. Invasive species arrive in the UK by a variety of means and then proceed to impact multiple pollinator species in different ways.

As a result, *preparing* to mitigate such a situation needs to be considered holistically.

The 2023-2030 GB Invasive Non-Native Species Strategy provides the framework for preventing, detecting and managing invasive species. It prioritises prevention, followed by early detection and rapid response where introduction occurs, and long-term management where a species becomes established. Risk analysis, surveillance, research and monitoring all support decision-making across these activities.

The Strategy's primary aims are as follows[15]:

- **Management:** eradicate, control or contain invasive species – prioritised by greatest impact and the likelihood of success.
- **Prevention:** reduce establishments of invasive species by at least 50% compared to 2000 levels.
- **Surveillance, early detection and monitoring:** significantly improve our detection and monitoring capability, including increasing inspections and investigations.
- **Prioritisation and risk analysis:** set out an agreed approach to the prioritisation of species based on risk and likelihood of success to ensure our efforts are focused to where they can achieve the greatest benefit.
- **Evidence:** commission the research priorities outlined in the Evidence Strategic Plan, to ensure that the strategy is based on the best available evidence, and identify gaps and priority areas for further development.
- **Awareness raising:** increase awareness of INNS issues and promote appropriate changes in behaviour or attitudes throughout all relevant sectors and among the general public.
- **Coordination:** improve co-ordination of actions within governments, government associated bodies, and key actors outside government.

THE STRATEGY AND POLLINATORS

As evidence given to the inquiry makes clear, no single organisation can maintain responsibility for all these diverse functions across a wide range of species threats.

In order to protect pollinators, organisations need to collaborate. Each will have a different role: some in prevention, others in the detection and risk assessment. Sound scientific research will also be required to evaluate the effectiveness of these interventions in different pollinator populations

The below sections describe the organisations and functions carrying out the different roles ascribed in the 2023-2030 Strategy.

PREVENTION

Preventing invasive species from arriving and establishing in Great Britain takes place through a combination of border controls, regulation, pathway management and public awareness.

Government agencies, including the Animal and Plant Health Agency (APHA), undertake inspections and controls relating to imported plants, animals and other goods that may provide pathways for non-native species. Meanwhile, the Non-Native Species Inspectorate (NNSI) monitors compliance with legislation governing invasive species. NNSI inspectors check businesses including garden centres, pet shops and zoos, monitor non-compliant online sales and can take enforcement action.

The Non-Native Species Secretariat (NNSS) has a broader coordinating role, working across government and relevant sectors to identify and manage pathways through which invasive species may enter Great Britain.

Prevention also relies on awareness and behaviour change among businesses, travellers and the public, particularly where trade and travel create routes for introduction.

[15] GB Non-Native Species Secretariat, 2023

DETECTION

Evidence received by the inquiry highlights a variety of surveillance mechanisms in place for non-native species that may be relevant to plant, animal or human health. Risks are identified through surveillance programmes, horizon scanning, citizen-science records, inspection of imported goods and pollinator health monitoring.

Detecting emerging threats in new areas of the country can rely on the public being able to identify and report sightings quickly. Citizen-science platforms such as *iRecord*, supported by the UK Centre for Ecology & Hydrology (UKCEH), allow biological records to be submitted and shared, while the *Asian Hornet Watch* app (set up by UKCEH and Defra) provides a dedicated route for members of the public to report suspected sightings of Yellow-legged (Asian) hornets.

For threats to managed pollinators, APHA and the National Bee Unit also undertake targeted surveillance for pests including Yellow-legged (Asian) hornet, Small Hive Beetle and *Tropilaelaps* mites.

Public awareness therefore also forms an important part of detection. APHA uses initiatives such as Plant Health Week and events including the RHS Chelsea Flower Show to promote biosecurity, while the Non-native Species Secretariat coordinates Invasive Species Week to raise awareness of invasive species and encourage reporting.

ASSESSMENT

Once a potential invasive species has been detected, the level of risk it poses, and the appropriate response need to be assessed. At a strategic level, the NNSS coordinates the GB risk analysis process, which assesses the likelihood that non-native species will arrive, establish and spread, and the potential environmental and economic impacts if they do.

This process draws on expert evidence and is used to help government prioritise species for further action. The NNSS also coordinates horizon scanning to identify species which may pose a future threat to Great Britain.

Operational assessment also takes place when suspected incursions are reported. For bee-health threats, the National Bee Unit within APHA investigates credible reports and can deploy bee inspectors to confirm whether a threat is present and determine its extent.

Suspected Yellow-legged (Asian) hornets, for example, can be collected for formal identification and genetic analysis by the York-based applied science company, Fera Science. APHA and the National Bee Unit (NBU) can then use this information to determine the scale and location of an incursion and inform the subsequent response.

RESPONSE

Responsibility for responding to an invasive species depends on the species and the risks it poses. Written and oral evidence given to the inquiry shows that the NNSS helps coordinate rapid response and contingency planning across Great Britain, while operational action is undertaken by the relevant government agencies and other organisations. In Northern Ireland, invasive species policy and response is led by the Northern Ireland Environment Agency. Responses are prioritised according to factors including the likely impact of a species and the feasibility of eradication or control.

For invasive species threatening pollinators, APHA and the National Bee Unit play an important operational role. Following a confirmed Yellow-legged (Asian) hornet sighting, for example, NBU inspectors undertake monitoring and tracking to locate nests. Once located, nests are destroyed as part of the Government's eradication response, with other APHA teams providing specialist support.

The NBU also manages incidents involving notifiable honey-bee pests and diseases and maintains contingency arrangements for exotic threats including Small Hive Beetle and *Tropilaelaps* mites.

EVALUATION

Monitoring continues after an invasive species has been detected and action has been taken, both to establish whether a particular intervention has succeeded and to inform subsequent surveillance and management. Responsibility for this varies according to the species and the organisation leading the response.

For Yellow-legged (Asian) hornet, APHA and the National Bee Unit continue monitoring following intervention; monitoring around an incursion continues until no hornets have been observed for five consecutive days.

Fera provides additional scientific analysis of destroyed nests and specimens. Genetic analysis can establish relationships between incursions, while nest dissections can indicate whether new queens may have dispersed. This information has subsequently been used to inform further surveillance.

At the strategic level, evidence gathered through surveillance, research and monitoring feeds back into the wider approach to risk analysis, prioritisation and management.

HOW WELL IS IT WORKING?

The following section offers an analysis of the effectiveness of the current system by judging it against the 2023-2030 Strategy's criteria.

- **Management**

  Does APHA/other delivery capacity allow rapid eradication and containment?

Evidence received by the inquiry suggests that the system can work well on small, recent incursions of certain species. Regarding the Yellow-legged (Asian) hornet, for instance, nests have repeatedly been found and destroyed quickly. APHA reported 72 nests in 56 locations in 2023[16] which were then quickly located and destroyed by APHA and the National Bee Unit.

However, the system is less effective at preventing the steady inflow of new non-native species or reversing damage from widespread invasive ones. The current Strategy says that only four non-native species have been eradicated from Great Britain since 2008[17], while around 2000 non-native species are established and about 12 more establish each year.

Although not all non-native species are invasive, these figures illustrate the scale of the challenge facing the UK's biosecurity system.

- **Prevention**

  Is the system sufficiently proactive? Are pathways being addressed effectively?

Prevention relies on being able to consistently monitor the pathways explained earlier in the report.

Written evidence received by the inquiry highlighted that the creation of a dedicated Non-Native Species Inspectorate has been a major step forward in facilitating this. Regarding the horticultural trade, for instance, inspectors check garden centres, pet shops, zoos, rehoming organisations and other users for breaches of relevant legislation. They also monitor and help remove non-compliant online sales of horticultural plants, take enforcement action and coordinate with the police when required.

However, the NNSI team responsible for carrying out these checks remains extremely small, limiting its reach, and the 2023-2030 Strategy itself points to a "lack of capacity, expertise and effective methods of control"[18].

There are also other trade pathways besides the horticultural trade that need to be monitored, and the sheer amount of trade in non-horticultural goods that can act as harbourage for invasive species means that only a small percentage of any cargo is directly inspected.

- **Surveillance and early detection**

  Are invasive species being successfully identified across the country?

Whilst bodies such as UKCEH, beekeeper's associations, APHA and others are undertaking surveillance extensively, the degree of surveillance and early detection varies depending on the species in question and funding availability.

A major factor in the reporting of Yellow-legged (Asian) hornet has been vigilance among domestic beekeepers, as well as bespoke reporting apps such as *iHornet*. However, comparable reporting networks do not exist for other invasive species that affect wild pollinators or soil-dwelling invertebrates.

Detecting other species can be more challenging than detecting, for instance, the Yellow-legged (Asian) hornet, because of their small size, diversity and ability to remain hidden within soil or root systems during transit. This reflects the fact that effective surveillance and early detection cannot be fully separated from having a well-resourced team of inspectors conducting checks on horticultural plants or other traded goods.

- **Prioritisation and risk analysis**

  Are emerging threats being assessed quickly enough, particularly under climate change?

Climate change is altering conditions in the UK in variable and unpredictable ways. This has damaging implications for risk analysis and prioritisation, because it is becoming more difficult to use historical data to evaluate risks.

Firstly, the data can less reliably predict which invasive species might arrive in the UK.Secondly, it is becoming more difficult to predict where future establishments of anticipated invasive

[16] Animal and Plant Health Agency, 2025a
[17] GB Non-Native Species Secretariat, 2023
[18] GB Non-Native Species Secretariat, 2023



Hoverfly, Helophilus pendulus
© Zach Haynes 2016

species might occur. This compounds a context in which the team prioritising resources is small and already stretched.

- **Evidence**

  Are evidence gaps being identified and filled?

Evidence taken from surveillance and detection efforts does not provide a clear enough picture of how much damage is being done to specific pollinators, and which invasive species are responsible for this damage.

A clearer evaluation of the data being collected through surveillance is needed. For instance, environmental DNA analysis of the gut contents of the Yellow-legged (Asian) hornet has identified 1400 different species – many of them pollinators. However, greater quantitative sequencing is needed to understand the scale of the impact on individual pollinator species.

Without this stronger evidence base being fed back into surveillance and detection systems, surveillance groups cannot make decisions about which invasive species to prioritise.

- **Awareness raising**

  Are the public and relevant sectors sufficiently engaged in detection and prevention?

Awareness of invasive species among the public at large is clearly heavily slanted towards the Yellow-legged (Asian) hornet and Harlequin ladybird but falls off dramatically in relation to other species. Evidence collected by the inquiry suggests that broader public support for honeybees makes it easier to initiate awareness around species such as the hornet, as it predates honeybees.

Sadly, for species targeting other pollinators, such as wasps and hoverflies, the process of generating public awareness is much more difficult.

- **Coordination**

  Do all these moving parts function coherently?

Examining specific points of the mitigation system referenced in oral and written evidence demonstrates that the system is not uniformly strong or weak but varies substantially according to whether an established pathway exists for detecting a threat, the capacity of specific teams to respond to it, and the quality of the data available to determine which out of multiple threats is the most pressing. This reflects a wider coordination challenge.



Leafcutter bee, Megachile lagopoda
© Gustav Parenmark, age 17, 2023

Prevention, surveillance, risk analysis, evidence gathering and response involve different government bodies, inspectorates, researchers and surveillance networks. However, these functions need to operate as parts of the same system. The capacity of inspectors affects what can be detected; what is detected determines the evidence available for risk analysis; and this evidence should in turn determine which threats are to be prioritised for surveillance and prevention. Public awareness can strengthen this process by increasing the likelihood that emerging threats are identified quickly.

The evidence considered in this report suggests that these connections are not always sufficiently strong. Different inspectorates can work towards different objectives and look for different species, while responsibility for coordinating different parts of the system is not always clear.

This risks creating a system that responds effectively where strong institutional arrangements already exist but is less prepared for threats that fall between established responsibilities.

Written evidence also suggested that the legal and decision-making process can be too slow. There are delays between risks being identified and decisions being taken on whether species should be listed as Species of Special Concern under the Invasive Alien Species Order, which can slow the translation of risk assessment into surveillance and control action.

Reforming the system to prepare for future threats

Solitary Bee – Megachile willughbiella
© Keith Trueman 2016



QUALITIES FOR REFORMING THE SYSTEM

Putting the previous observations together, the mitigation system needs to demonstrate the following qualities:

Coordination: Different actors performing the roles outlined above (prevention, detection, assessment, response and evaluation) must be able to work together as part of a wider strategic response.

Proactivity: The system should be sufficiently well-resourced to anticipate the arrival of new species into the UK. This means increased understanding of various critical species and monitoring multiple routes of entry, including trade, horticulture and natural spread from continental Europe.

Adaptability: The system should be able to quickly prioritise and respond to new detections in different areas of the country. Adaptability is especially important if accelerating climate change makes it harder to predict where invasive species will become established and spread once they arrive in the UK.

Resilience: While delivering faster detection and more successful eradications is important, the system must ultimately contribute towards delivering resilient and varied plant-pollinator networks and larger pollinator populations. These require all wild pollinators, not just honeybees, to be protected from invasive species.

ONE HEALTH

The emphasis on resilience is consistent with the concept of One Health. This is an approach to public health supported by international groups such as the United Nations Food and Agriculture Organisation and the World Health Organisation which recognises that the health of humans, domestic and wild animals, plants and the wider environment, including ecosystems, are closely linked and interdependent. This means that risks to biodiversity should not be considered in isolation from their wider environmental and societal implications.

In the context of invasive species and pollination, the evidence presented above demonstrates that individual risk factors combine to increase the strain on pollinators. Risk assessments must therefore consider interactions between climate change, land-use change and biological invasions, rather than evaluating each threat in isolation.

The related concept of **One Biosecurity** extends this analysis further, arguing that responses to these risks should reflect the same holistic understanding of the threats. The response must therefore bring together taxonomists, population biologists and modellers, as well as economists and social scientists. This would allow the wider implications of biodiversity loss for society to be better understood, prepared for and mitigated.

ENHANCING THE STRATEGY TO REFLECT THESE QUALITIES

Taking the evidence gathered by this inquiry as a whole and the observations made on the current strategy, the following table outlines overall directions of reform that our inquiry recommends to the 2023-2030 Strategy's seven functions.

The table also lists which of the four qualities outlined above could be strengthened by each reform direction.

Table 3

Function	Overall direction of reform	Qualities strengthened
Management	Take a holistic view of what a successful invasive strategy looks like by prioritising improved pollinator outcomes as well as the ability to eradicate, control or contain invasive species.	Adaptability, Resilience
Prevention	Strengthen inspectorates' ability to inspect consignments entering via risky pathways.	Proactivity, Resilience
Surveillance, early detection and monitoring	Ensure strong surveillance and monitoring **across** species, habitats and routes of entry, including increased inspections and investigation of emerging threats.	Proactivity, Adaptability
Prioritisation and risk analysis	Improve the identification and prioritisation of threats according to risk and likelihood of successful intervention, including consideration of interactions with climate change and other pressures.	Adaptability, Resilience
Evidence	Strengthen the evidence base underpinning invasive species policy, addressing gaps in knowledge and supporting long-term monitoring of impacts on pollinators.	Proactivity, Adaptability, Resilience
Awareness raising	Improve awareness of invasive species risks among relevant sectors and the public, supporting identification, reporting and changes in behaviour.	Proactivity, Resilience
Coordination	Strengthen coordination and information-sharing between governments, government bodies, researchers and other organisations involved in prevention, detection, assessment and management.	Coordination, Adaptability



Hummingbird Hawk-moth
© Marc Brouwer 2022

Conclusions and recommendations

The evidence considered in this report suggests that the overall direction of the 2023–2030 GB Invasive Non-Native Species Strategy is broadly the right one. Indeed, there is significant overlap between the Strategy's seven desired outcomes and the directions of reform that are suggested above.

The recommendations made below therefore seek to build upon, rather than replace, the existing Strategy. The Strategy should be amended to ensure that it:

- Provides an overall direction, such that separate actors work towards common goals (**Coordination**).
- Monitors multiple potential routes of entry into the UK, including trade, horticulture and natural spread from continental Europe (**Proactivity**).
- Detects and responds to detections of invasive species in different areas of the country at pace (**Adaptability**).
- Delivers healthier and more varied plant-pollinator networks and larger populations of pollinator species (**Resilience**).

RECOMMENDATIONS

These recommendations are organised according to the Strategy's seven functions and identify practical changes that would help deliver the more coordinated, proactive, adaptable and resilient system outlined in the section on reforming the system.

MANAGEMENT

- **Measure success primarily through ecological outcomes rather than operational outputs.**

Evidence received consistently advocates that the system should prioritise and record the recovery of affected native species, including pollinators, as well as recording eradication, control and containment of invasive species.

While procedural successes such as reducing new establishments of invasive species are important, the system cannot be said to be truly working if these successes are not accompanied by better outcomes for British pollinators, biodiversity and our food system.

Specifically, the system should record plant-pollinator network resilience by examining the number of plant and pollinator species interacting in given areas. On the level of individual pollinator species, metrics such as queen survival, colony establishment rates, body size, reproductive success and overwinter survival should all be recorded.

This is in line with the One Health approach, rooting the response to invasive species in wider concerns over biodiversity and the resilience of the UK's food system.

PREVENTION

- **Grant the NNSI statutory powers to inspect trade consignments.**

The NNSI should be granted statutory powers similar to other APHA inspectors, alongside sufficient staffing to exercise these powers effectively.

These measures should enable inspectors to routinely monitor garden centres and plant nurseries, given the importance of the horticultural trade as a transmission pathway.

- **Deploy new technologies to predict and monitor the highest-risk trade routes.**

At ports, AI should be deployed more systematically through computer-vision systems, automated image classification and risk-based cargo screening models. Computer vision should be used to analyse X-ray and photographic imagery of shipping containers, pallets and imported plants to identify potential biological contaminants that insects might use as harbourage.

SURVEILLANCE, EARLY DETECTION AND MONITORING

- **Integrate novel approaches such as environmental DNA, bioacoustic monitoring and pathogen screening into existing surveillance programmes.**

The current surveillance system should be an integrated system that combines horizon scanning, environmental monitoring and rapid-response capability. With appropriate application of novel molecular approaches, these networks could significantly increase the likelihood of detecting invasive non-native species that might otherwise go unnoticed. Some of these technologies were referenced in written evidence by the inquiry and are explained below.

Environmental DNA (eDNA) monitoring allows species to be detected from traces of genetic material, often before populations become large enough to be observed directly. This approach is increasingly being used internationally for invasive species surveillance at different entry points and could improve early detection of invasive insects, pathogens and plants.

Environmental bioacoustic monitoring also has significant potential. Networks of autonomous acoustic sensors can continuously record insect, bird and amphibian communities, with machine-learning algorithms identifying species from their characteristic sounds. Such systems are increasingly being used to monitor biodiversity change and could potentially provide an early-warning system for the arrival of invasive species or shifts in ecosystem condition associated with biological invasions.

Pathogen screening could help identify novel diseases before widespread transmission occurs. Routine genetic screening of managed pollinator imports and wild pollinator populations could provide earlier warning of emerging pathogens and spillover events.

PRIORITISATION AND RISK ANALYSIS

- **Assess threats systematically rather than in isolation and prioritise climate-risk modelling.**

Risk assessments should more systematically account for interactions between invasive species, land use change, climate change and other pressures on pollinators, rather than assessing individual threats in isolation.

Common carder bumble bee, Bombus pascuorum
© Michael Wood 2023



In particular, assessments should prioritise climate-risk modelling, considering how changing climatic conditions may alter both the likelihood of species becoming established in the UK and the geographical areas in which they could spread.

Horizon scanning should also anticipate species that may become viable threats under future climatic conditions, rather than focusing only on species capable of establishing under present conditions.

Evidence

- **Improve understanding of, and data on, the relative impacts of different invasive species on pollinators.**

Written evidence consistently remarked that data showing which invasive species are having the largest impact on UK pollinators is currently insufficient; the system needs to focus on improving this as a way of ensuring that the wider goal of improved pollinator abundance is met. A stronger evidence base would allow threats to be compared against one another, helping government determine which species require the most urgent intervention and where limited surveillance and management resources should be concentrated.

There is also not enough information on UK pollinator species – of their biology, population trends and the pathogens that might affect them. Without a clear understanding of the health and distribution of native pollinators, it is harder to identify when invasive species are causing damage, which pollinators are most vulnerable, or whether interventions are successfully improving outcomes.

These two evidence gaps are closely connected. Better baseline knowledge of UK pollinators and other beneficial insects is needed to understand the relative impact of invasive species upon them, and this evidence should in turn inform priorities for risk analysis, surveillance and management.

AWARENESS RAISING

- **Make it clear to the public which species present the greatest risk, and how they can report sightings.**

The government should actively promote apps for reporting potential sightings like iRecord, *iNaturalist* and *Asian Hornet Watch*.

Public awareness campaigns should also form part of the strategy, focusing on priority invasive species for which rapid identification and reporting can improve the likelihood of successful intervention.

There are multiple successful campaigns from abroad that the UK could emulate, such as California's "Buy It Where You Burn It" campaign, which sought to halt the spread of emerald ash borer through the movement of firewood[19]. This campaign encouraged changes in behaviour to prevent spread, rather than focusing solely on recognising certain species.

COORDINATION

- **Ensure monitoring and responses to different invasive species operate under a common framework.**

Cross-government involvement should be strengthened to ensure coordinated action on invasive species. A unified, integrated approach is needed so prevention, response, and control are treated as interdependent parts of one framework rather than separate workstreams.

This is a general recommendation, but the integrated approach it offers is exemplified by the following two recommendations, both of which would better connect governmental and administrative decisions with operational activity.

- **Introduce a time-bound process for government decisions on species identified as presenting a significant invasive risk.**

Given that the process for listing species as Species of Special Concern under the Invasive Alien Species Order can be too slow, there should be a clear timetable for reaching a ministerial decision on whether to add a species to the list of Species of Special Concern.

The Government should consider introducing a two-year maximum period between the commencement of a risk assessment and a ministerial decision on listing. During this period, identified risks should trigger proportionate surveillance and preparatory action rather than requiring the full legal process to conclude before further steps are taken.

- **Integrate citizen-science records with expert validation and spatial modelling so that sightings feed directly into risk mapping and response planning.**

Citizen science is a highly valuable source for determining where detections and spread of invasive species have occurred, but records should be tightly integrated with expert validation and spatial modelling so that sightings feed into risk mapping and response planning rather than remaining disconnected. These technologies should support, not replace, skilled field surveillance.

[19] National Park Service, 2023

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Bumblebee surrounded by flowers
© Jack Gardiner 2021

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ABOUT THE BEES, POLLINATORS AND INVERTEBRATES APPG

Bees, Pollinators and Invertebrates is the APPG dedicated to facilitating insect science. Chaired by Barry Gardiner MP, we hold events and promote research on a wide range of policy issues, including insect conservation, food security and vector-borne disease prevention.

The chair of the group is Barry Gardiner MP, and vice chairs are Lord Randall of Uxbridge and Irene Campbell MP. The secretariat is provided by the Royal Entomological Society.

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