Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
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A Pollinator Strategy for Scotland 2016 – 2026: Consultation document

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1 WHY IS POLLINATION IMPORTANT?

Pollination is a crucial element of Scotland's natural environment. It's essential for many of the healthy ecosystems and beautiful landscapes we enjoy, and it provides economic benefits in many agricultural crops. Our lives wouldn't be the same without it, or without the animals that mediate it.

Some plants are self- or wind-pollinated, but others require animals to transfer pollen between them to reproduce. Insects, especially bees, flies, moths, butterflies and beetles, are the most important pollinators, and insect-mediated pollination is one of the main drivers of biodiversity as pollination is responsible for cross-fertilisation of many plant species and therefore helps to maintain their genetic diversity.

Our aim:

To address the causes of decline in **populations**, **diversity** and **range** of our pollinator species.

The benefits of pollination are often measured in economic terms, particularly its value to agriculture, but they go beyond this. Our natural environment has important positive influences on our mental and physical health, including helping to reduce stress and improving physical fitness, and pollinators are a crucial building block in this 'Natural Health Service'.

Pollination is an integral part of many of our ecosystems and is a necessary part of healthy, resilient ecosystems. Around three quarters of the world's cultivated crops benefit from animal-mediated pollination, although only an estimated 10% depend on it entirely. This is about 2% of the global agricultural production. The benefits of pollination are estimated to be around £132 billion annually, or 9.5% of the world's agricultural production. Pollination services in the UK have an estimated market value benefit of £430 million, of which at least £43 million is in Scotland.

Animal-pollinated crops contribute to a healthy diet with vital nutrients, vitamins and minerals and their shortage could lead to micronutrient deficiency that already afflicts two billion people worldwide. In some circumstances, pollination improves crop quality and affects market value. Despite all these benefits, however, we don't fully understand the role each of our pollinators play or the impact that their losses may have on our lives.

2 WHY DO WE NEED A POLLINATOR STRATEGY FOR SCOTLAND?

Scotland's bumble bees, solitary bees, honey bees and hoverflies are under pressure. There are reports of declines in honey bees in North America and Europe. Pollinator declines that prove to be long-lasting and widespread could have serious implications for crop productivity, and for the maintenance of our diverse and healthy ecosystems. It is important therefore that we start to take action before there are significant impacts in our natural environment that we cannot halt and/or reverse.

KEY CROPS DEPENDENT ON POLLINATION IN SCOTLAND – WILD OR MANAGED

Crops in Scotland which rely on insect pollination are oilseed rape, raspberries, strawberries, blackcurrants, runner beans and apples (no commercial orchards in Scotland).

This Strategy sets out the current situation for our pollinators, the reasons why action is

urgent and the challenges that we need to meet for their conservation. Pollinators generally require extensive areas in which to forage, nest and hibernate, so measures to safeguard their food and habitats must be carried out at a landscape scale. The Strategy is intended to help guide Scottish Government, local government and public bodies. Our pollinators cannot, however, be conserved by policy statements or legislation alone, so it also identifies actions for a wider range of participants in the challenge.

Strategy vision

- **By 2020** the value of our pollinators will be widely recognised and action to support them will be firmly embedded in policy and practices;
- **By 2025**, we will be restoring populations and habitats in areas where pollinators need greatest support, ensuring a strong network of sites and enriching the environment to support improvements in ecosystem health and services.
- **2025 and beyond:** a strong network of good quality pollinator habitat will be in place, supported by policies and legislation that will help to sustain them.

3 WHAT ARE SCOTLAND'S POLLINATORS?

UK pollinators include the honey bee, bumble bees, solitary bees, wasps, hoverflies, other flies, beetles, butterflies and moths. By far the most important groups of wild pollinators in Scotland are bees and hoverflies. Wild pollinators are important to maintaining pollination services in the natural environment and are increasingly thought to have an important role in agricultural systems.

Bees

There are around 250 species of bee in the UK, comprising the honey bee, 25 species of bumble bees, and around 224 solitary bees. In Scotland there are 23 bumble bees, 79 solitary bees, and the honey bee. For UK bumblebees, the ranges of six are known to have declined, four have declined locally and another six are stable or increasing.

The domesticated honey bee is believed to be responsible for most agricultural pollination worldwide. Honey bee colonies are manageable, and hives can be transported from field-to-field so honey bees can pollinate a range of crops and wild plants. The timing of pollination by honey bees can also be controlled, which can improve the evenness of harvest timings, and the uniformity of fruit. Each hive has thousands of workers and, with this level of activity, it is unlikely that other bees would be able to replace the wide pollination services that honey bees provide. Honey bees are not, however, always as well adapted morphologically to pollinate many crops as are other bees. Bumble bees, for example, have longer tongues than honey bees and are effective pollinators of soft fruit. They also forage earlier in the day, and in weather that is unfavourable for honey bees. About 8% of all flowering plants, including tomatoes, aubergines and blueberries, have flowers that release pollen through narrow openings at the tip of their anthers – a morphological arrangement analogous to a salt shaker. Honey bees perform poorly in their pollination whilst bumble bees are especially skilled at dislodging pollen from these flowers. Over 95% of glasshouse tomatoes are pollinated by bumble bees.

Some solitary species, such as mason bees, are also better adapted than honey bees to pollinate apples, pears, plums, cherries, strawberries, raspberries and a wide range of garden flowers. The

red mason bee, which is widespread in England, has shown to be a promising pollinator for a number of crops grown under cover, especially strawberry, raspberry and blackberry. This species is rapidly spreading into Scotland.

Flies

Flies, particularly hoverflies, are often considered the next most important group of pollinators in the UK after bees. They are particularly important pollinators in upland and montane habitats. However, compared to bees, they have been the subject of relatively little research and their overall contribution to pollination services in Scotland is not well known.

Moths, butterflies and other insects

Although widespread and wide-ranging visitors to flowers, butterflies, moths, beetles and wasps are not thought to be efficient pollinators compared to bees and hoverflies. Research from Scotland suggests that less than 3% of moths carry pollen, but very little is known of the ecosystem or economic benefits of butterfly pollination.

4 WHAT IS THREATENING OUR POLLINATORS?

There are growing concerns that environmental pressures are leading to declines in the number, diversity and geographic range of our pollinator species. With the exception of a few individual species, we have very limited data on population trends for some of the UK's most important pollinators, e.g. bumble bees, solitary bees and hoverflies. For bumble bees, we know that the range of six species has declined, four have declines locally and another six are stable or increasing. In Scotland, there is evidence that the ranges of four out of 12 social bumble bee species have contracted.

It is not clear whether these apparent changes in pollinator diversity are related to population sizes although there is evidence that species richness of bees and hoverflies is also in decline. So, what is causing this and what can we do about it?

There are many possible reasons for observed changes. No single factor seems to be responsible for the changes, but many factors combine to create a greater overall impact. There are, however, some impacts that are more notable than others.

- **Habitat loss, degradation and fragmentation**: This is often considered to be the main cause of changes in wild pollinator communities during the late 20th century. Since the 1940s, an increase in urban expansion, and the conversion of semi-natural flower-rich habitats (e.g. meadow, traditional hedgerows) to agriculture have reduced the food and nesting opportunities available. In Scotland, areas of moorland and grassland, which are important habitats for pollinators, have also declined steadily. Flowering crops (e.g. orchards, oilseed rape) only provide transient sources of nectar and pollen so even policies which promote these will not compensate for the losses. Agricultural intensification can also fragment natural and semi-natural habitat, making it more difficult for pollinators to find food. **Effective pollination requires a landscape–scale approach where cropped land is interspersed with areas of natural habitats.**

- **Pesticides**: The majority of pesticide used in Scotland comprises herbicides and fungicides because our cooler climate generally leads to reduced insect pressure.

Insecticides account for around 2.5% of total pesticide use by weight in Scotland. Excessive or inappropriate use of pesticides can damage non-target pollinator species. There are also concerns about the approved use of some pesticides, for example the neonicotinoid insecticides which, since their launch in 1991, have become the most used insecticides worldwide as soil, seed and foliar treatments. .

In Scotland, neonicotinoid insecticides are mainly used on winter sown cereal and oilseed rape crops and to a lesser extent on potatoes, soft fruit, vegetables, fodder crops and ornamental and house plants. Research has shown that neonicotinoids may alter the behaviour of non-target organisms, especially honey bees and bumble bees. Sub-lethal levels, passed through residues in nectar and pollen, impair flight, navigation, olfactory memory, recruitment and foraging performance of honey bees and bumble bees. Recent research provides evidence for the mechanism by which honey bee colonies may compensate for individual level effects of neonicotinoids leading to the replacement of lost worker bees. However, we still lack quantitative estimates of the degree to which pollinators are exposed and susceptible to neonicotinoids through different pathways in the environment. To get an answer, field scale experiments are needed. There is evidence that neonicotinoids used in seed treatments can move into water bodies and wildflowers. However, we do not know yet whether this negatively effects wildlife populations.

Because of concerns about these impacts, the use of three neonicotinoids (imidacloprid, clothianidin and thiamethoxam) is currently restricted on pollinator-attractive crops throughout the EU while more evidence is generated. **In order to balance sustainable use of pesticides with protection of the natural environment, including pollinators, the adoption of an integrated pest management approach is necessary. This must take into account emerging evidence on the impacts of pesticides on both honey bees and wild pollinators.**

- **Diseases**: An estimated 40,000 to 60,000 artificial bumble bee hives (pollination units) are imported to the UK each year to use for pollination of tomatoes (in glasshouses), soft fruit crops (in polytunnels) and in smaller-scale orchard fruit crops. Around 1,400 pollination units were estimated to have been brought into Scotland for use in glasshouses (mainly for tomatoes) and 1,900 for fruit pollination in polytunnels. Bumble bees are commercially important for other crops as well, such as raspberries, which accounted for £21 million of Scotland's economy in 2011. A further 13,000 packages of honey bee queens and/or colonies are imported into the UK each year to maintain Scottish honey production and pollinator services.

  Commercial rearing and importation of both bumble bees and honey bees pose a potential biosecurity risk to native pollinators. Studies in Ireland and the UK showed that over 70% of commercial bumble bee colonies were infected with pathogens, including parasites infectious to the honey bee. Whilst there is some evidence that these diseases may already be present in our wild pollinator populations, there are currently no statistics from Scotland clarifying the level of pathogen spill-over from these commercial colonies or the routes of transmission. Additionally, importation and/or movement of bees increases the risk of introducing novel pathogens, which native pollinators may have little resistance to. Legislation and import checks are in place to prevent the importation of honey bees carrying known non-native pathogens of honey bees and other pollinators, and new pathogens and pathways are identified and assessed through horizon scanning exercises although it is often difficult to assess their impact on native pollinator populations. Beekeepers and users of commercially

reared bumble bees can reduce the risk of impact on native pollinators by sourcing stocks responsibly, following best practice guidance and reducing disease burden within their own colonies. **Early assessment and management of potential threats is essential.**

- **Climate change**: Warmer temperatures can interfere with species' ecology and can have a profound effect on pollination systems. Insects live with a body temperature which is close to their environment and a change in temperature can have a direct effect on their biology. There is also some evidence that the distributions of some insects and plants are changing in response to climate change. If pollinators and their food plants become desynchronized, natural processes may be disrupted, for example, plants that pollinators rely on for food may start to flower at different times from pollinators, or there may be geographical changes in where each species occurs. There is, at present, little evidence of these effects but **a better understanding of ecosystem functions, and the role of individual species, will help to identify the magnitude of changes that are climate-related.**

5 WHAT ARE WE DOING TO HELP POLLINATORS?

It is apparent that our pollinators are facing tough times. Environmental and human-induced impacts have developed gradually over the last 70-80 years but the evidence of their effects is more apparent now than ever before. If we don't do something soon we could face difficulties in pollinating our crops, the diversity in our ecosystems will be poorer and our pollinator populations could continue to decline to the point of losing species. So what can we do to prevent or offset these?

The good news is that we are already working to support healthy and productive wild pollinator populations, their habitats and their ecosystems. Setting a clear framework to do this is important and it currently includes:

The 2020 Challenge for Scotland's Biodiversity, which recognises the benefits of using agro-ecological approaches to sustain insect-mediated pollination;

The Common Agricultural Policy (CAP) and the Scottish Rural Development Programme (SRDP), which link payments for farmers to 'green' management options which will directly and/or indirectly benefit pollinator habitats, for example Ecological Focus Areas (EFAs);

The Scottish Land Use and Forestry Strategies, both of which provide opportunities and potential management challenges to pollinators, for example replacement of flower-rich habitats with trees.

National Planning Framework 3 (NPF3), which includes priorities for greening vacant and derelict land areas, thereby providing a rich and varied invertebrate fauna.

More detail on these policies is set out in Annex 1.

Gaining a better understanding of pollinators and their requirements is crucial in ensuring the right actions are taken. This has been recognised in Government-sponsored research and, since 2010, the BBSRC Insect Pollinator Initiative (IPI) has funded a £10M, five-year research programme into the

causes and consequences of perceived declines in our pollinator species. Scottish Government has contributed to this to establish the evidence needed to direct future action.

Also in 2010, Scottish Government published a 10-year *Honey Bee Health Strategy for Scotland* which aims to achieve a sustainable and healthy honey bee population in Scotland through strengthened partnership between individuals and organisations with interests in honey bees.

Recognising that pesticide use is an integral part of today's Scottish agriculture, the Scottish Government supports and promotes Integrated Pest Management (IPM). This encourages the use of non-chemical methods to control pests and diseases, for example using pest-resistant crop varieties, mechanical techniques and biological pesticides. It also encourages better targeted use of conventional pesticides. The Scottish Government supports research on IPM techniques at the James Hutton Institute, funds Scotland's Rural College to promote IPM to Scottish growers and also collects information about IPM uptake by Scottish growers.

Policies and practices funded by Government are setting a strong agenda in support of our pollinators, but it is also crucial that we do not put off practical action. The voluntary sector is playing an important role in this respect, and there is currently a wide range of projects, funded and managed by non-governmental organisations, which contribute high quality information and practical support (see box).

Current volunteer projects:

Highland garden for bees (Black Isle Brewing Company)	Glorious Green Roofs (Inner Forth) (Buglife)
Polli:Nation	Slammanan bog restoration (Bogs for Bugs) (Buglife)
'Thurso-Gateway to the Great Yellow' (BBCT)	BeeWalks and BeeWatch (BBCT)
B-lines (Buglife)	Bees for Everyone (BBCT)
Buzzing Projects (Glasgow, Muirton, Fife) (Buglife)	On the Verge (Creative Stirling)
Bing's For Wildlife (Inner Forth) (Buglife)	

6 WHAT ELSE SHOULD WE BE DOING?

Whilst we have in place a strong policy framework for action and an enthusiasm to take action, we also need to set a clear agenda to ensure any resources available are used wisely to improve conditions for our native pollinators.

Section 4 sets out the main pressures on our pollinator populations. The impacts of some of these are more easily remedied than others but the following sets out a package of actions which we consider important to pursue over the next ten years. Detailed actions that will help to achieve these, and form the basis of an implementation plan, are set out in Annex 2.

Theme 1: Address the impacts of habitat loss and fragmentation, promoting the restoration of semi-natural and flower-rich habitats

We know pollinators rely on flower-rich habitats but many of these are now fragmented patches which are isolated from each other by large areas of less pollinator-friendly land. We also need to improve our knowledge of specific plant-pollinator interactions, to understand more clearly how they use their environments and the pressures upon them. We need to prevent further loss and degradation, retain connected habitat networks for wild pollinators, and promote the restoration or creation of natural flower-rich habitats and landscapes. This needs to be done at a landscape-scale to ensure appropriate nesting, foraging and hibernation conditions for pollinators, particularly bees.

Agri-environment schemes are a good vehicle for encouraging landscape-scale management and the Environmental Audit Committee recommended that pollinator protection must become a CAP priority. The Scottish Rural Development Programme provides such a vehicle in Scotland and we will continue to design and set in place appropriate options to support management that favours pollinators. This will include ECAF incentives to encourage 'green' management across individual landholdings. Grassland comprises around 30% of Scotland's land area and efforts directed at these habitats are particularly important.

There is also a substantial area of land under public sector management, including hospital and college grounds, NNRs and the National Forest Estate, which presents opportunities to increase habitat networks. Urban areas also offer a wide range of opportunities to create and improve pollinator habitat, for example, domestic gardens comprise 19-27% of the area of cities. Managed sympathetically these and other amenity areas such as parks, playing fields and woodlands, can be converted to flower-rich areas and establish good urban networks for pollinators. Adopting less intensive practices on roadside verges, railway sidings and roundabouts can also enhance habitat connectivity for pollinators. Commitments to these can be embedded in Management Agreements or, for Local Authorities, in Single Outcome Agreements.

Occasionally the needs of pollinators need to be weighed against conflicting conservation interests. For example, some plant species seen as unimportant, or harmful, such as common ragwort, spear thistle, creeping thistle, cow parsley or rosebay willowherb, are amongst the most important nectar sources in Scotland. Allowing some of these species to grow can have significant benefits for local pollinator populations.

Theme 2: Develop, and implement, better evidence-based plans for pollinator-friendly management

There is currently a lot of useful information available to identify the biodiversity benefits of land management options. It can, however, be difficult to distil and interpret this into practical advice for specific pollinator-friendly management. We need to translate this information into clear, constructive, practical and evidence-based advice for farmers, land managers, Local Authorities, and others.

SRDP options offer financial incentives for actions that can help to boost biodiversity in farmed land. Few of these specifically target pollinators but a better understanding of pollinator-plant interactions will help to redress this by identifying which crops and plant communities should be

favoured. Setting out the economic and environmental benefits of the choices will help to inform land managers about mutually beneficial outcomes.

Pesticide toxicity to pollinators is currently assessed on honey bees, with a safety factor used to extrapolate the risk to other pollinating species. The current Code of Practice for using Plant Protection Products in Scotland contains a section on protecting wildlife and the environment, including bees, and provides a statutory framework for pesticide use in the countryside. It must be read in conjunction with additional guidance on pesticides published by Scottish Government, which supersedes sections of the Code.

Brownfield sites are particularly important for solitary bees. Pollinator-friendly management of these neglected areas can offer good habitat and advice needs to be available for Local Authority planners to ensure that development of these sites takes into account their biodiversity benefits.

Volunteer groups currently make a significant contribution to managing pollinator-friendly habitat through project-driven initiatives. Funding such groups and initiatives is an important factor in establishing and maintaining these and information needs to be made available on funding streams for local projects that benefit pollinators.

Theme 3: Management of disease risks

The Wildlife and Natural Environment (Scotland) Act 2011 amended the Wildlife & Countryside Act 1981 to make it an offence to release a non-native species in Scotland. Adherence to this legislation should reduce contact between non-native captive-reared bees and our wild pollinators.

The Invasive Non-Native Species Framework Strategy for GB will also help to detect new or emerging sanitary threats whilst clear biosecurity measures in apiaries will help to prevent cross-contamination between managed and native bees.

Theme 4: Addressing climate change impacts

The Climate Change Action Plan sets out the consequences of climate change to a range of species. As well as the phenological changes which disrupt the synchrony between pollinators and their food plants, changes in climate may encourage pollinator species into new areas, and increase the risk of their encountering pests and pathogens.

The Climate Change Action Plan sets out a number of things we can do to ameliorate the impacts of climate change. Actions which help to maintain healthy ecosystems, and in particular reduce habitat fragmentation to facilitate opportunities for dispersal, will offset some of the impacts on pollinators. A better understanding of ecosystem functions, and the role of individual species, can help to identify the magnitude of changes that are due to climate. It will also help with a better understanding about actions which can be taken to offset the impacts of this.

Theme 5: Increase public involvement in recording and monitoring wild pollinators.

It is important to understand the trends and status of many of our pollinators within and across habitats and landscapes. We do not have long-term data on the number of bees or other pollinators

which makes it difficult to accurately detect or monitor population changes. This, in turn, makes it difficult to develop measures to help them.

Initiatives are already in place, such as the volunteer national recording scheme to monitor the abundance of bumble bees across the UK ('Beewalk'), and volunteers training to identify and record bumble bees species (Bumblebee Conservation Trust), and we need to build on both these and the recommendations of the Defra-led National Pollinator Monitoring Scheme (NPPMS) to provide a standard, cost-effective method of monitoring pollinators which informs future decision on pollinator conservation.

Public involvement and citizen science is crucial in getting the information to achieve the principles embedded within this strategy. Information needs to be available to enthuse contributors and encourage a wider understanding of the importance of these species, and pollination as an ecological service. There is a need for good identification tools, such as keys and databases (DNA barcoding and wing venation recognition) to encourage greater taxonomy skills for the future.

Community initiatives, such as the Nectar Networks, the 'On the Verge' project (Creative Stirling) and the 'Glasgow's Buzzing' project, also encourage participation in the creation of habitat networks for pollinator species.

Partnership working must include policy makers and those with practical skills in the management of habitats, public awareness, understanding the needs and status of pollinator populations and, importantly, the ability to direct and monitor achievements.

7 MONITORING OUTCOMES

Progress under the Strategy will be reviewed in 2020. This aligns with targets for Scottish, UK and EU Biodiversity reporting timescales.

Although the strategy covers the period 2015 – 2025, action will not stop in 2025. The objective is to continue to embed the Strategy into Government policies and practices for a sustainable future for our pollinators, landscapes and ecosystems.

8 IMPLEMENTATION

An Implementation Plan for Pollinators will be prepared by September 2017. Using Annex 2 as a starting point, this will set out in detail the work needed to meet the targets in the Strategy.

A working group will be established to develop and monitor progress of the Implementation Plan. This will include representatives of government, non-governmental and trade organisations to ensure wider ownership and participation in action for our native pollinators.

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ANNEX 1: POLLINATOR POLICY FRAMEWORK IN SCOTLAND

Scottish Biodiversity Strategy

The UK is signatory to the Convention on Biological Diversity, which places obligations and targets on Government to conserve our native biodiversity. *The 2020 Challenge for Scotland's Biodiversity* recognises the importance of our ecosystems and biodiversity to the environment, and the benefits of using agro-ecological approaches to sustain insect-mediated pollination.

The *Scotland's Biodiversity: a Route Map to 2020* sets out milestones and targets to meet the 2020 Challenge. In particular, enhancing, restoring and creating habitats to provide wild pollinators with healthier, and more widely available, habitat, including in towns and cities, will increase their population resilience. Action for wildlife conservation and sustainable management of land and freshwater will similarly help to re-establish a balance between environment, social and economic outcomes at a landscape scale. This will also help to ameliorate some of the potential effects of climate-change in providing wider, less fragmented and more varied availability of pollinator-friendly habitats in the landscape/ at a landscape scale

Common Agricultural Policy (CAP) and the Scottish Rural Development Programme (SRDP)

The EU Common Agricultural Policy (CAP) helps support viable agriculture in Scotland. Pollinator-friendly management options include:

- Maintenance or restoration of permanent or short-term flower-rich habitats, such as unimproved grassland and field margins.
- Creation of wildflower-rich mosaics and increasing diversification of flowering habitats at a landscape scale.
- Creation of permanent species-rich grassland habitats, including mixtures of grasses and wild flowers.

The new Environment Cooperation Action Fund, under Pillar 2, supports environmental benefits across multiple holdings. This will encourage cooperative, landscape-scale management action which is of greatest importance to many of our pollinator species.

The Scottish Land Use and Forestry Strategies

Careful integration with other land-use objectives, and better strategic planning, could however lead to improved species- richness and connectivity to benefit our pollinators.

National Planning Framework 3 (NPF3)

The Central Scotland Green Network (CSGN), a national priority under NPF3, is an example where past land use has in places left a legacy of disused land, poor quality green space and fragmented habitats. Coordinated action under NPF3 can help to redress this whilst creating habitat corridors for pollinators. Community initiatives, such as Nectar Networks, play a strong role in substantially improving the quality of these areas, closing gaps and providing a network of habitats to encourage pollinator dispersion and survival at the landscape-scale.

Strategic research

Insect Pollinator Initiative projects included research on managing diseases of bees and other insect pollinators; the impact of habitat structure on bee population; understanding the impact of land use changes on pollinators; the ecology and conservation of urban bees and pollinator efficiency. By establishing a strong network of participants, the IPI has ensured that the outcomes of the research can be effectively applied to address the various pressures on pollinators.

Beekeeping and Bee Health

There are several initiatives currently in place, or being developed, to ensure the continuity of an active beekeeping community. These include beginner classes run by local beekeeping associations around the country, and the Bee Farmers' Association Apprenticeship Scheme. The latter aims to introduce younger people to the business of sustainable commercial bee farming.

Beekeepers play an important role in maintaining the health of their honeybee colonies to prevent disease spillover to wild pollinator populations. Beekeepers and importers are obliged to report suspicion of any notifiable pests or diseases, thus they have an important role to play in disease management and control.

Managed bumble bees may escape into the wild and, like honey bees, can infect their native counterparts and other native bees. Some imported bumble bee units contain non-native subspecies, which may hybridise with native subspecies and out-compete the native subspecies.

Bees are also potentially at risk from novel, non-native pests spreading to the UK, for example the small hive beetle. Beekeepers need to be constantly vigilant and the Scottish Government carry out checks and provide guidance to assist in this.

The release of non-native bees is controlled under section 14 of the Wildlife & Countryside Act 1981. The Wildlife & Natural Environment (Scotland) Act 2011 strengthened this protection and the *Code of Practice on Non-Native Species* sets out how to act responsibly, within the law, to ensure that non-native species do not cause harm to our environment. The Acts apply equally to imported and commercially-reared non-native pollinator species. Scottish Natural Heritage is the licensing authority and any application to release a non-native species would need to satisfy both the Code and the letter of the law. This would include being able to demonstrate that an accepted set of screening protocols for known diseases and pathogens have been implemented.

Until we can eliminate any risks posed by commercially-managed bees on our native bee fauna, we need to adopt practices that limit the likelihood of serious damage to our native species. This is particularly relevant in Scotland, where commercially-reared bumble bees are almost exclusively used for pollinating crops in open-ended poly-tunnel systems.

Pesticide policies

Pesticides are used to protect crops from insects, slugs, weeds and fungal disease, and to prevent contamination of stored foods. The European Commission is responsible for approving the active substances used in pesticides and part of the process involves assessing the risk to pollinators and other non-target insects. If necessary, restrictions to reduce the risk to invertebrates can be identified on the product label.

Scientific opinion from the European Food Safety Authority expressed concern in relation to the risks posed by three neonicotinoid insecticides: imidacloprid, thiamethoxam and clothianidin. The European Commission restricted the use of these products, from 1 December 2013, on crops with

flowers attractive to bees. These restrictions will continue until the Commission reviews the evidence and considers whether or not it is appropriate to lift them.

The Scottish Government Pesticide Survey Unit (PSU), based at the Scottish Agriculture and Science Agency (SASA), monitor the use of agricultural pesticides. The results are published annually on the SASA website and include estimates of conventional and biopesticide use. Scotland has extensive grassland areas that have low pesticide input so, despite having almost 30% of the UK's agricultural area, we use only 10% of the total UK pesticide use.

ANNEX 2: OBJECTIVES, ACHIEVEMENTS AND PARTICIPATION

Theme 1: Address the impacts of habitat loss, promoting the restoration of semi-natural and flower-rich habitats	
Important achievements will be to:	Who can help achieve these tasks:
• Encourage and support land managers to work together to carry out management at a landscape scale. This should include urban green space and urban fringe areas that may make a significant contribution if appropriately managed. • Understand better what resources are available to pollinators at a landscape scale, and whether these are changing. • Ensure strategies, policies and initiatives are fully coordinated to avoid the potential for conflicting outcomes, such as the loss of an important pollinator habitat to other land-uses e.g., development, intensive agriculture, afforestation. • Improve spatial planning and targeting to ensure that land-use change and management is directed to the areas where it will achieve the greatest benefit and minimise impacts on pollinator habitats and their connectivity. • Support schemes that increase the diversification of flower-rich habitats across farmland, the countryside and developed areas • Work with planners and local councils to ensure that pollinators are taken into account in the planning system.	Research institutions, universities and government.

Theme 2: Develop, and implement, better evidence-based plans for pollinator-friendly management	
Important achievements will be to:	Who can help achieve these tasks:
• Improve our knowledge of plant-pollinator interactions. This should include assessing the relationship between wild pollinators and habitat patch size, quality, type, and connectivity. • Identify the measures needed to protect and enhance pollinator habitats at both habitat- and landscape-scales. • Provide management guidance and advice for the public, land managers and policy makers. This should include information on pollinators, their habitats, requirements and the services they provide. Practical guidance should include information on sources of financial support, including appropriate SRDP options, as well as how to create and restore flower-rich habitats to enhance pollinator abundance, health and diversity • Support further research on the effects of neonicotinoids on both managed and wild pollinators. Information arising from this can be used to review the Code of Practice on Pesticides and Integrated Pest Management (IPM) • Encourage and support the use and development of pollinator-friendly pest control measures, including Integrated Pest Management, in agricultural areas.	Advisory bodies, government and land management organisations for practical support. Local government, NGOs, volunteer groups, community action groups and gardeners for habitat management in habitat networks and public areas.

Theme 3: Management of disease risks	
Important achievements will be to:	Who can help achieve these tasks:
• Understand better the potential impacts on wild pollinator populations from beekeeping operations, including evaluating the risk of disease spread between managed and wild pollinator populations. • Ensure that practical advice is available to reduce disease impacts on pollinators. This will include reviewing the risk to both managed and wild pollinators from the importation of managed bees and their associated pests and diseases. • Encourage establishment of local business to provide commercially-reared, native species pollination boxes in support of Scottish agriculture. Particular attention should be paid to ensure high sanitary standards which will reduce the risk of transmission of pests and diseases to wild pollinators.	Research institutes Government and beekeeping organisations. Farmers and land managers.

Addressing climate change impacts	
Important achievements will be to:	Who can help achieve these tasks:
• Evaluate climate-associated shifts in the phenology of plant-pollinator systems. • Assess what can be done to help habitat and pollinator species adaption to climate-change?	Government, research institutes, NGOs and land management organisations.

Increase public involvement in recording and monitoring wild pollinators.	
Important achievements will be to:	Who can help achieve these tasks:
• Develop standardised, cost-effective monitoring methods that support long-term, repeatable assessments of wild pollinators to accurately determine trends. These should be suitable for use by a wide range of participants. This will be obtained from the recommendations arising from the National Pollinator Monitoring Scheme (NPMS) applied in a Scottish context. Support will also continue for volunteer recording schemes for bees, hoverflies, moths and butterflies which all generate valuable data. • Engage the public in recording and monitoring pollinator species through support for species recording and monitoring schemes, and the volunteer programmes being included under development of the NPMS. • Encourage planting of wild flowers to help pollinators and raise awareness that many plants considered weeds e.g., dandelions, thistles, hogweed, rosebay and willowherb, can support and sustain populations of wild and managed pollinator species. • Support community initiatives, such as the Nectar Networks, the 'On the Verge' project currently being run by Creative Stirling and the 'Glasgow's Buzzing' project, to encourage involvement in recreation of habitat networks at a landscape-scale for pollinator species. • Continue to encourage the adoption of pollinator-friendly management in policies on transport infrastructure, i.e. management of road and rail verges. • Develop demonstration sites on publicly-owned land, including parkland, forestry and NNRs, and	Many organisations and individuals are well placed to support these tasks. Membership and participatory NGOs can help enthuse and offer opportunities for participant, local government, Scottish Government. SEARS partners can encourage the use of pollinator-friendly management in public areas.

contribute to the SAC initiative *Farming for a better Climate.* • Plant flower-rich gardens and amenity areas to help sustain pollinators in urban areas, and boost pollinator numbers in any areas adjacent to farmland. • Develop regionally appropriate species planting advice to assist public support of pollinators in both urban and rural areas. Support continued provision, by NGOs, of information and advice on pollinators, and the monitoring and recording schemes operated by the NGOs • Use Scotland's Environment Web (SEWeb) to provide a 'one-stop-shop' of pollinator information.	