

Honey Bee Health Strategy Review



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Glossary:

ABA	Affiliated Beekeeper Association
AFB	American foulbrood
APHA	Animal and Plant Health Agency
BBKA	British Beekeepers Association
BBSRC	Biotechnology and Biological Sciences Research Council
BBVA	British Bee Veterinary Association
BFA	Bee Farmers Association
BHIP	Bee Health Improvement Partnership
BHIT	Bee Health Improvement Team
BIC	British Irish Council
BioSS	Biomathematics and Statistics Scotland
CRF	Contract Research Fund
DEFRA	Department for Environment, Food and Rural Affairs
DWV	Deformed Wing Virus
EBSOC	Easter Bush Science Outreach Centre
EFB	European foulbrood
FERA	Food and Environment Research Agency
FSS	Food Standards Scotland
HSE	Health and Safety Executive
IPI	Insect Pollinator Initiative
IPM	Integrated Pest Management
LBI	Lead Bee Inspector
NBU	National Bee Unit
NDB	National Diploma in Beekeeping
NNSS	Non-native Species Secretariat
OSR	Oil Seed Rape
PCR	Polymerase chain reaction
RHS	Royal Highland Show
RPID	Rural Payments and Inspections Division
SAC	Scottish Agriculture College
SASA	Science and Advice for Scottish Agriculture
SBA	Scottish Beekeepers Association
SCQF	Scottish Credit & Qualifications Framework
SG	Scottish Government
SGRPID	Scottish Government Rural Payments and Inspections Directorate
SHB	Small Hive Beetle
SNHBS	Scottish Native Honey Bee Society
SNH	Scottish Natural Heritage
SRUC	Scotland's Rural College
ToR	Terms of reference
VMD	Veterinary Medicines Directorate
WIIS	Wildlife Incident Investigation Scheme

Summary Review of: The 2010 Honey Bee Health Strategy – for a sustainable and healthy population of honey bees

Introduction:

The first [Scottish Honey Bee Health Strategy](#)¹ was published in June 2010 - the main aim of which was “to achieve a sustainable and healthy population of honey bees for pollination and honey production in Scotland through strengthened partnership working between stakeholders with interests in honey bees”. This followed the uncovering of EFB and AFB in honey bees across Scotland in 2009 and highlighted the need for a strategic approach to honey bee health in Scotland.

This 10-year Strategy brought together stakeholders involved in the beekeeping industry throughout Scotland; from the amateur and commercial beekeeping sectors along with Scotland’s beekeeping advisor at SRUC, SASA, the SG Inspectorate and relevant key people from the Scottish Government, including Scotland’s very first Lead Bee Inspector (LBI) and provided for the establishment of a working group (now known as the [Bee Health Improvement Partnership \(BHIP\)](#)²). Their [Terms of Reference](#)³ detail their role in the creation, implementation and progress reporting of the Honey Bee Health Strategy outcomes.

Delivery of the Scottish Honey Bee Health Strategy was taken forward using the following 4 key outcomes which had been developed by all those with an interest in honey bees including the Scottish Government, its agencies and delivery bodies, stakeholder associations and more importantly, individual beekeepers:

Outcome 1. Education, Training and Knowledge Transfer: good standards of beekeeping and husbandry will minimise pest and disease risks and contribute to sustaining healthy honey bee populations.

Outcome 2. Communication: effective communication and relationships operating at all levels.

Outcome 3. Surveillance, Diagnosis and Biosecurity: positive surveillance based on vigilance, reporting and diagnosis.

Outcome 4. Research and Development: sound science and evidence underpinning bee health policy, disease prevention and control, and good husbandry.

¹ [The Honey Bee Health Strategy - gov.scot \(www.gov.scot\)](#)

² <https://www.gov.scot/groups/bee-health-improvement-partnership/>

³ [Bee Health Improvement Partnership: terms of reference - gov.scot \(www.gov.scot\)](#)

Purpose of and contributors to the review:

The purpose of this review is to acknowledge and understand the progress made and act on the lessons learned from the previous 10 years of the 1st Honey Bee Health Strategy in Scotland and to enable the continuation of protecting honey bee health in Scotland.

The Strategy expired in June 2020 and it is important to reflect on and appreciate what has been successful, and more importantly, identify the areas which can be improved upon to best support a healthy and sustainable population of honey bees in Scotland in future years.

The review has also given the opportunity to remind ourselves and better understand the importance of how a healthy honey bee population impacts on other areas, for example:

- other pollinators, biodiversity, climate change, plant health and wildlife issues
- the rural economy: bees and honey are a very small sector of the economy but Scottish honey, particularly heather honey, has a world-class reputation and its contribution should be nurtured and championed

Since the start of this journey we have become increasingly aware of both the threats to honey bees that were already present in Scotland (such as Varroa, EFB and AFB) as well as an increased risk of new threats arriving on our shores (such as the Small Hive Beetle and Asian Hornet). All members of the Bee Health Improvement Partnership (BHIP) have acknowledged the importance of this group which has allowed the involvement from interested parties in preparing for, identifying and dealing with such threats. This direct link between Scottish Government officials and stakeholders has proved invaluable in gathering information on the views and needs of the sector when establishing honey bee health policy. It should be noted that equivalent plans for England & Wales and Northern Ireland have also been prepared.

In line with the Strategy's emphasis on partnership working, all members of the BHIP, including Steve Sunderland (as Scotland's first Lead Bee Inspector (LBI) and participant in the creation of the first strategy), were asked to contribute ideas, information and evidence to this review. The responses provide evidence of success and highlight what work has been achieved and continues to be taken forward against the proposed initiatives, activities and proposed outcomes of the original strategy – further information is gathered in the tables below.

The Group as a whole recognise that several of the achievements have been accomplished early on and are now firmly established (for example: the formation of the BHIP, the increase in training and education opportunities and the introduction of the [EFB Control Plan](#)) and these such achievements should be fully appreciated.

Of particular significance during the lifetime of the Strategy it was a great honour for 2 members of the BHIP to be recognised for their services to beekeeping and bee health. The late Mr Ian Craig MBE was the first beekeeper in Scotland to be honoured with the prestigious award in Her Majesty the Queen's New Year's

Honours List in 2013 and Fiona Highet BSc, MBE was honoured in the Queen's Birthday Honours List in 2018.

Through this successful collaborative working since 2009/10, the picture we have now shows how these achievements have positively impacted on the Scottish Bee Health landscape. This is further recognised by the supportive comments from those involved:

- SBA commented that they have found the experience a rewarding process for them and their members especially having forged close links with other organisations in Scotland focusing on honey bees and beekeeping. These links have allowed for an increase in exchange of knowledge and ideas.
- BFA praised the co-operation between all sectors involved (professional and amateur, science and non-science, inspectors and secretariat) and comment that a spirit of valuing differences and respect for the views of others has prevailed and this should be paramount when establishing the new plan.
- SRUC highlighted how the health of honey bee colonies in Scotland has noticeably improved. For example, European foulbrood in affected commercial beekeeper's colonies has reduced to very low bacterial levels when compared to the scene witnessed in 2009. Furthermore, only a small number of cases of American foulbrood have been detected in the colonies of all types of beekeepers. Additionally, there has been improved Varroa management practised by Scottish beekeepers. The education of amateur and commercial beekeepers through outputs of the strategy has helped to achieve a more sustainable and healthy population of bees over the last ten years through a variety of training days, evening talks, phone and email advice all distributed by the BHIP.
- SASA have found partnership working between a wide range of stakeholders, SG policy and scientists under the framework of the honey bee health strategy has greatly improved the understanding of factors affecting sustainable beekeeping in Scotland. Beekeepers have access to better support and training to enable them to maintain the health of their colonies. This partnership has supported Scottish bee science, fostering networks and building lasting connections between beekeepers and scientists, delivering world class scientific outputs from Scotland.
- Steve Sunderland (Scotland's 1st LBI (retired)) took the lead in the establishment of the original plan and has been the driving force over the majority of the first 10 years. Looking over the list of achievements since Ministerial approval of the Strategy, some of which have hit the ground running early on are now firmly established and Steve comments that 'we must not allow ourselves or the officials responsible to ever forget where the sector has come from. An oft repeated mantra throughout this period has been "we are hitting well above our weight"'.
- SG-LBI since 2019, Luis Molero MRCVS, comments that "this review will draw to a close the first Scottish Honey Bee Health Strategy and provide valuable information in the development of the next 10-year plan. Looking back at the

history of the bee health team and bee health in Scotland and what has been achieved in the past 10 years is testimony to the passion and hard work of all those involved. Upon my appointment I found on the BHIP a fantastic group of motivated, open and honest people with a true passion for bee health and beekeeping. I am lucky to have the opportunity to work with such a group of exceptional people and look forward to working together on the creation and implementation of the next 10 year strategy and further improving bee health in Scotland.”

Summary of progress:

The Scottish Government would in particular like to acknowledge and thank all members of the BHIP for their written contributions to this report, their considerable contribution to the achievements of the 1st Honey Bee Health Strategy and for their continued support in developing the areas to focus on for the new 10-year strategy.

The following points highlight the main achievements, successes and progress of each outcome with more specific details relating to the proposed initiatives and activities of Scotland’s 1st Honey Bee Health Strategy attached at ‘the review’ section below.

Outcome 1. Education, Training and Knowledge Transfer: good standards of beekeeping and husbandry will minimise pest and disease risks and contribute to sustaining healthy honey bee populations.

Bringing together closer working relationships between Scotland’s Lead Bee Inspector, SRUC’s Apiculture Specialist, SASA, SG-Bee Inspectors and representatives from the SBA, NDB and BFA has complemented the education of both amateur and commercial beekeepers through outputs of the strategy. This co-ordinated approach has helped to achieve a more sustainable and healthy population of bees over the last ten years, which in turn makes identification and control of pests and diseases more effective. For example:

SRUC’s programme of training.

- The SG continues to fund the apiculture specialist at SRUC who provides comprehensive advisory, training and education programmes for beekeepers throughout Scotland on all aspects of Integrated Pest Management and good husbandry.

SASA

- The SG continues to fund SASA bee health activities. SASA delivers training and education programmes throughout Scotland; assisting with SBA education workshops, bee inspector training, providing local association talks, and working with The Roslin Institute and EBSOC to deliver science workshops for Nat 5 Beekeeping students.

Other initiatives such as:

- SG has provided funding for a variety of training initiatives (e.g. NDB's Train the Trainer)
- BHIP Bee Health Workshops - bringing in experts from the Inspectorate, SRUC, SASA, SBA, NDB and BFA to improve bee health awareness of beekeeping communities across the country.

As a result of these education programmes, and linking in with Outcome 2 through effective communication, beekeepers have become more aware of their essential role in helping to ensure that disease management is under control within their own apiaries as well as keeping up-to-date with good knowledge/best practice of biosecurity, good hygiene measures and their legal obligation to report any suspicion of a notifiable/reportable disease or pest.

Outcome 2. Communication: effective communication and relationships operating at all levels.

Linking in to all the other outcomes, effective communication has proven to be key in the development of all progress, for example:

- There has been a significant improvement in the dialogue with sectors of the beekeeping network in Scotland which has ensured that SG Policy have access to and understand the needs of the beekeeping community. A particular success has been the partnership working through the BHIP which has been essential in the development of the Strategy and is imperative that this collaboration continues.
- SG having regular contact with other Government Administrations such as:
 - having regular meetings to ensure that a coordinated approach can be taken throughout the UK
 - the Bee Health Advisory Forum which is chaired by DEFRA
- SG and its operational partners (SASA and SRUC) also complete a wide variety of talks and presentations where our work is explained to the beekeeping community. SG also has a programme of contributions to beekeeping magazines as well as regular updates through the SG website bee health pages and the use of the National Bee Unit (NBU) web based system, BeeBase.

Outcome 3. Surveillance, Diagnosis and Biosecurity: positive surveillance based on vigilance, reporting and diagnosis.

Prior to the Honey Bee Health Strategy, Scotland did not have an inspection programme and the only surveillance was occasionally for Varroa. Although foulbroods were reportable only one or two reports were received during the year.

In 2009 the Scottish beekeeping community became abruptly aware that a severe outbreak of EFB had been uncovered which was the trigger to the implementation for the Scottish Honey Bee Health Strategy. Since then much has been achieved:

- Scottish Government joined [BeeBase](#) (Animal and Plant Health Agency's (APHA) National Bee Unit website designed for beekeepers and supports Defra, Welsh Government and Scotland's Bee Health Programmes) and continues to annually contribute to its maintenance and upkeep for the benefit of Scottish Beekeepers.
- Improved inspections, surveillance and effective use of BeeBase have provided for a better understanding of the disease distribution throughout Scotland and will aide with future planning of policies.
- Bee Inspector training – continued improvement to training for Bee Inspectors to enable them to deliver a professional and effective service which includes the dissemination of information.
- Improved diagnostics at SASA including new technologies to support inspectors and beekeepers manage both notifiable and non-notifiable pests and diseases.
- Linking in with outcome 1, additional training and education has allowed for the establishment of an [EFB Control Plan](#) authorising commercial beekeepers, after achieving a high level of competency, to conduct their own initial disease inspections. This has allowed commercial bee farming businesses to continue to operate within their historical movement patterns while implementing strict measures to prevent spread of disease from these businesses to other beekeepers in the area.
- Increased vigilance for new pests and diseases through post-import inspections. We have also introduced sentinel apiaries and continue to develop contingency plans for the possible incursion of exotic notifiable pests.
- Having a co-ordinated approach throughout the UK with equivalent plans and good communications is vital in ensuring a successful future for a sustainable and healthy population of honey bees.

• Details of the number of inspections in Scotland since 2009 is as follows

No. of Scottish Inspections and positive results	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total colonies inspected	2263	3150	3501	1463	1723	2302	2784	3936	2298	3767	4117	8401
Total apiaries inspected	254	213	208	253	276	236	228	222	181	208	200	411
AFB+ Colonies	136	11	5	9	5	1	6	30	5	0	10	8
AFB+ apiaries	38	8	3	5	5	1	4	16	2	0	5	5
EFB+ colonies	310	71	127	54	25	53	67	62	90	59	193	180
EFB+ apiaries	69	25	42	34	10	28	25	31	43	37	61	76

Outcome 4. Research and Development: sound science and evidence underpinning bee health policy, disease prevention and control, and good husbandry.

As highlighted with Outcome 3, having a better understanding of a situation will help guide future bee health policy in the Scottish Government and research and development is critical to collecting this information. Work has so far included:

- SG co-funded the Insect Pollinators Initiative, which has delivered many important research outcomes and sparked lasting partnerships between the SG, beekeepers and the Scottish and UK research community.
- A high profile Citizen Science collaborative project between SASA, Dundee University and the SBA which engaged beekeepers from project planning stages to molecular analysis, improving understanding of Scottish honey bee health and changing attitudes to science.
- Continued collaborations between the SBA, SG, SASA and academia have led to cutting edge science with relevance to Scottish beekeeping, including work on Varroa resistance, bee viruses, genetics and microbiome. Scottish beekeepers are considered to be highly engaged with science, and relevant scientific outcomes are put into practice through training events, SASA services and academic outreach.
- SASA have collaborated with FERA and worked independently to deliver research outcomes to underpin bee health, such as developing in-house molecular tools to support EFB outbreak control.

The Honey Bee Health Strategy has and will continue to encourage a range of beekeeping initiatives all leading to a better understanding of bee management.

The Review:

The following information details the 'proposed initiatives & activities' (as detailed in the Overview Section of the 1st Honey Bee Health Strategy), the 'proposed outcomes' (as detailed in Section 3 of the Strategy) and provides examples of how this has been achieved.

Outcome 1: Education, Training and Knowledge Transfer

– good standards of beekeeping and husbandry will minimise pest and disease risks and contribute to sustaining healthy honey bee populations

Proposed initiatives and activities

(i) Continue to promote and access the education and training available through the Scottish Agriculture College (SAC (now SRuC)), the Scottish Beekeepers Association (SBA) and also through local associations, e.g. to raise awareness of disease threats (such as EFB, AFB and Varroa) and how to identify them; best management practices; disease control methods and home-based queen rearing activities

SG Bee Inspectorate:

- The Lead Bee Inspector for Scotland running a programme of talks throughout Scotland for local Associations (approximately 10 per year, reaching on average 30 beekeepers per talk making a total of over 3,000 beekeepers in the past 10 years)
- In partnership with the SG, SRUC, SBA and BFA, numerous Bee Health Awareness days which have been invaluable to give all an opportunity to understand and recognise diseases better. These events involve a day of lectures and practical sessions covering bee health, apiary hygiene, good husbandry, practical and integrated pest control. From 2011-2019, 15 events have been delivered with around 400 beekeepers in attendance overall.

SRUC's apiculture specialist enables a wealth of education and training events to take place, for example:

- 'Beekeeping Beginners' training days, from 2010-2019, 54 training days have been delivered with approx. 450 beekeepers in attendance.
- 'Intermediate Level' beekeeping training days, from 2012-2019, 42 training days have been delivered with approx. 336 beekeepers in attendance.
- 'Varroa Management' training days, from 2010-2016, 30 training days have been delivered with approx. 360 beekeepers in attendance.
- Education Apiary visits at SRUC Auchincruive, from 2010-2019, 15 visits have taken place with approx. 300 beekeepers attending from beekeeping associations across Scotland.
- Evening workshops with talks, lectures and demonstrations to local beekeeping associations throughout Scotland, from 2010-2019 there has been around 18 visits per year reaching approximately 4,500 beekeepers over the duration of the Strategy.

SASA:

- Varroa monitoring and an increase in self-reported cases of foulbrood (from 0-2 per annum to 10 per annum) indicates that training and workshops have led to a rise in awareness of signs/symptoms of diseases and how to report findings in the beekeeping community.
- Delivery of 37 talks to the SBA and affiliated associations and 17 practical workshops for beekeepers (including BHIP bee health workshops and SBA microscopy workshops).
- Delivery of 16 presentations to other stakeholders (vet groups, pest controllers, soft fruit growers, etc.) where feedback has indicated that wider stakeholder groups are keen to help bee health.

SBA:

- Continuation of the SBA modular examination system, with separation of the theoretical and practical streams, allowing greater uptake overall. Focus within the Basic Beekeeping certificate on honey bee health and good husbandry.

BFA:

- In March 2013 SASA hosted the BFA annual conference with attendance from bee farmers throughout the UK and guest speaker Christophe Gautier sharing his knowledge of queen rearing in France.

NDB:

- The NDB delivered the 'Train the Trainers' weekend seminars (part funded by the Scottish Government) with the emphasis on how information and learning are best achieved

(ii) Develop and publish a common set of good husbandry principles, including regular monitoring of colonies and apiary health planning

- Scottish Government continues to contribute to the funding of BeeBase which allows Scottish beekeepers full access to the wealth of available guidance notes and examples of best practices.
- Whilst the first Strategy expired in June 2020 work has continued until a new Strategy is in place. An example of one such activity that has been completed in the interim period is that the Scottish Government has contributed to the funding of the SBA online training program which will form a repository of information for Scottish Beekeepers.

(iii) Improve the education of beekeepers and standards of bee husbandry by co-ordinating and streamlining training programmes, outreach initiatives and examinations

There has been a major shift in taking a co-ordinated approach to improving the education of beekeepers and standard of bee husbandry through areas such as:

- a much improved visible profile of Bee Inspectors and SASA scientists which has developed since 2010.

- the SAC/SRUC programme of training rolled out throughout Scotland as well as apiary-based at Auchincruive. More specialised areas of training were also included, such as:
 - ‘Making a Move into Bee Farming’ training days
 - ‘Knowledge Transfer Event’ in Perth 2018 - a day of free meetings and lectures for 50 Scottish members of the Bee Farmer’s Association and invited guests, organised in partnership with SRUC and BFA
 - Hosting the ‘National Diploma in Beekeeping’ practical exams at SRUC Auchincruive Estate, Ayr, in July 2016 and 2018.
- training tools looking to the future of beekeeping being introduced, for example:
 - sponsorship of ‘Train the trainers’ where training is provided on teaching methods and techniques to beekeepers wishing to train others about beekeeping (around 10 participants per year)
 - sponsorship of the BBKA developed ‘Course in a Case’ and made available to local Beekeeping Associations around the country
 - educating young people on the importance of healthy bees and pollinators – from nursery visits through to collaboration with EBSOC to deliver a series of Royal Society funded science workshops to Nat 5 Beekeeping students.
 - representatives at the International Meeting of Young Beekeepers - an annual meeting of young beekeepers promoting beekeeping and cultural exchange.
 - from 2017, the National Progression Award: Beekeeping SCQF Level 5 being a formally recognised school and college level qualification in Apiculture
- BFA developed and launched a very successful apprenticeship scheme to attract young people into an aging industry
- SBA developed the ‘Healthy ‘BEES’ (Bee Education in Scotland) Project’ covering IPM and adult bee diseases, swarm control, colony handling, nutrition and bee farming.

(iv) Explore the scope for home-based queen rearing through co-ordinated education and training initiatives.

- ‘Queen Rearing’ practical training days were held at the SRUC Education Apiary from 2014-2019 (5 training days were delivered with approx. 40 beekeepers in attendance).
- The SG commissioned a feasibility study (financed through the SG-Contract Research Fund (CRF)):

[Restocking honey bee colonies in Scotland review - gov.scot \(www.gov.scot\)](http://www.gov.scot)

 Since then, several independent groups have focussed on local breeding programmes. This has been from association and individual business level through to the establishment of the SNHBS, all of which should play a part in improving the sustainability and local adaption of Scottish honey bees.

(v) Encourage the exchange of good breeding stock within Scotland

- See information at (iv) above

(vi) Maintain contingency planning for the possible arrival of exotic pests, diseases and undesirable species

- Work is ongoing in relation to finalising and publishing comprehensive generic and pest specific contingency plans
- Taking a coordinated approach throughout the UK allowed for Scottish inspectors to participate in Defra/APHA real-time training exercises on a response to the arrival of Small Hive Beetle and the Asian Hornet (which included being shown how to use bait stations, mark hornets and track them to their nests).

Proposed outcomes

(i) Beekeepers take pride in their craft and are competent in honey bee husbandry, health, best management practices and home based queen rearing activities. As a result, they benefit from healthier bees, earlier detection and better control of pests and diseases in co-operation, as necessary, with the Scottish Government Bee Inspectors.

- Multiple initiatives have been implemented through the Honey Bee Health Strategy which aimed to improve competence, management and understanding of bee health by both commercial and amateur Scottish Beekeepers. The initiatives can be identified through various sections in this document.

(ii) Beekeepers have the skills and knowledge to identify disease in their colonies and know where to seek help in identifying them if required. They know the symptoms of notifiable diseases and understand how to report such diseases.

- Multiple educational activities have been implemented with the purpose of disease recognition, treatment and reporting.
- Scottish Government and its operational partners run specific bee health days where notifiable diseases are studied in depth with live examples of foulbroods.
- The [EFB Control Plan](#) requires signatories to demonstrate competence and pass a certification process on self-inspections, diagnosis and reporting of foulbroods to the lab and inspectorate. This plan has proved extremely positive allowing the bee inspectors to focus on controlling the spread of disease whilst these businesses control their own levels of infection. The number of accredited beekeepers in the EFB control plan has fluctuated between 6 & 10 per year.
- The level of self-reporting of foulbrood cases from non-accredited beekeepers has increased from 0 cases/year to approximately 10/year. More specifically as detailed in sections (i) and (iii) of the proposed initiatives and outcomes section above.

(iii) Beekeepers continue to have access to education and training programmes through their national associations and Scottish Government supported programmes. This allows them to receive practical evidence-based advice to help establish their competence in husbandry and health management and to further develop these skills.

- SG have contributed to greatly improving bee health by providing ongoing training sessions for beekeepers, and the expert services provided by the Bee Inspectors, SASA and the Lead Bee Inspector for Scotland.
- SRUC have provided numerous events (as detailed above) with BFA and SBA members taking a proactive approach in attending, enabling a better understanding and recognition of honey bee pests and diseases. Around 5,000 attendees have joined these various events and have been educated on various subject matters relating to best practice.
- SBA education programme and exam modules continue to allow beekeepers to develop their knowledge and obtain certifications.
- The NDB also forms part of the BHIP and continues to provide an advance curriculum for those seeking the highest level of qualification in beekeeping.

(iv) As members of national or local beekeeping associations or other informal networks, beekeepers recognise the benefits gained from access to further support, training and practical advice from other beekeepers to help them maintain good standards of honey bee husbandry and health.

- There has, and continues to be a steady increase in the number of requests for bee health talks and workshops over the last 10 years.

(v) Honey and other hive products are produced safely. Veterinary medicines and other treatments are used correctly and are recorded to ensure that honey is as far as possible free from residues and that consumer safety and consumer expectations that honey is a pure product are not compromised.

- Information is available for all beekeepers on BeeBase detailing effective procedures for recording medicine use.
- A wide variety of training and educational activities have included the need for adequate and responsible drug usage/recording in beekeeping.
- The inspectorate takes part in the national surveillance program for honey residues.

(vi) Appropriate and effective veterinary medicines, diagnostics and other treatments are available as a result of engagement with treatment manufacturers and regulatory agencies, and are used sustainably.

- This will be kept under review and developed in the new Strategy

Future Planning

Following analysis of the responses received and the evidence provided above the following recommendations / suggestions should be taken into account when establishing the next Honey Bee Health Strategy:

Education and training must remain at the forefront for the 2030 Bee Health Strategy and continue to be one of the key elements of improving bee health in Scotland. For example:

- Ensuring that there are wide ranging education initiatives across the beekeeping sector in Scotland, from private commercial courses, to those carried out by local associations, Scottish Government and operational partners and the Scottish Beekeepers Association.
- Developing the introduction of a new and current programme of events ensuring there is a standardisation and comprehensive approach taken to education and that relevant and effective reviews are completed. This should include:
 - maintaining a high level of understanding of bee health issues among the beekeeping community
 - increase Varroa management information / training – working with the Varroa Working Group to produce a review of Varroacides and adequate Varroa treatments for Scottish beekeeping practices
 - recognising that people learn in different ways and education materials should be tailored for people with different levels of experience and provided in a variety of formats (e.g. bite-sized online training courses, classroom based, hive side training and mentoring)
 - continuing to develop the [EFB Control Plan](#) for commercial beekeepers highlighting the importance of improvements to biosecurity and disease management
 - the development of knowledge transfer events that focus on the key aspects of beekeeping that should be delivered to the commercial beekeeping sector at least once per annum
- Investigating the possibility of increased resources, for example:
 - increasing financial and experienced staffing levels to deliver the outcomes of the strategy effectively
 - looking into the possibility of providing funding for teacher training to facilitate any increased uptake of SQA Nat. 5/6 (which delivers a practical science-based qualification, awareness of nature and understanding of food production)
 - exploring more into the use of technology, for example recent development of online training material and presentations could open relevant approved and trusted training to remote beekeeping communities and those who are not members of associations
 - additional support for the BFA apprenticeship scheme in Scotland
- Continuing to encourage sustainable, locally adapted stocks and explore the possibility of producing a list of certified local queen rearing producers to allow for transparency around origin of stock/trade.

- Ensuring that education and training is available on emerging threats and that beekeepers continue to be aware of their 'responsibilities'.
- The use of currently licensed veterinary medicines under Scottish conditions has recently been highlighted as a concern and the Varroa Working Group, led by the SBA, has been set up to improve advice for Scottish beekeepers. This has been highlighted as one of the areas in need of improvement on the next 10 year strategy and conversations are already taking place with the Food Standards Scotland the food crime unit to tackle possible honey fraud and residues which could have a damaging effect on the beekeeping industry. Another key outcome has been established to produce a review of Varroacides and adequate Varroa treatments for Scottish beekeeping practices and the BFA continues to keep members informed on this subject.

Outcome 2: Communication

- effective communication and relationships operating at all levels.

Proposed initiatives and activities

(i) Review and strengthen communications and liaison arrangements between representative bodies and the Scottish Government – e.g. through annual meetings and regular dialogue with Bee Inspectors

Improved stakeholder relationships has been the run-away success of this Honey Bee Health Strategy and is valued by all. Several outcomes and events have firmly been put in place and now form part of the regular calendar, for example:

- BHIP's main/sub groups meet between 3-4 times per annum (continuing to be demand led)
- Accredited Bee Farmers attend annual training, planning and wash-up meetings
- Royal Highland Show – SBA invite SG/SASA/SRUC to host a stand in the beekeeping tent which allows for communications with the wider general public
- SG have increased and improved links with colleagues in other Government Departments (primarily NBU, Defra, other Devolved Administrations, APHA and VMD) and have regular meetings sharing information. A proactive cross-border approach is actively encouraged towards disease control and prevention as it benefits all. The importance of these relationships has proved invaluable, for example when faced with new potential threats such as following up contacts from the finding of SHB in Italy in 2016 and Asian hornet findings across the UK.
- SASA has developed trusted partnerships with representatives from major stakeholder groups and many individuals.
- Provision of speakers on a regular basis at the invitation of local beekeeping associations around the country (as well as further afield, e.g. Prague, Kiev and Gormanston) allowing sharing and dissemination of information as well as delivering presentations.

(ii) Issue of routine updates and alerts to beekeepers through the Scottish branch of the BFA and the SBA

- SG news is shared regularly through: the BFA magazine ('Bee Farmer' available on subscription to non-members); SBA magazine/website, as well as direct communication to members through Affiliated Beekeeper Association (ABA) secretary alerts; Twitter and Facebook. This is a valued way to share important information with members.
- In addition, information is disseminated via the SG website, press releases, and BeeBase alerts.

(iii) Develop and implement a co-ordinated strategic communication plan between all stakeholders with an interest in honey bees

- All members have commented that this has become well established through the BHIP. Particular appreciation is felt with the sharing of press releases (especially relating to the first AFB find each year).
- BHIP members provide input to SG and UK government policy decision making related to bee health and advise stakeholder groups on relevant issues. Advice

has been used to inform individual business biosecurity measures, SG ministerial correspondence and UK responses to new threats such as the Small Hive Beetle.

- Members of the BHIP are involved in the Pollinator Strategy to represent the interests of honey bees as important pollinators and to consider strategy crossover areas; the pollinator strategy co-ordinator is an invitee to BHIP meetings to ensure reciprocal arrangements are in place.
- a strong network of past and current working partners (e.g. stakeholders, government policy and researchers) continues to be developed in the UK and overseas which strengthens position and knowledge.

Proposed outcomes

(i) All parties to this strategy agree to work openly and communicate with each other proactively.

- Particular reference has been made to the regular, well-run meetings throughout the plan. Excellent relationships have been developed with all parties (SG, Bee Inspectors, SRUC, SASA and both the hobbyist and commercial bee keeping sectors) which has fostered open and honest dialogue between parties and gained invaluable insight on bee health issues and broader issues affecting agriculture and Governance.

(ii) BeeBase will form a central component of communications between stakeholders. Regular dialogue using the most appropriate means is encouraged.

- Beekeepers in Scotland have been able to register on BeeBase since 2010 and continue to be actively encouraged to do so. This provides beekeepers with accurate advice on all aspects of bee health and facilitates official contact in the event of any outbreak.

(iii) The Scottish Government, its agencies/delivery bodies, beekeepers and their Associations will review and share information, best practice, risk assessments and ideas. They will agree and review priorities and responsibilities in partnership.

- This has been well established and will continue to be kept under review

(iv) The Scottish Government will continue to strengthen current liaison arrangements with beekeeping associations and other stakeholders, Government Departments and Agencies such as FERA/NBU and VMD on honey bee health matters.

- This has been well established and will continue to be kept under review

(v) All partners to this strategy will use their available resources to engage effectively with beekeepers including those who are hard-to-reach and new to beekeeping to ensure that they are aware of available sources of advice and training on good practice, disease recognition etc.

- This has been well established and will continue to be kept under review

(vi) **BeeBase:** Lessons learned in the tackling of exotic diseases in animals show that knowing where animals are and where they have come from is critical to disease control and eradication. In the foulbrood outbreaks of 2009 a lack of information on hive locations and movements made the tasks of establishing the extent of the disease and preventing its spread more difficult. Reliable and up-to-date information on the movements also allows the earliest possible lifting of movement restrictions.

- The Scottish Government originally subscribed to BeeBase in March 2010 and continues to provide funding on an annual basis enabling beekeepers to access this service with no charge to them.
- There is a clear protocol established regarding the cascade of information relating to disease outbreaks. Automatic notifications of disease outbreaks are issued to beekeepers in defined areas via BeeBase.

(vii) **BeeBase:** In order to resolve this issue the Scottish Government will support the development of BeeBase to serve the needs of Scottish beekeepers and to enhance our ability to deal effectively with exotic pests and diseases.

- please see details at (vi) above

(viii) **BeeBase:** Stakeholders will ensure that the benefits of signing up to BeeBase for pest and disease control purposes are highlighted in education and training programmes for beekeepers.

- There are now around 2,750 beekeepers (responsible for more than 3,000 apiaries and 17,500 colonies) registered in Scotland in 2021 - to put this figure in perspective in 2009 there were no registered beekeepers in Scotland on BeeBase.

(ix) **BeeBase:** The Scottish Government, its agencies and delivery bodies, beekeeping associations and suppliers will work together to increase the numbers of beekeepers who register on BeeBase in order to enhance communication and disease control.

- please see details at (vii) above

Future Planning

Following analysis of the responses received and the evidence provided above the following recommendations / suggestions should be taken into account when establishing the next Honey Bee Health Strategy:

- BHIP to clearly identify and agree future initiatives/activities, agree priorities and consider who is best equipped to lead each project.
- Work plans, specific goals and milestones for delivery and the establishment of indicators upon which the plan's success can be measured should be established to ensure that progression can be achieved.
- As detailed in Outcome 1, consider how technology can be used to improve our ability to provide information to those not currently receiving it (e.g. those in more remote areas).
- Identify how to reach beekeepers who are not members of any association, involved in association activities or avoid contact with the SG Bee Inspectorate, to establish levels of possible infection and encourage education on good husbandry techniques as well as reminding them of their legal responsibilities.
- Consider how to engage more effectively with a wider stakeholder group (e.g. LINK partnership, SNH, Pollinator Strategy Group) and others who have an interest in bee health such as those dealing with biodiversity, climate change, plant health and wildlife issues.
- Consider the implications of introducing a compulsory registration scheme for beekeepers (e.g. via BeeBase) to allow better engagement with beekeepers and better management and control of pests and diseases.
- Consider if there is a need or a will within industry to better regulation and enforcement, for example, to consider the introduction of Fixed Penalty Notices for those failing to report honey bee health notifiable diseases, breaking standstills orders after detection of disease or intentionally carrying out any other illegal activities which might pose a risk to bee health in Scotland.
- Utilise the SG Bee Health website and BeeBase effectively to ensure that Scottish interests are taken into account and easily identified.
- Developing communications and liaising with VMD, highlighting:
 - the availability of effective medications for honey bees and review how to optimise treatments for use in Scotland, and be most efficient in management techniques (including discussions prior to removing any approved medication and what replacement products will be available).
- Developing communications and liaising with FSS, highlighting:
 - the prevention of possible honey fraud and the safety and integrity of honey as a safe, natural product, free from residues and additives.

Outcome 3: Surveillance, Diagnosis and Biosecurity

– positive surveillance based on vigilance, reporting and diagnosis.

Proposed initiatives and activities

(i) Continue to monitor high risk areas and provide early warning of evidence of new exotic pests and diseases

- Continued close liaison with the NBU and the beekeeping community to ensure risk intelligence.
- The establishment of a network of Sentinel apiaries, set up to monitor high risk areas (such as ports and airports) and provide early warning of evidence of new exotic pests and diseases.
- Bee Inspectors carry out the bulk of Scotland's surveillance work through their programme of inspections. A variety of inspection prioritisation and disease control strategies have also been implemented to cover new exotic pests and diseases. Results are officially published on BeeBase.
- SASA's routine diagnostic services provide additional reassurance of exotic pest freedom throughout the community. The first finding of *Nosema ceranae* in Scotland through routine testing highlights the importance of these efforts.

(ii) Establish a database of Scottish beekeepers

- To enable a joined up approach with other Administrations and as detailed in Outcome 2, the Scottish Government joined BeeBase in March 2010, providing beekeepers with access to the service with no charge to them

(iii) Raise awareness about exotic pests, undesirable alien species and import risks with relevant agencies, beekeepers and with honey importers and packers

- BHIP members regularly participate in a number of events (e.g. Bee Health days, RHS, Gardening Scotland, Asian hornet week, etc.) throughout Scotland raising awareness of non-native pests of honey bees.
- SASA and SBA commissioned a visually impactful Asian Hornet display for use at public events - engaging and raising awareness among non-beekeepers is essential to ensure early detection and eradication.
- Provision of information to beekeepers on how to register on the BeeBase website which gives access to a wealth of information.
- Both the BFA and SBA, through their communication channels, most notably their magazines, websites and social media, have distributed both official notices and best-practice guidelines from the Government to their members.

(iv) Strengthen enforcement of existing regulations, develop and publish clear guidance on best practice for disease control, including the importation of honey bees

- There have been several areas of awareness implemented, for example links to relevant legislation on the SG, SBA and BFA websites with clear guidance also available on BeeBase.

- The implementation of The Bee Keeping (Colonsay and Oronsay) Order 2013, the aim of protecting the population of *Apis mellifera mellifera* (Amm, native black bee) on Colonsay.

(v) Strengthen and raise awareness of existing voluntary arrangements on domestic sale of honey bees

- All parties encourage beekeepers to source their honey bees responsibly. Guidance on nuclei production and standards are available to all beekeepers and updated regularly.
- The BHIP have considered extending accreditation to domestic producers, to ensure that they have adequate training of pests and diseases (specifically foulbrood), biosecurity and records of sales that can be used for trace-back. This could potentially include official inspection of premises and nucs for sale. Scoping exercises indicated that the additional cost of accreditation and inspection would not be supported by the customer, so this is currently on hold.

(vi) Raise awareness of the impact and interaction of honey bees and bumble bees

- A consequence of a sustainable and healthy population of honey bees is the reduced risk of disease spill-over and impact on wild pollinator communities. Therefore all efforts of the Strategy positively impact on this interaction, and the message of 'responsible beekeeping' is regularly shared with beekeepers in talks and events.
- SASA have developed molecular methods and a screening test for specific bumble bee diseases to ensure their capability to measure potential impacts of managed bees on wild communities, and investigate incidents.
- BHIP have representation at Pollinator Strategy meetings with a reciprocal arrangement in place for Pollinator colleagues to attend BHIP meetings

(vii) Review and improve current arrangements and practices in relation to other hazards such as Small Hive Beetle (SHB)

- Monitoring for invasive species has been carried out using a blend of targeted (import) inspections, non-targeted (surveillance) inspections, passive surveillance (colony loss investigations) and active (sentinel apiary) surveillance. A programme for inspections of imports and follow-on checks has been established.
- LBI and SASA attended the British-Irish Council (BIC) Asian Hornet workshop held in Jersey in 2018. This allowed excellent contacts with NNSS, DEFRA, and APHA to be developed as well as invaluable hands-on staff training on understanding the biology of the pest. A follow up visit by the LBI and SG Bee Inspectorate (BI) team in 2019 provided further training on identification and tracking of the pest.
- SG BI teams are invited and actively take part in SHB contingency exercises with colleagues in England and Wales. SASA and SG policy teams also take active roles in generic plant and animal contingency exercises.
- The SG have been members of Coloss since 2010 and SASA are members of the Coloss Small Hive Beetle taskforce with key contacts across UK, Europe and

US/Canada, allowing early awareness of new outbreaks and scientific developments in this area.

- SASA staff provided input into the EU Reference Lab key for *Tropilaelaps* spp.

(viii) Ensure suitable diagnostic systems are available to beekeepers, associations and Government and that arrangements are in place for sample submission and reporting of results

- SASA staff are fully trained in the identification of notifiable and non-notifiable pests and diseases; diagnostics and reporting are accredited to ISO9001 quality assurance standards and all diagnostics are free to beekeepers. Guidance on services provided and how to submit a sample are available on SASA's website. Resources are limited so triaging through association experts and SRUC is recommended, however, feedback indicates that beekeepers are content with the service and turnaround times.
- SASA's wildlife investigation team also investigate potential bee poisoning incidents; analyses are accredited to ISO17025, and feed into the HSE Wildlife Incident Investigation Scheme (WIIS) to help ensure that pest control products are used correctly, and unexpected safety issues are identified rapidly.
- SASA continue to provide support as well as developing diagnostic services so that it is routinely available as well as the profile of SASA being raised.

(ix) Develop strategies for controlling foulbrood diseases to reduce incidences to the lowest achievable level

Government and stakeholder co-operation has been key to:

- The establishment of the EFB control plan in 2011 establishing an accreditation scheme (covering disease identification, biosecurity, record keeping and movement control) for the most affected commercial beekeepers to mitigate the risk of transmission to other colonies. The support of partners from both the SBA and BFA is critical to the success of this plan.
- Sampling and inspection rates are evidence based using statistical models supplied by BioSS. Clear protocols established for the cascade of information relating to disease outbreaks, e.g. the automatic notifications of disease outbreaks to beekeepers in defined areas via BeeBase.

Proposed outcomes

(i) Beekeepers will be proficient in monitoring the health and welfare of their own hives, they will know the procedures for reporting notifiable diseases and what action to take to control other diseases or conditions.

- All members of the BHIP have been involved in training and education to raise awareness across the beekeeping community of the signs/symptoms of diseases and how to report.
- Through training and education by all members of the BHIP, websites regularly being updated to inform beekeepers on the range of diagnoses available, how to report and how to submit samples. These services are currently available to all beekeepers.

- The health of honey bee colonies in Scotland has noticeably improved. For example:
 - EFB in affected commercial beekeeper's colonies has reduced to very low bacterial levels when compared to those witnessed in 2009.
 - Only a small number of cases of American foulbrood have been detected in the colonies of all types of beekeepers.
 - much improved Varroa management practised by Scottish beekeepers.
- Following the identification of a new pathogen in Scottish bees (*Nosema ceranae*, 2010) SASA, SBA and Dundee University worked collaboratively to assess the prevalence of this pathogen. Beekeepers were involved in all parts of the analysis, from colony sampling and microscopy to PCR analysis. As a result Scottish beekeepers developed a good understanding of this new problem and continue to engage positively with bee health related science.

(ii) Inspectors supported by the Scottish Government will carry out inspections where notifiable diseases are suspected.

- This has been well established and will continue to be kept under review

(iii) Stakeholders and Scottish Government will strengthen compliance with and enforcement of existing regulations on disease control (including the importation of honey bees and bumblebees) by developing clear guidance and best practice procedures to minimise disease risk.

- Whilst there has already been a marked improvement work will continue to improve compliance with legislation, especially in high-risk areas such as unlicensed imports, notifiable diseases, use of veterinary medicines and food production.

(iv) Stakeholders will ensure that the domestic sale and trade of honey bees, honey and other bee products present a minimal risk spreading pests and diseases.

- Beekeepers are advised that they should thoroughly inspect any colonies prior to sale (twice if possible) and avoid any apiaries that have a history of disease.

(v) Honey importers and packers will ensure that their packing plants present a minimal risk of spreading pests and diseases to local honey bee apiaries.

- To be developed in future strategy.

(vi) BeeBase will provide essential information about the location and numbers of colonies for the purposes of risk assessment, and for prevention and control of serious endemic and exotic pests and diseases. As a result, beekeepers, particularly those who are not members of an association, are encouraged to register on the database.

BeeBase holds a wealth of information and has proved invaluable in notifying beekeepers of disease outbreaks etc. As detailed in the proposed outcomes Section at Outcome 2 above, work will continue to engage with beekeepers who are not members of any association to make them aware of their responsibilities.

Future Planning

Following analysis of the responses received and the evidence provided above the following recommendations / suggestions should be taken into account when establishing the next Honey Bee Health Strategy:

- **Surveillance:** understand what further investigation/information is required in relation to notifiable pests and diseases:
 - Roll out an Annual Surveillance programme with more emphasis on the beekeepers completing self-inspections and posting of samples. This would complement the work of the official inspectorate and would ensure that Scotland does not lose the opportunity to reliably deliver the real health state of bees and beekeeping.
 - Investigate what relevant resources (e.g. staffing and finance) are available and what additions would be required e.g. for surveillance programmes, sentinel apiary activities etc.
 - To ensure that SG has a well-resourced and trained bee inspectorate which is able to deliver an efficient programme of surveillance and education across Scotland.
 - To work in partnership with the BHIP to establish the most effective surveillance programme agreeing on delivery priorities for the SG bee inspectorate.
 - Import inspections, surveillance and sentinel apiaries are important for biosecurity, improving the success of eradication efforts if a new pest is detected.

- **Diagnosis:**
 - Establish whether there are more effective ways to tackle relevant issues around policy/stakeholders buying-in to consider and implement potential new methods.
 - Investigate what more can be done to encourage livestock keepers in identifying signs and responsibly controlling pests and diseases
 - Whilst education, beekeeper engagement and the EFB strategy have observably improved the levels of infection of foulbroods in Scotland, the annual number of apiaries and beekeepers affected by EFB remains stable. In order to further control this pathogen new strategies, backed by robust science and statistical modelling, may be required. The use of new technologies could also be considered to improve outcomes, target inspection resources and/or reduce EFB levels in affected businesses.

- **Biosecurity:**
 - Varroa Management - as this continues to be a major issue for bee health in Scotland beekeepers must learn how to manage Varroa successfully as doing nothing will be extremely detrimental. For example, the production of additional guidance on effective Varroa control, e.g. what treatments are most suitable for using in Scotland and advice on timings for these treatments.
 - Review and exercise contingency planning procedures for new and emerging threats such as the Asian Hornet or Small Hive Beetle ensuring that a coordinated approach is taken with other Government departments and that additional resources are available if required.

- Through further education, honey importers and packers will be encouraged to ensure that their packing plants present a minimal risk of spreading pests and diseases to local honey bee apiaries by compartmentalising their production systems to keep apiary equipment separate and clean.
- **Other:**
 - In liaison with the hobbyist and commercial sector, continue collecting information and developing ways of working to enable a proactive and positive response to both current and future bee health threats and emergencies.
 - Continuation of improving compliance with legislation, especially in high-risk areas such as unlicensed imports, notifiable diseases, use of veterinary medicines, and food production.
 - Investigate whether husbandry, genetics and stress (disease, environment) could be managed to reduce disease burdens in affected colonies and gather evidence to establish whether EFB may now be endemic in some parts of Scotland.

Outcome 4: Research and Development

– sound science and evidence underpinning bee health policy, disease prevention and control, and good husbandry.

Proposed initiatives and activities

(i) Ensure the contingency plan for exotic bee pests and diseases is regularly maintained

- Generic bee health and specific Asian Hornet contingency plans are updated / kept under review to deal with new and emerging pests and diseases.
- As detailed at Outcome 3(vii), the LBI has been invited to attend the BIC (British Irish Council) Asian Hornet Taskforce to ensure consistency across the UK
- SASA is a member of DEFRA's contingency plan working group also increasing their expertise in this area.

(ii) Improve co-ordination and collaboration of research with other research funding bodies

Starting from a very small group, Scotland has greatly increased its standing as a research base for bee health. There has been a significant increase in dialogue between academics, research institutes, the SBAs, SRUC and SG/SASA over the duration of the Strategy. This has included:

- The SG, in partnership with the Scottish Beekeepers Association, signing up to COLOSS (Colony Loss Survey) and establishing on an annual basis, a robust database of understanding of the true extent of honey bee losses. This will enable the development and dissemination of emergency measures and sustainable management strategies to prevent large scale losses. Scottish submissions to the annual survey of European colony losses are coordinated by SBA (around 300 participants annually).
- COLOSS CSI Pollen Project (2014-2016) – a Europe-wide survey with pollen sampling by SBA volunteers across Scotland, examining pollen diversity and nutrition (around 50 participants). Further analysis of Scottish samples was carried out through a collaboration between SBA/University of Strathclyde/SASA, providing useful insight into important forage plants in Scotland.
- Feral Colony Monitoring - monitoring of potential feral colonies across Scotland by SBA volunteer members (around 20 participants annually).
- Apiaries being established at vet schools and universities, and animal research integrated into bee health education.
- Establishment of British Bee Veterinary Association (BBVA) which includes workshops being developed between beekeepers / academics
- Establishment of the Scottish Native Honey Bee Society (SNHBS) which includes breeding programmes, sharing of expertise and scientific input from academics at The Roslin Institute.
- Varroa PhD Funding (University of Aberdeen, 2014-18) - SG part-funding of a PhD investigating methods of feeding and maintaining Varroa mites in laboratory conditions without the use of bee larvae. The bee lab at Aberdeen continues to provide important research outcomes to support bee health, and recently embarked on a new PhD studentship (EastBio funded, SASA co-supervising)

investigating how pesticides are used in urban and suburban areas and exploring their effect on honeybees.

- Following the discovery of *Nosema ceranae* in Scotland, SASA and SBA collaborated with University of Dundee (one of the IPI fund recipients) to conduct an investigation into bee health (BBSRC Sparking Impact fund). Beekeepers sampled colonies from across Scotland to survey for *N. ceranae*, *N. apis* and Deformed Wing Virus (DWV).
- Another IPI research team (University of St Andrews and Warwick) developed a close partnership with SASA, SRUC and local ABA's, analysing the spread of DWV with the introduction of *Varroa* to a new area, and assessing the impact of co-ordinated *Varroa* control to DWV and colony loss (including an EastBio funded, SASA co-supervising PhD).
- Scientists at The Roslin Institute continues a long term partnership with SASA and SBA, leading to high impact research outputs including characterisation of the British honey bee metagenome and Scottish input into a genotyping platform for assessing the provenance of bees. Whilst the research is high level, researchers have a keen interest in ensuring outputs are applied, including the development of new genetic services available for all beekeepers.
- Several other academic/beekeeper association partnerships have developed in Scotland, including studies into the antimicrobial qualities of honey and propolis.
- SASA also works closely with researchers at NBU (FERA), Newcastle University, Rothamsted Research and other institutes to ensure that new technology available is used to benefit Scottish beekeepers, such as resistance testing of *Varroa* mites and the development of Foulbrood strain typing to assist disease control.
- Feasibility study financed through Contract Research Fund (CRF): "Review into Options for Restocking Honey Bee Colonies in Scotland".

(iii) Commission science and evidence appropriately to support policy development

- SG has contributed £500k to the £10m Insect Pollinator Initiative (IPI) research into the causes and consequences of insect pollinator decline and to inform efforts to do something about it. The following nine projects were funded:
 - i. Sustainable pollination services for UK crops (*Dr Koos Biesmeijer, University of Leeds*)
 - ii. Modelling systems for managing bee disease: the epidemiology of European foulbrood (*Dr Giles Budge, FERA*)
 - iii. Investigating the impact of habitat structure on queen and worker bumblebees in the field (*Dr Claire Carvell, NERC Centre for Ecology and Hydrology*)
 - iv. An investigation into the synergistic impact of sub lethal exposure to industrial chemicals on the learning capacity and performance of bees (*Dr Chris Connolly, University of Dundee*)
 - v. Linking agriculture and land use change to pollinator populations (*Professor Bill Kunin, University of Leeds*)
 - vi. Urban pollinators: their ecology and conservation (*Professor Jane Memmott, University of Bristol*)
 - vii. Impact and mitigation of emergent diseases on major UK insect pollinators (*Dr Robert Paxton, Queen's University of Belfast*)

- viii. Unravelling the impact of the mite *Varroa destructor* on the interaction between the honeybee and its viruses (*Dr Eugene Ryabov, The University of Warwick*)
- ix. Can bees meet their nutritional needs in the current UK landscape? (*Dr Geraldine Wright, Newcastle University*)

- BHIP members have contributed to the development of the Scottish Pollinator Strategy and are now integral members of the group.
- SASA have worked to develop new and improved tools to support EFB control programmes, such as sub-clinical testing of asymptomatic colonies.

(iv) Ensure that research priorities, scientific developments and evidence are shared widely with the science community and beekeepers

- Government funded research is published in open access journals to ensure availability to all, and a list of links to recent publications is available on SASA's website and other institutes. Outputs are shared with the scientific community through these outputs and conference attendance. Additionally and importantly, research outputs are shared with beekeeping community through ABA 'winter talks', SBA magazine and blogs. Research priorities, developments and outcomes are discussed at BHIP meetings.

Proposed outcomes

(i) Stakeholders will have a well-developed awareness and knowledge of the science and evidence base relating to bee health and husbandry, disease risks and control strategies.

- Starting from a very small scale, Scotland has greatly increased its standing as a research base for bee health, for example: SASA and SBA have collaborated with many researchers, fostering networks and building lasting connections between beekeepers and scientists.
- Scottish beekeepers are widely regarded in international scientific circles as a highly engaged group to work with.

(ii) Research results relevant to proactive honey bee health management and husbandry as well as pest and disease risks, prevention and control methods are shared routinely between beekeepers and the science community.

- Research outputs have been shared through association talks, workshops and inspector/farmer training, as well as RHS, SBA magazine, Pollinator blog, Varroa mapping exercise.

(iii) Appropriate science and evidence will be used fully in the formulation of policy, in training programmes and in development of best practices.

- Information has already been used in the developments of SG policy such as the Honey bee health survey and Strategy as well as relevant research being supported through co-supervision of PhD students and collaborative projects.
- Training and guidance is available to researchers interested in bee health related issues, to ensure their outcomes are relevant to Scottish beekeeping e.g. training

on extraction and identification of acarine mites to support academics at University of Aberdeen / co-supervision of PhD students by SASA and SRUC, providing links with beekeepers, practical advice and insight into how research can be used to advise beekeepers and policy.

(iv) Stakeholders participate in multi-funder programmes such as the Insect Pollinators Initiative and further research will be commissioned as appropriate, drawing on all potential sources of funding.

- Scottish beekeepers were directly involved in an IPI project and further BBSRC funded sparking impact project to ensure that outcomes of a recent finding of *Nosema ceranae* in Scottish bees was suitably investigated, disseminated, and beekeepers given the tools to investigate potential cases themselves.
- The Easter Bush Outreach Centre (EBSOC) has been used as a hub for further 'citizen science' work in this area, with Roslin Institute scientists leading small groups of beekeepers to investigate bee health using various funding sources and SASA/SBA support.
- Further research at Scottish universities have drawn on EastBio PhD studentships to support bee health science, and SBA/SASA support and involvement have been instrumental to gaining funding for these projects.
- The long-term impact of the IPI funded programme within Scottish bee health has been significant, for example:
 - Long-standing relationships between beekeepers, academics and institutes
 - Several citizen scientist beekeepers have sought further education and are now directly involved in training other beekeepers
 - A shift in attitude within beekeeping communities, with improved levels of trust and engagement with science
 - A social enterprise providing genetic analysis of bees for beekeepers to use

(v) Stakeholders have the opportunity to influence priorities and new developments in bee health such as development of new diagnostics and management tools for bee health threats.

- BHIP provides a sounding board for new ideas from all partners into potential research priorities. These are fed into the research community through SBA, SASA and SRUC and leading to work such as:
 - investigating nectar availability in Oil Seed Rape (OSR) (SRUC)
 - EFB subclinical testing (SASA)
 - co-ordinated Varroa control (University of St Andrews)

Future Planning

Following analysis of the responses received and the evidence provided above the following recommendations / suggestions should be taken into account when establishing the next Honey Bee Health Strategy:

- Research and Development links in with all the other Outcomes and provides information in relation to future policy making.
 - Utilising technology to improve notifiable disease control, general bee health and sustainability of Scottish beekeeping.
 - To enable further investigation in areas such as noseosis and whether EFB is endemic in Scotland
 - Exploring new diagnosis methods for the early detection of EFB, for example, at subclinical level.
- Better awareness of what information is available, investigate what evidence gaps there currently are and how they can be addressed. This will help guide future policies being taken forward.
- A Scottish bee health stakeholder conference to showcase the excellent work going on in Scotland to disseminate research to beekeepers and share ideas for new collaborations.
- Establish an area (e.g. on the SG Bee Health / SASA website) which can be referred to in order to keep stakeholders and other interested parties well informed.
- Maintain and improve stakeholder/scientist links to minimise participant fatigue and ensure outputs are relevant and easily accessed by Scottish beekeepers
- Better understanding of disease treatment methods which support disease control policies in Scotland.

The future – the next 10 years:

The next 10-year plan must build on the lessons learned from the first Strategy (which contributed to the Strategic Objectives at that time: 'Wealthier & Fairer' and 'Greener') and contribute to the Scottish Government's overarching [National Performance Framework](#) and its National Outcomes, particularly:

- **Environment** - We value, enjoy, protect and enhance our environment
- **Fair Work and Business** - We have thriving and innovative businesses, with quality jobs and fair work for everyone
- **Health** - We are healthy and active

Given the evidence detailed in the above summary, it is clear that the main outcomes of the 1st Strategy are just as relevant today as they have ever been. Initial work has commenced on the production of the new Strategy and we plan to consult with the Scottish beekeeping community with the aim of providing an understanding of what the important issues are which will enable us to determine the direction of the new Strategy over the next 10 years.

This of course cannot be done in isolation and will rely on all Scotland's beekeepers and other interested parties being aware of their own responsibilities to help ensure that the underlying principle that prevention is better than cure continues.

Moving forward, using the original 4 pillars as a guide and having the continued co-operation of the Bee Health Improvement Programme, work can continue in order to promote a sustainable and healthy population of honey bees in Scotland.

We see the 2nd Strategy as continuing to be a living document, being a useful tool in guiding our direction over the next 10 years. Further information will be published on the Scottish Government website in due course and we look forward to progressing this work together.

**SG: Honey Bee Health Team
September 2021**



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