



**Report on current policies and entry points relevant to
PoshBee outputs and planned briefs
Deliverable 10.8**

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PoshBee

**Pan-European assessment, monitoring, and mitigation
of stressors on the health of bees**



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Summary

This report explains the approach to developing policy briefs for PoshBee's expected outputs. It provides an overview of the main European, global and national policy areas, and likely future developments, and goes on to identify the main decision makers and potential entry points for policy briefs. Our overall strategy is to develop high quality policy briefings capturing three broad areas of the PoshBee expected outputs: Policy briefing 1: Effects of multiple stressors; Policy briefing 2: New protocols and tools; and Policy briefing 3: Mitigation of multiple stressors. Briefings will include high level key findings and recommendations with links to the primary underpinning evidence supporting these. The briefings will be written to be accessible to a wide range of international, national and local policy and decision makers. They will initially be drafted in English, however, we plan to use these to engage with national policy makers and so we will encourage PoshBee partners to translate them in to national languages wherever possible. Finally, we plan an early online briefing as a key policy entry point now precedes the delivery date of relevant PoshBee Deliverables (primarily due to Covid-related delays), and therefore we will use this as an opportunity to make decision makers aware of future PoshBee outputs and briefings.

1. Introduction and context

PoshBee expected outcomes are highly relevant to multiple policy areas, and these include:

- Risk assessments: European Food Safety Authority (EFSA)
- Agriculture: Common Agricultural Policy (CAP) and Sustainable Use of Pesticides Directive (SUPD)
- Biodiversity: EU Biodiversity Strategy to 2030
- EU Pollinators Initiative (EPI)
- Non-EU national policies
- Global policies: Convention on Biological Diversity (CBD), Food and Agriculture Organisation (FAO), Promote Pollinators, and the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES)

While there are several relevant policies areas, there is also a degree of mirroring. For instance, while commitments towards pollinators are made in the EU Biodiversity Strategy and EPI, the major work is being conducted in the context of the CAP. Some of these areas are also in active development at the time of writing this report, with new instruments expected in the near future (e.g. Common Agricultural Policy and EU Biodiversity Strategy), and major reviews are underway (e.g. update of the EFSA Guidance Documents for bees). Given this dynamic background we have proposed a series of policy briefs and engagement activities based on current knowledge of the policy areas, and their expected development. However, an active vigil will be maintained to ensure emerging opportunities are quickly identified and where possible PoshBee outputs targeted towards these.

2. PoshBee expected outputs

Taking a high level view across the whole PoshBee project, expected outputs can be summarised under five broad headings (Table 1). The key Deliverables, Tasks and responsible beneficiaries, underpinning these broad outputs are summarised in Appendix A.

Table 1. Summary of the main expected outputs from PoshBee.

Output Type	Specific outputs
Knowledge	Chronic and sub-lethal effects of chemicals and combinations
	Effects of chemical x pathogen and chemical x nutrition
	Field level effects of stressors
Protocols for bee regulatory testing schemes	Testing chemicals on life-stages and castes/sexes of model species
	Ground nesting model for solitary bees
	Chemical x pathogen and chemical x nutrition interactions
	Field testing
Proteomics tools for health monitoring	'Health card' for bees to monitor stressors and impacts
	Proteomics database for wider use
Air sensor tool	Measuring atmospheric agrochemicals exposure inside and outside hives
Toolkits	Multi-media knowledge exchange to enhance tool uptake and use

3. Approach to identifying opportunities for PoshBee outputs to engage with policy

The PoshBee stakeholder mapping exercise (Deliverable 10.1 Report on the knowledge exchange and impact strategy for PoshBee) has provided a clear understanding of the main policy areas, Directorates-General (DGs) and national authorities relevant to PoshBee outputs. This, combined with an ongoing dialogue with policy experts in the Commission, has helped us assess the current policy areas and likely future directions, identify concrete and potential future entry points, and topics deemed to be of high policy importance. Colleagues from EFSA, DG SANTE, DG AGRI, DG ENV and EPI have been invaluable in providing guidance for this process, and PoshBee will maintain an active dialogue with these individuals as our policy engagement activities progress. In addition, we have engaged with experts from IPBES, FAO and CBD to assess global policy opportunities and with PoshBee beneficiaries to address policies in European countries outside the EU (namely Switzerland and UK).

For each broad topic area (Pesticides and risk assessment, Agriculture, Biodiversity, EPI, Non-EU national, and global) we provide:

- i. A brief description of the current situation and likely future directions/changes;
- ii. A summary of the most relevant PoshBee deliverable and their proposed delivery dates;
- iii. Policy briefing topics, bringing together several PoshBee outputs, and the proposed timing and mode of delivery.

It is important to note that several PoshBee Deliverable dates have been postponed due to Covid and there are potentially further delays. Therefore we have used the current anticipated Deliverable timeline available (August 2020), and based our engagement plans around this. However, timelines and synchrony with policy entry points may still change. We will therefore monitor both PoshBee timelines and the changing policy environment to ensure adaptive responses to our policy engagement activities.

4. Pesticides and risk assessment

4.1 Current position and future directions

EFSA is currently revising the Guidance Documents for bees, which was published in 2013 (EFSA 2013), in response to a request from the European Commission, reflecting that a number of Member States asked for sections of the document to be updated. Substantial new evidence has become available since the original guidance was published in 2013. The EC asked that the review should focus on: evidence on bee background mortality, taking account of realistic beekeeping management and natural background mortality; exposure routes, particularly through spray application and seed treatment or granular application; the list of bee-attractive crops; and the methodology with regard to higher tier testing. The guidance is expected to be finalised in 2021.

As part of this process, EFSA recently completed a comprehensive analysis of the available scientific evidence on bee mortality, as part of its ongoing review of the guidance for assessing risks to bees from pesticides (EFSA 2020a,b). The report was based on large systematic collection of evidence on mortality rates of three bee groups: honey bees, bumble bees and solitary bees. A crucial component of the guidance review was to establish reliable figures on bee mortality rates. The report aims to strengthen existing knowledge by adopting a more systematic approach than used previously, and widening the scope of the analysis beyond the mortality of forager bees. The main sources of information were a systematic literature review and a survey of beekeepers from several EU countries. Following consultations and workshops involving risk managers from Member States and the Commission, EFSA's working group has also proposed four possible approaches to defining the specific protection goals (SPGs) that will be used in the guidance review. Risk managers will now decide which approach EFSA should use (i.e. specify what needs to be protected and to what extent); this will be guided by an assessment of scientific methods, as well as the advantages and limitations, associated with each approach (EFSA 2020c).

An indicative time plan for the revision process, consultations steps, and finalisation of the Guidance Documents includes a public consultation which is planned for October to November 2020; this will be followed by a workshop in December 2020, with final revision and publication planned for March 2021 (EFSA 2020a). Further revisions and updates may take place beyond this date.

4.2 Relevant PoshBee outputs

Based on dialogues with EFSA and DG SANTE, the following PoshBee outputs and Deliverables, were identified as of high relevancy and are presented under the broad output types of Table 1.

4.2.1 PoshBee outputs relating to improved knowledge: The chronic and sub-lethal effects of chemicals and combinations on honey bees, bumble bees and solitary bees (D3.1, 3.4 and 4.1) are all

due by March 2021 and D3.3 by August 2021. In the context of the bee Guidance Document review, EFSA is collecting laboratory toxicity data from published results for: (i) deriving dose-response curve information; (ii) deriving factors for between species toxicity endpoint (sensitivity). This sub-project is planned to be executed in September 2020. Sub-lethal effects on honey bee colonies will also be considered by MUST-B¹, and the agent-based model ApisRAM² should be finalised by mid-2021, with three suggested endpoints (queen reproductive performance, development of HPG, homing ability). The effects of multiple stressors (i.e. chemical x pathogen and chemical x nutrition, Deliverables 4.2, 5.1, 5.2, 6.1-6.4) will be completed between August 2021 and September 2022. Synthesis of multiple stressor exposure (D10.3) and impacts (D10.4) will consolidate knowledge from the above PoshBee Deliverables by January 2023. Deliverables for semi-field and field level effects of stressors (D7.1-7.3) are currently scheduled for delivery in August 2022, February 2022 and May 2023 respectively. In the context of the bee GD review, EFSA is revising the requirements for field studies with consideration of: (i) the identification of the key endpoints (for regulatory needs), and (ii) an analysis of the methods of measurement of these endpoints. The sub-project is running during summer and autumn 2020.

4.2.2 Improved protocols for bee regulatory testing schemes: PoshBee protocols for semi-field (D7.1, 7.2, due August and February 2022) and field testing (D7.3, due May 2023) of multiple stressors are relevant in the context of the EFSA bee Guidance Documents review, though they will not be available during the review period which is due to end March 2021. EFSA is revising the requirements for field studies, in particular: (i) study design and statistical robustness, (ii) identification of the key endpoints (for regulatory needs), and (iii), an analysis of the methods of measurement of those endpoints. The sub-project will run during summer and autumn 2020. In the longer-term, protocols for testing chemicals on life-stages and castes/sexes of model species (D3.2, due March 2021), protocols for testing ground nesting solitary bees (D4.2, due September 2022), and protocols for chemical x pathogen/nutrition effects (D4.2, 5.1, 5.2, due August 2022, and D6.1-6.4 due November 2021) could be recommended/used by EFSA in a regulatory context. More broadly, DG SANTE is interested in PoshBee work on developing or improving test protocols for bees, and highlight these will need to be internationally endorsed (e.g. at OECD level) to be considered for use in the risk assessment for pesticides. DG SANTE will follow-up more closely as new developments emerge in this area, and asked to be kept informed.

4.2.3 Improved and new models: PoshBee will develop holistic and agent based models of bee health (D8.1 due August 2021, 8.2 due August 2022, and 8.3 due October 2021), culminating in a risk assessment tool for EFSA (D8.4 due May 2023). EFSA are currently developing the agent-based ApisRAM (for honey bees) to look at multiple stressors (including multiple chemicals), and a key aspect is access to good data to calibrate the model (and validate it in different EU regions having different landscapes).

4.2.4 Novel proteomics tools for monitoring bee health: PoshBee is developing and testing a 'Health card' for bees to monitor stressors and impacts which will be available through Deliverables 10.5 (January 2023) and D9.15 (May 2023). In addition, a proteomics database for wider use will be available in May 2023 (D9.10). EFSA has developed a HEALTH-B³ toolbox (with indicators) to assess

¹ <https://www.efsa.europa.eu/en/topics/topic/bee-health>

² <https://www.anses.fr/fr/content/overview-honey-bee-colony-model-apisram-model-integrating-multiple-stressor-effects-bees>

³ <https://www.efsa.europa.eu/en/efsajournal/pub/4578>

health status of honey bees. This can be used by beekeepers and scientists (depending on the methods/indicators), and the B-GOOD⁴ project is assessing ways to filter down the list of indicators to identify the most important. EFSA highlighted links between PoshBee and B-GOOD would be useful. More widely, EFSA recognise that the Health Card or other proteomics methods can potentially allow the assessment of bee health status in a harmonised and interoperable manner that would be extremely useful for the future monitoring of bees in their natural environment.

4.2.5 Air sensor tool: PoshBee will develop and test new technology to measure environmental contamination (D2.6 anticipated to be due January 2023). While measuring atmospheric agrochemicals exposure in/outside hives is in the context of the EFSA bee Guidance Document review, the exposure route via air will not be addressed. However, as a long-term opportunity, such tool and the results/experience could be the basis to develop risk assessment schemes for such exposure route. EFSA, via MUST-B, are finalising a scientific opinion on the development of a systems-based approach based on both modelling and monitoring which will go to public consultation in spring 2021. This approach may include sentinel hives equipped with digital sensors (to promote standardised/interoperable data collection) and the PoshBee air sensor tool could potentially be a useful addition if ready.

4.3 Proposed engagement

A number of opportunities to engage with EFSA have been identified, however, the delay (due to Covid) of some relevant PoshBee Deliverables means entry points may be missed. Therefore we propose a mixed approach of (i) policy briefs based on Deliverables once published, and (ii) these preceded by short verbal briefings of key EFSA and DG SANTE staff on the current status, and likely outcomes, of these Deliverables.

Target	Timing	Topic	Engagement	PoshBee Deliverables
EFSA Guidance Document Review	Nov 2020	Chronic and sub-lethal effects of chemicals and combinations.	Initial briefing of EFSA staff by WP3 lead(s) via online meeting	3.1, 3.3, 3.4, 4.1
EFSA ongoing activities, DG SANTE, DG AGRI, DG ENV, national government authorities	Jan 2023	Effects of multiple stressors on bees; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 1: Effects of multiple stressors. open access pdf widely disseminated (WP11)	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4
EFSA ongoing activities, DG SANTE, national government authorities	May 2023	New protocols and tools for bee regulatory testing schemes; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 2: New protocols and tools. open access pdf widely disseminated (WP11)	2.6, 3.2, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.3, 8.4, 9.1, 9.10, 9.14, 9.15, 10.5

⁴ www.b-good-project.eu

5. Agriculture

5.1 Current position and future directions

Common Agricultural Policy. The EU's Common Agricultural Policy (CAP) is a partnership between agriculture and society, and between Europe and its farmers. The current policy (2014-2020) is soon to be replaced by the CAP Strategic Plans 2021-2027 (COM (2018) 392). The current CAP had a strong focus on food production, rural community development and environmentally sustainable farming, however, regarding wild pollinators, the European Court of Auditors concluded "As far as the CAP is concerned, the auditors consider that it is part of the problem, not part of the solution. The greening and cross-compliance requirements under the CAP have not been effective in halting the decline of biodiversity on farmland" (ECA 2020a,b). The proposals for the new CAP for the 2021-27 period (COM (2018) 392) indicate a key priority of the reform is to enhance environmental ambitions in order to make a greater contribution towards key EU environmental objectives (Bas-Defosse and Meredith 2019). Member States are required to prepare plans setting out the types of interventions to address these needs and priorities and contribute to the CAP's general and specific objectives. The effects of stressors on pollinators, and potential ways to mitigate these, may be important for the design and implementation of CAP measures related to pollinators (e.g. eco-schemes, Agri-environment-climate Measures, and possibly the implementation of some Good Agricultural and Environmental Conditions); this relates directly to Action 5 of the EPI (see below). Further, within the framework of the post 2020 CAP, the transfer of National Apiculture Programmes is currently in the process of being organised into the new system of CAP-Strategic plans of the Member States. While EU and Member State plans are in active development, they will almost certainly offer opportunities for PoshBee outputs to inform them; and the project will maintain its active dialogues with DG AGRI and others to identify these.

Sustainable Use of Pesticides Directive. The Sustainable use of pesticides Directive (SUPD, EC 2009) aims to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on the environment (and on human health) and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides. Many of the actions taken by Member States under the Directive are also relevant to the Biodiversity Strategy (see below) and the Farm to Fork Strategy (EC 2020), which includes the adoption of pesticide reduction targets. EU countries have drawn up National Action Plans⁵ (NAPs) to implement the range of actions set out in the Directive and progress towards these have been assessed (COM 2020). The European Court of Auditors emphasise "Overall, the Commission and Member States have taken action to promote the sustainable use of PPPs. However, we found that there is limited progress in measuring and reducing the risks of PPP use" (ECA 2020a,c). As with the CAP, policy areas relevant to pesticides are being revised/updated including the Biodiversity Strategy, Farm to Fork Strategy, and NAPs; there may also potentially be a new EU Chemicals strategy, though this is to be confirmed. PoshBee will maintain its active dialogues with DG AGRI, DG SANTE and others to identify upcoming opportunities for policy engagement.

⁵ https://ec.europa.eu/food/plant/pesticides/sustainable_use_pesticides/nap_en

5.2 Relevant PoshBee outputs

PoshBee will generate several outputs expanding knowledge around the risks of multiple stressors on bees, and in particular pesticides, and these are summarised in section 4.2. A policy brief summarising these related Deliverables would be highly relevant to future developments of the CAP, Biodiversity Strategy, Farm to Fork Strategy and National Action Plans for the SUPD. Specifically, NAP's aim to be updated every 5 years, and many were last reviewed in 2017/18; therefore the next round of reviews may be expected in 2022/2023. In addition, there are also some mid-term assessments planned (e.g. Belgium 2020; France phase 1 to phase 2 review 2020, though under Covid timelines may have changed). Several chemicals being assessed by PoshBee (e.g. glyphosate and sulfoxaflor) will be very pertinent to NAP revisions and updates.

In addition to assessing risks to bees, PoshBee will also investigate the effectiveness of different response options to multiple stressors (D10.6, March 2023) including those for chemicals and habitat management.

5.3 Proposed engagement

Target	Timing	Topic	Engagement	PoshBee Deliverables
DG AGRI, DG SANTE, DG ENV, national agricultural authorities, rural payment agencies	Jan 2023	Effects of multiple stressors on bees; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 1: Effects of multiple stressors. open access pdf widely disseminated (WP11)	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4
DG AGRI, DG SANTE, DG ENV, national agricultural authorities	May 2023	Effectiveness of mitigation options in reducing the risks of agricultural practices on bees	Policy briefing 3: Mitigation of multiple stressors. open access pdf widely disseminated (WP11)	D10.6

6. Biodiversity

6.1 Current position and future directions

A core part of the European Green Deal, the new Biodiversity strategy to 2030⁶ specifically mentions “halting and reversing the decline of pollinators” and is committed to reducing the risk and use of chemical pesticides and the use of more hazardous pesticides by 50% by 2030. This will mainly be achieved via the Farm to Fork (F2F) strategy⁷, and should link directly to the EPI (a key rationale for the reduction is to mitigate the impacts on (pollinating) insects and birds). Under Action 7 of the EPI,

⁶ https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/actions-being-taken-eu/eu-biodiversity-strategy-2030_en

⁷ https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf

risk assessment and management of sustainable use of pesticides as well as IPM are incorporated under the Directive 2009/128/EC⁸. The Biodiversity strategy also incorporates an EU Nature Restoration Plan⁹ - a series of concrete commitments and actions to restore degraded ecosystems across the EU by 2030, and manage them sustainably, addressing the key drivers of biodiversity loss

6.2 Relevant PoshBee outputs

PoshBee will generate several outputs expanding knowledge around the risks of multiple stressors on bees (see Table 1) with the ones pertaining to pesticides summarised in section 4.2 and those feeding into the CAP Strategic Plans 2021-2027 in section 5.2. The specific outputs that will be of importance to the new Biodiversity strategy to 2030 and the EPI are outlined below.

6.2.1 PoshBee outputs relating to improved knowledge: The effects of multiple stressors (i.e. chemical x pathogen and chemical x nutrition, Deliverables 4.2, 5.1, 5.2, 6.1-6.4) will be completed between August 2021 and September 2022. Synthesis of multiple stressor exposure (D10.3) and impacts (D10.4) will consolidate knowledge the above Deliverables by January 2023. Deliverables for semi-field and field level effects of stressors (D7.1-7.3) are currently scheduled for delivery in August 2022, February 2022 and May 2023 respectively.

6.2.2 Novel proteomics tools for monitoring bee health: PoshBee is developing and testing a ‘Health card’ for bees to monitor stressors and impacts which will be available through Deliverables 10.5 (January 2023) and D9.15 (May 2023). In addition, a proteomics database for wider use will be available in May 2023 (D9.10). The health card or other proteomics methods can potentially allow the assessment of bee health status in a harmonised manner and would be extremely useful for the future monitoring of bees in their natural environment

6.3 Proposed engagement

Target	Timing	Topic	Engagement	PoshBee Deliverables
DG AGRI, DG SANTE, DG ENV, national agricultural authorities, rural payment agencies	Jan 2023	Effects of multiple stressors on bees; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 1: Effects of multiple stressors. open access pdf widely disseminated (WP11)	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4
DG AGRI, DG SANTE, DG ENV, national agricultural authorities	May 2023	Effectiveness of mitigation options in reducing the risks of agricultural practices on bees	Policy briefing 3: Mitigation of multiple stressors. open access pdf widely disseminated (WP11)	D10.6
DG ENV	June 2023 onwards	Demonstration of bee health card and proteomics database	Engagement in existing policy fora or targeted workshops, as appropriate by WP9 and WP10 leads	10.5, D9.15 D9.10

⁸ https://ec.europa.eu/food/plant/pesticides/sustainable_use_pesticides_en

⁹ https://ec.europa.eu/info/sites/info/files/communication-annex-eu-biodiversity-strategy-2030_en.pdf

7. EU Pollinators Initiative

7.1 Current position and future directions

The European Commission adopted the EU Pollinators Initiative (EPI, COM(2018) 395 final) in 2018. The initiative sets out several long-term objectives (towards 2030) and 31 short-term actions to be taken by the EU by 2020 under three priority areas: improving knowledge on pollinator decline, its causes and consequences; tackling the causes of pollinator decline; and raising awareness, engaging wider society and promoting collaboration. The EPI spans across agriculture, environment, and pesticide risk assessment areas. Several of the EPI specific actions are relevant to PoshBee, and four in particular present opportunities for project outputs to contribute to:

- Action 7a: The Commission will encourage Member States to include specific targets and measures for pollinator conservation in their revised National Action Plans under Directive 2009/128/EC to reduce the risks and impacts of pesticide use on pollinators, and will assess the situation in a second report on the Directive's implementation.
- Action 5c: The Commission will promote the integration of pollinator considerations in the implementation of the post-2020 Common Agricultural Policy, and will include a pollinator indicator in the performance and monitoring framework once finalized and operational.
- Action 4b: The Commission will, in cooperation with Member States, identify conservation measures and management approaches to optimize benefits for endangered pollinators and their habitats, including in the frame of the Natura 2000 biogeographic process.
- Action 1a: The Commission will devise and test an EU-wide pollinator monitoring scheme to ensure the provision of good quality data for assessing the status and trends of pollinator species in the EU and developing a pollinator indicator. A technical expert group will be set up to support this work.

The EPI was part of the EU Biodiversity Strategy to 2020 and will be reviewed by the end of 2020, with a likely phase 2 follow on in the context of the EU Biodiversity Strategy for 2030. While the details are not yet known, it is expected that several of the actions in the first phase of the EPI will be carried over and extended in the second phase. PoshBee beneficiaries have been directly involved in the development of the EPI, and will remain engaged in the next phase so that PoshBee can exploit arising opportunities.

7.2 Relevant PoshBee outputs

Multiple PoshBee Deliverables in section 4.2 (Pesticides and risk assessment) are highly relevant to EPI action 7a, reducing the risks and impacts of pesticide use on pollinators. Similarly, those Deliverables highlighted in section 5.2 (Agriculture) relate to EPI action 5c to inform the post-2020 CAP development. EPI action 4b (identify conservation measures and management approaches for pollinators) could be informed by D10.6 (March 2023) which will assess the effectiveness of response options to multiple stressors. Finally, action 1a is underway to develop an EU pollinator monitoring scheme (EUPMS) and the next steps in its implementation could take into consideration field level protocols for assessing stressor impacts on bees (D7.3).

7.3 Proposed engagement

As the EPI bridges multiple policy areas, the proposed engagement plans in sections 4, 5 and 6 above are pertinent here. Further, EPI action 3a (launch an online platform on pollinators to serve as a central data and information hub) is an ideal platform to help engage with policy and decision makers as well as a wider range of stakeholders. The EU Pollinator Information Hive¹⁰ was recently launched and will provide ongoing opportunities for many PoshBee outputs to be disseminated (WP11). Below we present engagement activities based on the current EPI actions, though these can be tailored as the next phase of the EPI emerges.

Target	Timing	Topic	Engagement	PoshBee Deliverables
EPI Action 7a (reduce pesticide risks)	Jan 2023	Effects of multiple stressors on bees; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 1: Effects of multiple stressors. open access pdf widely disseminated (WP11)	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4
EPI Actions 5c (CAP development) and Action 4b (pollinator conservation)	May 2023	Effectiveness of mitigation options in reducing the risks of agricultural practices on bees	Policy briefing 3: Mitigation of multiple stressors. open access pdf widely disseminated (WP11)	D10.6
EPI Action 1a	May 2023	New protocols and tools for bee regulatory testing schemes; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 2: New protocols and tools. open access pdf widely disseminated (WP11)	2.6, 3.2, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.3, 8.4, 9.1, 9.10, 9.14, 9.15, 10.5

8. Non-EU national policies

While the EU includes 27 countries, the need to halt the decline of pollinators is a European level challenge, and two countries participating in PoshBee are not in the EU, namely Switzerland and UK. Therefore we have assessed the opportunities for PoshBee to engage with national policies in these two countries.

¹⁰ <https://wikis.ec.europa.eu/display/EUPKH/EU+Pollinator+Information+Hive>

Switzerland

8.1 Current position and future directions

Pesticides. The legal basis for the use of pesticides in Switzerland is the Swiss Plant Protection Product Ordinance¹¹. In 2017, the Swiss Action Plan for the Reduction and Sustainable Use of Pesticides¹² was implemented. It comprises 51 concrete measures to reduce the risks associated with pesticides. Of these measures, 16 measures have been implemented, while the other 35 measures are still the elaboration/planning phase¹³. Research inputs are required, and those particularly emphasized by the administration responsible for the implementation of the Action Plan are: (i) lists of pesticides considered to have a risk for bees/pollinators are currently entirely based on data of acute impacts, and data on chronic impacts are lacking and cannot be considered for the risk assessment; and (ii) data on exposure are lacking (e.g. data on residual levels of pesticides in pollen, nectar, bees etc. are urgently needed), and also for monitoring of exposure risk and assessment of measures to reduce risks.

Agriculture. The legal basis of the Swiss Federal agricultural policy is the Federal Act of 29 April 1998 on Agriculture¹⁴. The agricultural policy is regularly revised on 4 year basis. The Federal Council's Dispatch on the development of agricultural policy after 2022 (AP22+)¹⁵ was adopted on 12 February 2020. This positions the agricultural sector in such a way as to take account of the concerns of the Swiss society. Concerns over the impact of intensive agriculture on biodiversity, the environment and human health have increased during the past years. Reductions of such impacts on the environment will therefore be the focus area of the new agricultural policy after 2022 (AP22+).

Biodiversity. Switzerland signed the Rio de Janeiro Convention on Biological Diversity and adopted a national biodiversity strategy, the Swiss Biodiversity Strategy and Action Plan¹⁶, on 6 September 2017. The main objectives are to: (i) promote biodiversity (creation of ecological infrastructure, support for species); (ii) harmonize policies and strengthen synergies between the federal biodiversity policy and other policy areas (e.g. agriculture, spatial planning, transport, economic development); and, (iii) raise awareness among decision makers, stakeholders and the general public about the importance of biodiversity. Implementation of measures is ongoing; other policies and legal bases for the conservation of biodiversity in Switzerland are also considered¹⁷. The motion 20.3010 'Mitigating insect loss'¹⁸, submitted on 11 February 2020 by the Environment, Spatial Planning and Energy (UREK) commission of the parliament requests that the Swiss Federal Council ensures rapid realization of the measures and achievement of the goals of the: Swiss Biodiversity Strategy and Action Plan, the Action Plan to Promote Bee Health, and the Swiss Action Plan for the Reduction and Sustainable Use of

¹¹ <https://www.admin.ch/opc/de/classified-compilation/20100203/index.html>

¹² https://www.blw.admin.ch/dam/blw/de/dokumente/Nachhaltige%20Produktion/Pflanzenschutz/AktionsplanPflanzenschutzmittel/Aktionsplan_Pflanzenschutzmittel_de.pdf.download.pdf/Aktionsplan_Pflanzenschutzmittel_de.pdf

¹³ <https://www.blw.admin.ch/dam/blw/de/dokumente/Nachhaltige%20Produktion/Pflanzenschutz/AktionsplanPflanzenschutzmittel/Umsetzungsbericht%202019.pdf.download.pdf/Umsetzung%20Aktionsplan%20Pflanzenschutzmittel%20Stand%20August%202019.pdf>

¹⁴ <https://www.admin.ch/opc/en/classified-compilation/19983407/index.html>

¹⁵ <https://www.admin.ch/opc/de/federal-gazette/2020/3955.pdf>

¹⁶ <https://www.bafu.admin.ch/bafu/en/home/topics/biodiversity/info-specialists/massnahmen-zur-erhaltung-und-foerderung-der-biodiversitaet/strategie-biodiversitaet-schweiz-und-aktionsplan.html>

¹⁷ <https://www.bafu.admin.ch/bafu/en/home/topics/biodiversity/law/acts-ordinances.html>

¹⁸ <https://www.parlament.ch/de/ratsbetrieb/suche-curia-vista/geschaefft?AffairId=20203010>

Pesticides. It highlights a series of measures should be taken to promote insects, including measures to promote more sustainable agricultural production.

Bee health. In 2014, the Swiss Federal Council adopted the National Action Plan to Promote the Health of Bees as a response to the motion 13.3372 of the Environment, Spatial Planning and Energy (UREK)¹⁹ commission. Measures include, among others: (i) promoting food resources for bees by floral enhancements; (ii) measures to reduce risks from pesticides; (iii) improving risk assessment of chronic and sub-lethal effects of pesticides on bees and other pollinators; and, (iv) development of new test schemes for risk assessment of sub-lethal effects of pesticides on bees. Some measures have been implemented, while others are still in the development phase or/and require research input. Research input identified include: (i) what are good indicators of bee health, and how can bee health be measured and monitored? (ii) how can we improve risk assessment of chronic and sub-lethal effects of pesticides on honey bees and in particular also wild bees (i.e., bumble bees, solitary bees, including ground-nesting bees) and other pollinators, along with development of protocols and new test schemes for risk assessment? (iii) can floral enhancements such as flower strips improve bee health? (iv) what are the impacts of pesticides on the delivery of pollination services? (v) development of new/improved models highly appreciated, in particular also for wild bees (beyond BEEHAVE for honey bees); (vi) more data on exposure and impact of fungicides is needed; (vii) field/semi-field data on combined impacts of multiple stressors (different pesticides, in particular insecticides plus fungicides, pesticides plus pathogens/nutritional stress) needed to improve risk assessment; (viii) how important drift and exposure routes of pesticides applied in crops through non-crop plants (e.g. flower strips)?; and, (ix) combined data of exposure and impact for improved risk assessment is needed.

8.2 Relevant PoshBee outputs

The three core policy briefs, and underpinning Deliverables, described above (section 4 to 6) will be highly relevant to Swiss policies and these will be adapted for use in Switzerland. Where possible these will be adapted and translated into German and French.

8.3 Proposed engagement

Target	Timing	Topic	Engagement	PoshBee Deliverables
Swiss Action Plan for the Reduction and Sustainable Use of Pesticides, and Agriculture Act (AP26+)	Jan 2023	Effects of multiple stressors on bees; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 1: Effects of multiple stressors. open access pdf widely disseminated (WP11)	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4
Swiss Action Plan for the Reduction and	May 2023	New protocols and tools for bee regulatory testing schemes; including chemicals, pathogens, nutrition and interactions,	Policy briefing 2: New protocols and tools. open access pdf widely	2.6, 3.2, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.3,

¹⁹ <https://www.news.admin.ch/news/message/attachments/34894.pdf>

Sustainable Use of Pesticides, and Agriculture Act (AP26+)		honey bees, bumble bees and solitary bees, from lab to field scales.	disseminated (WP11)	8.4, 9.1, 9.10, 9.14, 9.15, 10.5
Swiss Biodiversity Strategy and Action Plan	May 2023	Effectiveness of mitigation options in reducing the risks of agricultural practices on bees	Policy briefing 3: Mitigation of multiple stressors. open access pdf widely disseminated (WP11)	D10.6

United Kingdom

8.4 Current position and future directions

The UK government’s 25-year environment plan (YEP)²⁰ launched in January 2018 has specific goals that include clean air; clean and plentiful water; thriving plants and wildlife; reduced risk of harm from environmental hazards such as flooding and drought; using resources from nature more sustainably and efficiently; enhanced beauty, heritage and engagement with the natural environment; mitigating and adapting to climate change; minimising waste; managing exposure to chemicals; and enhancing biosecurity. The plan states “UK supports further restrictions on the use of neonicotinoid pesticides because of the growing weight of scientific evidence they are harmful to bees and other pollinators. Unless the scientific evidence changes, the Government will maintain these increased restrictions after we leave the EU.” However, the impact of chemicals other than neonicotinoids on pollinators is a significant knowledge gap that can be addressed by specific PoshBee deliverables.

The Countryside Stewardship (CS) schemes currently in place, provides financial incentives for farmers, woodland owners, foresters and land managers to look after and improve the environment. One of the existing Mid-Tier options in the CS includes a wild pollinator and farm wildlife package²¹ - To meet the specifications of this mid-tier scheme, options need to be chosen that help provide winter bird food and nectar and pollen sources for 3% of the land in the agreement. The new Environmental Land Management (ELM) scheme which is due to be fully rolled out by the end of 2024, will replace the CS schemes currently available under the EU’s Common Agricultural Policy (CAP), and is, founded on the principle of “public money for public goods”²². The ELM scheme seeks to deliver on the targets on the 25 YEP and the public goods this scheme will pay for include: clean and plentiful water; clean air; protection from and mitigation of environmental hazards; mitigation of and adaptation to climate change; thriving plants and wildlife; and beauty, heritage and engagement. Tests and trials were established in 2018 as a mechanism to co-design the ELM scheme with stakeholders and to help refine and improve the policy framework and delivery methods. These will continue throughout the life of the Pilot and potentially beyond, up to 2028, providing potential entry points for PoshBee deliverables to provide evidence for future policy.

²⁰https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

²¹[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908457/Countryside Stewardship Mid Tier and Wildlife Offers Manual 2019 v3.0.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908457/Countryside_Stewardship_Mid_Tier_and_Wildlife_Offers_Manual_2019_v3.0.pdf)

²²https://consult.defra.gov.uk/elm/elpolicyconsultation/supporting_documents/ELM%20Policy%20Discussion%20Document%20230620.pdf

The UK government's Department for Environment Food and Rural Affairs (Defra) has a Pollinator Advisory steering Group (PASG). The PASG meets every quarter and gathers research and evidence updates that feed into the National Pollinator Strategy (NPS) for England under four main themes - Strengthening the evidence base; Managing our land; Bee health; and Engaging people. The current NPS implementation plan²³ covers the period 2018-2021 and NPS is linked to the 25YEP, the Environment Land Management Scheme (ELMS) development as well as the second National Adaptation Plan (NAP) published in 2018²⁴. The NPS evidence is updated every five years and the next update will be a key entry point for PoshBee outputs to inform and strengthen the science and evidence base for future pollinator related policy in the UK.

The Welsh and Scottish governments have their own strategies and plans for pollinators. The Action Plan for Pollinators in Wales²⁵ was first launched in 2013 and focuses on developing policy, governance and a sound evidence base for action for pollinators. In addition to improving habitat for wild pollinators it also links to Defra and the Welsh Government's Healthy Bees Plan²⁶ aimed at managed pollinators particularly honeybees. The current Pollinator Strategy for Scotland²⁷ runs from 2017-2027 with annual progress reports published with a key aim "to address the causes of decline in populations, diversity and range of our pollinator species, and to help them thrive into the future". Northern Ireland is incorporated into the All Ireland Pollinator Plan²⁸ with the first plan covering the period 2015-2020 and a new version to be developed to cover 2021-2025.

The UK environment and agriculture strategies mentioned are currently in a state of flux due to uncertainties related to EU exit and are likely to change or be modified in due course. Our engagement plans will therefore need to be revisited and revised when the new strategies and plans are confirmed.

8.5 Relevant PoshBee outputs

The three core policy briefs, and underpinning Deliverables, described above (section 4 to 6) will be highly relevant to UK policies and these will be adapted for use in the United Kingdom.

8.6 Proposed engagement

The main entry point for engagement with UK government will be through Department for Environment, Food and Rural Affairs (Defra)'s Pollinator Advisory Steering Group (PASG). The PASG meets every quarter and gathers research and evidence updates that feed into the National Pollinator Strategy (NPS) for England under four main themes: Strengthening the evidence base; managing our land; bee health; and engaging people. The current NPS implementation plan²⁹ covers the period 2018-2021. The NPS evidence is updated every five years and the next update will be a key entry point for PoshBee outputs to inform and strengthen the science and evidence base of the PASG.

²³https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766200/nps-implementation-plan-2018-2021.pdf

²⁴https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727252/national-adaptation-programme-2018.pdf

²⁵ <https://gov.wales/sites/default/files/publications/2019-04/action-plan-for-pollinators.pdf>

²⁶<http://www.nationalbeeunit.com/downloadNews.cfm?id=44#:~:text=The%20Healthy%20Bees%20Plan%20was,today%20and%20for%20the%20future.>

²⁷ <https://www.nature.scot/sites/default/files/2018-04/Pollinator%20Strategy%20for%20Scotland%202017-2027.pdf>

²⁸ <https://pollinators.ie/>

²⁹https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766200/nps-implementation-plan-2018-2021.pdf

Target	Timing	Topic	Engagement	PoshBee Deliverables
Next UK National Pollinator Strategy evidence update through PASG	Jan 2023 onward	Effects of multiple stressors on bees; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 1: Effects of multiple stressors. open access pdf widely disseminated (WP11)	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4
Next UK National Pollinator Strategy evidence update through PASG	Jan 2023 onward	New protocols and tools for bee regulatory testing schemes; including chemicals, pathogens, nutrition and interactions, honey bees, bumble bees and solitary bees, from lab to field scales.	Policy briefing 2: New protocols and tools. open access pdf widely disseminated (WP11)	2.6, 3.2, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.3, 8.4, 9.1, 9.10, 9.14, 9.15, 10.5
Next UK National Pollinator Strategy evidence update through PASG	Jan 2023 onward	Effectiveness of mitigation options in reducing the risks of agricultural practices on bees	Policy briefing 3: Mitigation of multiple stressors. open access pdf widely disseminated (WP11)	D10.6

9. Global policies

9.1 Current position and future directions

Beyond Europe, there are several global treaties and initiatives where PoshBee outputs could contribute to the formulation and implementation of policies and action plans.

IPBES³⁰: The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services has a rolling work programme³¹ up to 2030, with specific objectives around assessing knowledge, supporting policy, and communicating and engaging. The IPBES (2016) assessment of Pollinators, Pollination and Food Production was a landmark report helping drive many national and international actions. Pollinators were also included in the IPBES global and regional assessments³². Many PoshBee partners remain highly active in the IPBES process and any emerging pollinator-specific opportunities will be capitalised on.

CBD³³: At the Convention on Biological Diversity COP-13, the Parties endorsed the key messages of the IPBES assessment and use them to improve conservation and management of pollinators, address drivers of pollinator declines, and shift to sustainable food production systems and agriculture (CBD 2016). At the COP-14, the Parties adopted the Plan of Action 2018-2030 for the International Initiative for the Conservation and Sustainable Use of Pollinators (IPI-2) for implementation according to national legislation and national circumstances. Several PoshBee partners remain active in the CBD

³⁰ <https://ipbes.net/>

³¹ <https://ipbes.net/work-programme>

³² <https://ipbes.net/assessing-knowledge>

³³ <https://www.cbd.int/>

SBSTTA and IPI-2 process, and opportunities for PoshBee outputs to inform on IPI-2 implementation will be pursued.

Promote Pollinators³⁴: Promote Pollinators aims to support country-led politics to foster policy measures and innovative action on protecting pollinators. More than 30 national pollinator strategies are already in place with several more under development³⁵. PoshBee partners work closely with Promote Pollinators, and national governments with national pollinator strategies, allowing PoshBee to engage at the international and national levels.

Other opportunities: Upcoming joint IPBES-IPPC activities on biodiversity (including pollinators are underway) and the UN Decade on Ecosystem Restoration (2021-2030)³⁶ may also offer openings for engagement.

Across all these international conventions and initiatives, the project will remain vigilant to opportunities to engage and we will adapt proposed briefings described above as a potential basis for engagement.

9.2 Relevant PoshBee outputs

Multiple PoshBee Deliverables in sections 4 to 7 are likely to be highly relevant to IPBES, CBD, FAO, IPCC and Promote Pollinator activities.

9.3 Proposed engagement

Once concrete entry points are identified, we will use the policy briefings described above, and adapt them where appropriate, to feed into consultations and to be used as overarching summaries if PoshBee partners participate in international workshops or events (e.g. CBD side events). We will also share briefings with key contacts at IPBES, CBD, FAO and Promote Pollinators as part our dissemination strategy (WP11).

10. Summary of policy briefs and proposed timetable

Our overall strategy is to develop high quality policy briefings capturing three broad areas of the PoshBee expected outputs:

- Policy briefing 1: Effects of multiple stressors.
- Policy briefing 2: New protocols and tools.
- Policy briefing 3: Mitigation of multiple stressors.

Briefings will include high level key findings and recommendations with links to the primary underpinning evidence supporting these (i.e. PoshBee Deliverables and peer-reviewed publications). The briefings will be written in a way to be accessible to a wide range of international, national and local policy and decision makers. Briefings will initially be drafted in English, however, we plan to use these to engage with national policy makers also, and so we will encourage PoshBee partners to translate them in to national languages wherever possible; these could potentially include Bulgarian,

³⁴ <https://promotepollinators.org/>

³⁵ <https://promotepollinators.org/members/>

³⁶ <https://www.un.org/en/sections/observances/international-decades/index.html>

Danish, Estonian, French, German, Hungarian, Italian, Polish, Spanish, and Swedish. PoshBee partners already have well-established links with national authorities responsible for agriculture, the environmental and bee health and through WP11 a programme of national engagement activities will be coordinated. A summary of timelines and actions are summarised below.

Action and partners involved	Briefing 1: Effects of multiple stressors	Briefing 2: New protocols and tools	Briefing 3: Mitigation of multiple stressors
Key Deliverables	10.3 & 10.4 plus 3.1, 3.2, 3.4, 4.1, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.1-8.4	2.6, 3.2, 4.2, 5.1-5.3, 6.1-6.4, 7.1-7.3, 8.3, 8.4, 9.1, 9.10, 9.14, 9.15, 10.5	10.6
Short summary texts drafted by Deliverable leads	Nov 2022 (INRA, EMU, UMONS, WBF, ALU-FR, BERN, MLU, RHUL, UNIUD, SLU, AU)	Mar 2023 (EMU, UMONS, WBF, ALU-FR, BERN, MLU, RHUL, AU)	Mar 2023 (BERN)
Briefing drafted	Dec 2022 (MLU & ANSES) with support from UREAD	Apr 2022 (EMU & MLU) with support from UREAD	Apr 2022 (UREAD)
Briefing complete and ready for WP11	Jan 2023 (Pensoft)	May 2023 (Pensoft)	May 2023 (Pensoft)

The briefings, plus related national and language adaptations, in conjunction with target policy stakeholders, will form the basis of policy engagement and dissemination strategy and actions planned in WP11.

References:

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- COM (2018) 395 final EU Pollinators Initiative. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0395&from=EN>
- COM (2020) 204 final. On the experience gained by Member States on the implementation of national targets established in their National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides. https://ec.europa.eu/food/sites/food/files/plant/docs/pesticides_sud_report-act_2020_en.pdf
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- EC (2020) Farm to Fork Strategy. For a fair, healthy and environmentally-friendly food system. https://ec.europa.eu/food/sites/food/files/safety/docs/f2f_action-plan_2020_strategy-info_en.pdf
- ECA (2020a) EU action had little effect on halting the decline of wild pollinators, say auditors https://www.eca.europa.eu/Lists/News/NEWS2007_09/INSR_Pollinators_EN.pdf
- ECA (2020b) Biodiversity on farmland: CAP contribution has not halted the decline. https://www.eca.europa.eu/Lists/ECADocuments/SR20_13/SR_Biodiversity_on_farmland_EN.pdf
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- EFSA (2020b) Review of the evidence on bee background mortality. <https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2020.EN-1880>
- EFSA (2020c) Review of the Guidance Document for the risk assessment for bees Supporting document for Risk Managers consultation on Specific Protection Goals for bees. <http://www.efsa.europa.eu/sites/default/files/topic/EFSA-Supporting-document-for-RMs-in-defining-SPGs.pdf>
- IPBES (2016). The assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services on pollinators, pollination and food production. S.G. Potts, V. L. Imperatriz-Fonseca, and H. T. Ngo, (eds). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. <https://ipbes.net/assessment-reports/pollinators>

Appendix A: Detailed mapping of Deliverables on to expected outputs. * Denotes key Deliverable contributing to broader output, acronym and number in parentheses are the Deliverable lead beneficiary and month of delivery. Underlined denotes proposed overall lead for that output. HB = honey bee; BB = bumble bee; SB = solitary bee.

Output Type	Specific output	Lead	Deliverables
Knowledge	Chronic and sub-lethal effects of chemicals and combinations	<u>INRA</u> , EMU	3.1 (INRA, 33) Toxicokinetics of 3 chemicals (sulfoxaflor, azoxystrobin, glyphosate) bees 3.3 (INRA, 39) Acute/chronic chemical effects (sulfoxaflor, azoxystrobin, glyphosate) and interactions in bees 3.4 (EMU, 33) Toxicokinetics/dynamics of chemicals (sulfoxaflor, azoxystrobin, glyphosate) in bees 4.1 (UMONS, 34) Chemical (sulfoxaflor) effects on SB
	Effects of chemical x pathogen and chemical x nutrition	<u>MLU</u> , <u>RHUL</u> , <u>BERN</u> , <u>UMONS</u>	*4.2 (MLU, 52) Chemical (sulfoxaflor and a neonicotinoid) x nutrition plus pathogen (viral) x nutrition effects on SB 5.1 (UMONS, 51) Nutritional requirements of bees *5.2 & 5.3 (UMONS, 51) Chemical (sulfoxaflor, azoxystrobin, glyphosate) x nutrition effects on bees *6.1 (BERN, 42) Chemical (sulfoxaflor, azoxystrobin, glyphosate & flupyradifurone) x pathogen effects (<i>Nosema</i> , <i>Paenibacillus</i> , <i>Varroa</i> and DWV/BQCV) on HB *6.2 & 6.3 (RHUL, 42) Chemical (sulfoxaflor, azoxystrobin, glyphosate) x pathogen (<i>Crithidia</i>) effects on BB *6.4 (MLU, 42) Chemical (sulfoxaflor, azoxystrobin, glyphosate) x pathogen (<i>Crithidia</i>) effects on SB 10.3 (ANSES, 56) Synthesis of multiple stressor exposure *10.4 (MLU, 56) Synthesis of multiple stressor impacts
	Field level effects of stressors	<u>WBF</u> , <u>ALU-FR</u>	7.1 (WBF, 51) & 7.2 (WBF, 45) Multiple stressor effects on bees in semi-field conditions (sulfoxaflor pesticides x azoxystrobin fungicide; flupyradifurone pesticide x nutrition) 7.3 (ALU-FR, 60) Multiple stressor effects on bees in field (stressors not yet selected)
Protocols for bee regulatory testing schemes	Testing chemicals on life-stages and castes/sexes of model species	<u>EMU</u>	3.2 (EMU, 33) Improved protocols for chemical (sulfoxaflor) testing in bees
	Ground nesting model SB	<u>MLU</u>	*4.2 (MLU, 52) Chemical (sulfoxaflor & a neonicotinoid) x nutrition plus pathogen (viral) x nutrition effects on SB
	Chemical x pathogen/nutrition	<u>MLU</u> , <u>RHUL</u>	*4.2 (MLU, 52) Chemical (sulfoxaflor & a neonicotinoid) x nutrition plus pathogen (viral) x nutrition effects on SB

		<u>BERN</u> , <u>UMONS</u>	5.1 (UMONS, 51) Nutritional requirements of bees *5.2 & 5.3 (UMONS, 51) Chemical (sulfoxaflor, azoxystrobin, glyphosate) x nutrition effects on bees *6.1 (BERN, 39) Chemical (sulfoxaflor & flupyradifurone) x pathogen effects (DWV/BQCV) on HB *6.2 & 6.3 (RHUL, 39) Chemical (sulfoxaflor, azoxystrobin, glyphosate) x pathogen (<i>Crithidia</i>) effects on BB *6.4 (MLU, 39) Chemical (sulfoxaflor) x pathogen effects on SB
	Field testing	<u>ALU-FR</u> , <u>WBF</u>	7.1 & 7.2 (WBF, 39) Multiple stressor effects on bees in semi-field conditions (sulfoxaflor pesticides x azoxystrobin fungicide; flupyradifurone pesticide x nutrition) 7.3 (ALU-FR, 60) Multiple stressor effects on bees in field (stressors not yet selected)
Models	Holistic and agent based models of bee health (improved HB and BB, plus new SB models)	<u>AU</u> , <u>SLU</u> , <u>UNIUD</u>	8.1 (SLU, 39) Bee health definition and indicators 8.2 (UNIUD, 51) Chemical (nicotine, sulfoxaflor) effects on bee health model 8.3 (AU, 41) Agent based risk assessment model for BB *8.4 (AU, 60) Risk assessment tool for EFSA
Proteomics tools for health monitoring	'Health card' for bees to monitor stressors and impacts	<u>CNRS</u>	9.1 (CNRS, 6) Haemolymph collection kit and tool 9.14 (CNRS, 48) HB MALDI imaging method *9.15 (CNRS, 60) Use of 'BeeTyping' for monitoring *10.5 (CNRS, 56) Synthesis of Omics approaches
	Proteomics database for wider use	<u>CNRS</u>	D9.10 (CNRS, 60) Consolidated peptide/protein database and markers
Air sensor tool	Measuring atmospheric agrochemicals exposure in/outside hives	<u>Bordeaux</u>	D2.6 (Bordeaux, 56) New technology to measure environmental contamination
Toolkits	Multi-media knowledge exchange to enhance tool uptake and use	<u>UREAD</u> , <u>RHUL</u> , <u>BERN</u>	10.1 (UREAD, 12) Impact strategy *10.2 (UREAD, 48) Incentives and barriers to tool adoption *10.6 (BERN, 58) Responses to multiple stressors *10.7 (RHUL, 56) Overview of tools, protocols, guides *10.8 (UREAD, 27) Policy entry points and briefs