EKLIPSE
Knowledge & Learning Mechanism
on Biodiversity & Ecosystem Services

Brief

Photo: Dan Chapman

# RESEARCH NEEDS TO STRENGTHEN CONSERVATION MEASURES FOR POLLINATORS

## A science policy brief identifying research needs to better understand the impacts of pesticide and fertiliser use on the effectiveness of adjacent pollinator conservation measures

## Context

Following a request from an European NGO, Pollinis, EKLIPSE produced an overview of the current knowledge and research needs related to the impacts of pesticide and fertiliser use in farmland on the effectiveness of adjacent pollinator conservation measures. This process was implemented through a Joint Fact Finding approach including a multi-stakeholder consultation in a workshop on the 9-10th Jan, 2020 in Brussels.

This brief summarises the outputs of this process that are relevant for the current guidance document developed under the EU Pollinators' Initiative, as well as for policy makers at national and EU level, scientists and funding bodies.

More information is available at: https://www.eklipse-mechanism.eu/pollinators_request

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## SOME ELEMENTS ON CURRENT KNOWLEDGE

*The expert working group found that there was limited direct evidence available on the specific question of how pesticide and fertiliser use might affect conservation measures for pollinators so no conclusion could be drawn here.*

*However, there remains the potential for non-target exposure of insect pollinators to agrochemicals when foraging in habitats adjoining crops. Based on the trusted knowledge sources brought to the table by the experts, here are some key elements that can be highlighted:*

*- The addition of diverse and abundant floral resources within agricultural landscapes often helps to increase populations sizes, and increase the local activity and species richness of pollinators* (Park et al. 2015, Carvell et al. 2017, Carvell et al. 2006, IFAB & Bayer 2017, Marshall & Moonen 2002, Wratten et al. 2012, Blake et al. 2012, Buhk et al. 2018, Campbell et al. 2017). *There is now direct evidence that this can increase bumble bee population sizes by increasing colony survival and reproduction* (Carvell et al. 2017)

*- Pollen and nectar from flowers in planted herbaceous field margins (e.g. AES), and potentially from woody semi-natural habitat, can be contaminated by pesticide and fertiliser applications that expose pollinators foraging in those habitats.* (Long & Krupke, 2016, Wood et al. 2019, Mogren & Lundgren, 2016).

*- Drift of herbicides and fertilisers can alter the composition and structure of plant communities, which may then indirectly affect pollinators seeking floral rewards and in turn wild plant pollination.* (de Jong et al. 2008, Snoo & Poll, 1999,Dupont et al. 2018, Schmitz et al. 2014, Requier et al. 2015, Schmitz et al. 2014b). *Some studies have shown that herbicides and fertilisers reduce plant diversity, suppress the formation of flowers and reduce seed set* (Schmitz et al. 2014, Schmitz et al. 2014b).

*- Best practices including technologies that minimize drift or establishing buffer strips can mitigate negative effects of pesticides on pollinators in non-crop habitat* (the effect is less clear for fertilisers). (de Jong et al. 2008, Snoo & Poll 1999, SETAC 2017,Frampton 2002).

## METHODOLOGY

The process implemented the first phase of a Joint Fact Finding Approach as described in Dicks et al. (2017). A team of knowledge-holders, representing various perspectives, sectors and disciplines, was selected and invited to collate and share their trusted sources of knowledge on the topic. These could be reports, scientific papers, articles or online resources. This body of information was evaluated for relevance to produce the preliminary document that was used as a basis for discussions during the workshop held on January 9-10 2020 in Brussels.

The workshop brought together a team of experts from academia, NGOs, beekeeper organisations, industry, and the requester organisation (Pollinis). The participants discussed the key findings from the identified evidence and knowledge gaps during the first day and identified a list of key research needs and policy recommendations during the second day. In addition to the research needs related to specific conservation measures, several cross-cutting themes emerged during the deliberations. The list of knowledge gaps were scored by the participants based on importance, feasibility and policy impact. Finally a list of policy recommendations on research needs were produced based on the outputs of the workshop.

## Pollinator conservation measures taken into consideration in the process:

| Intervention category | Conservation measure | Description | Photo |
|---|---|---|---|
| Adding flowers | Woody structures, hedges<br><br>Adding and maintaining trees | Type of conservation measure that includes woody elements in the landscape. In this report, three types of woody structures were considered: hedges, adding trees and maintaining trees. |  *@Adam Vanbergen* |
| | Herbaceous strips providing pollen and nectar, grass or wild bird seed | A narrow strip of land in an agricultural field, planted with different types of plants that produce flowers that mainly live for more than two years. |  *Provided by Veerle Mommaerts* |
| | Semi Natural Habitat (SNH): extensive, whole field or grassland | An ecosystem with most of its processes and biodiversity intact, though altered by human activity in strength or abundance relative to the natural state (IPBES). |  *@Sara Leonhardt* |

| Intervention category | Conservation measure | Description | Photo |
|---|---|---|---|
| Explicitly adding nest sites | Provision of nest boxes | Type of conservation measure represented by above ground bee hotel that provides nesting place for solitary bees. |  *@ Nadine Kinz and Anke Dietzsch* |
| Protecting water bodies | Wetland buffering efficacy | "A wetland buffer is a setback area between a stream, river, or wetland and any upland development. It maintains the natural vegetation cover along the waterway, which is an essential part of the aquatic ecosystem." [http://planportsmouth.com/wetlandbuffer.pdf] |  *Provided by Vasileiadis* |

## LIST OF RESEARCH NEEDS FOR EACH CONSERVATION MEASURE

Knowledge gaps are listed in each conservation measure in order of priority based the total score obtained for the 3 criteria :

***Feasibility:*** capacity to address the knowledge gap including in terms of resources, infrastructure availability, scope, environmental constraints, timing, etc.

***Cost-Benefit ratio:*** the ratio between investment to address the knowledge gap and expected results and outcomes.

***Policy relevance:*** Connection and relevance to current EU policy agenda including all relevant policy sectors.

**WOODY STRUCTURES** Since very few studies were highlighted that assess conservation benefits of adding woody structures for pollinators, it is very difficult to assess whether pesticide/fertiliser use impacts their efficacy. More specific research needs:

- Quantify/assess the gain in safety from the exposure reduction of the use of drift reduction technology
- Assess quantitative pollen collection by wild bees at the plant-species level (and not just at the family level)
- Where pesticides are not directly applied in areas, measure effects on the conservation measure itself in addition to evidence of exposure
- Quantify the possible buffering effects of tree planting on off-site pesticide exposure
- Study and identify a threshold of pesticide use (given different levels of surrounding habitat), under which orchards could have a net positive effect on bee populations owing to the mass bloom
- Explore how to find real controls for field trials due to the wide distribution of pesticide residue

**NEST BOXES**

- Assess the effects of pesticides (drift) on the efficacy of nest boxes in supporting bee reproduction

**SEMI-NATURAL HABITATS (SNH)**

- Assess the impact of fertilisers on plant composition of conservation measures
- Assess how much semi-natural habitat at landscape scale could help mitigate adverse effects of agrochemical use
- Assess how increasing crop diversity and reducing field size help mitigate agrochemicals impact?
- Assess the impact of livestock on conservation measurements? 1. Biocides/ veterinary products; 2. livestock pressure.

**HERBACEOUS STRIPS**

**Exposure risk in field margin habitats**

- Study the link between exposure and pollinator population size or health
- Study the impact of these levels of exposure on foraging behaviour and reproduction
- Study the spatial scales at which pesticides/ fertilisers affect pollinators in field margins

**Plant community change in response to pesticide and fertiliser drift**

- Study the trophic effects of changes in plant community and associated microbial communities on pollinator diversity and populations
- Study how best practices in agrochemical usage affect the impacts on pollinator communities and populations, including cascading trophic effects. Develop replicated studies following best practices recommendations.
- Explore how practices in pesticide and fertiliser use have changed since 2008

**Effects of field margins/herbaceous strips in the landscape on pollinator populations**

- Study the trade-off between the risks from agrochemical exposure and the benefits of additional floral resources
- Study the efficiency/efficacy of conservation measures without any pesticides or fertilisers

## CROSS-CUTTING KEY RESEARCH NEEDS

In the preparatory phase the identified evidence by the group of experts was very limited on woody structures and semi-natural habitats as well as on nest boxes and wetland buffering. However, based on the more extensive evidence available from herbaceous strips some cross-cutting research needs were identified and could be considered by research policy at EU and national level:

- ***Research is needed to better understand how the Sustainable Use Directive (Directive 2009/128/EC1)[1] is implemented at national level.*** *In particular, studies would need to* ***explore how best practices recommendations (nozzle technology, unsprayed buffer zones) on pesticide and fertiliser use are implemented by farmers.*** *In addition, collecting experience from farmers in different countries on the practical aspects of implementation of conservation measures through questionnaires would be recommended.*
- *Some studies are available on drift and exposure routes but* ***further research is needed on the impact of new technologies, particularly new nozzle types (e.g. anti-drift nozzles, one side sprayers for inward spraying) on the efficacy of conservation measures.*** *In addition, research should further assess and quantify the gain in safety from the exposure reduction of the use of drift reduction technology.*
- ***Research is urgently needed on the link between exposure and impact on pollinator diversity, populations, and health****. In particular, research should explore the impact of various types of pesticides (not just neonicotinoids) and the resulting various levels of exposure in different landscapes or habitats on foraging behaviour and reproduction of pollinators.*
- ***Research is needed on the impact of fertilisers on plant composition in conservation measures to understand the indirect impact on forage resources underpinning pollinator health and biodiversity.***
- ***Additional research is needed to strengthen the understanding of drift, exposure and impact on woody structures and to further investigate the role of semi-natural habitats and nest boxes.***

*1) Directive 2009/128/EC aims to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on human health and the environment and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides. EU countries have drawn up National Action Plans to implement the range of actions set out in the Directive.*

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