POLLINERA

Understanding pesticide-pollinator interactions to support EU Environmental Risk Assessment and policy

Introducing the PollinERA project

Systems-based Environmental Risk Assessment for wild bees, butterflies, moths and hoverflies

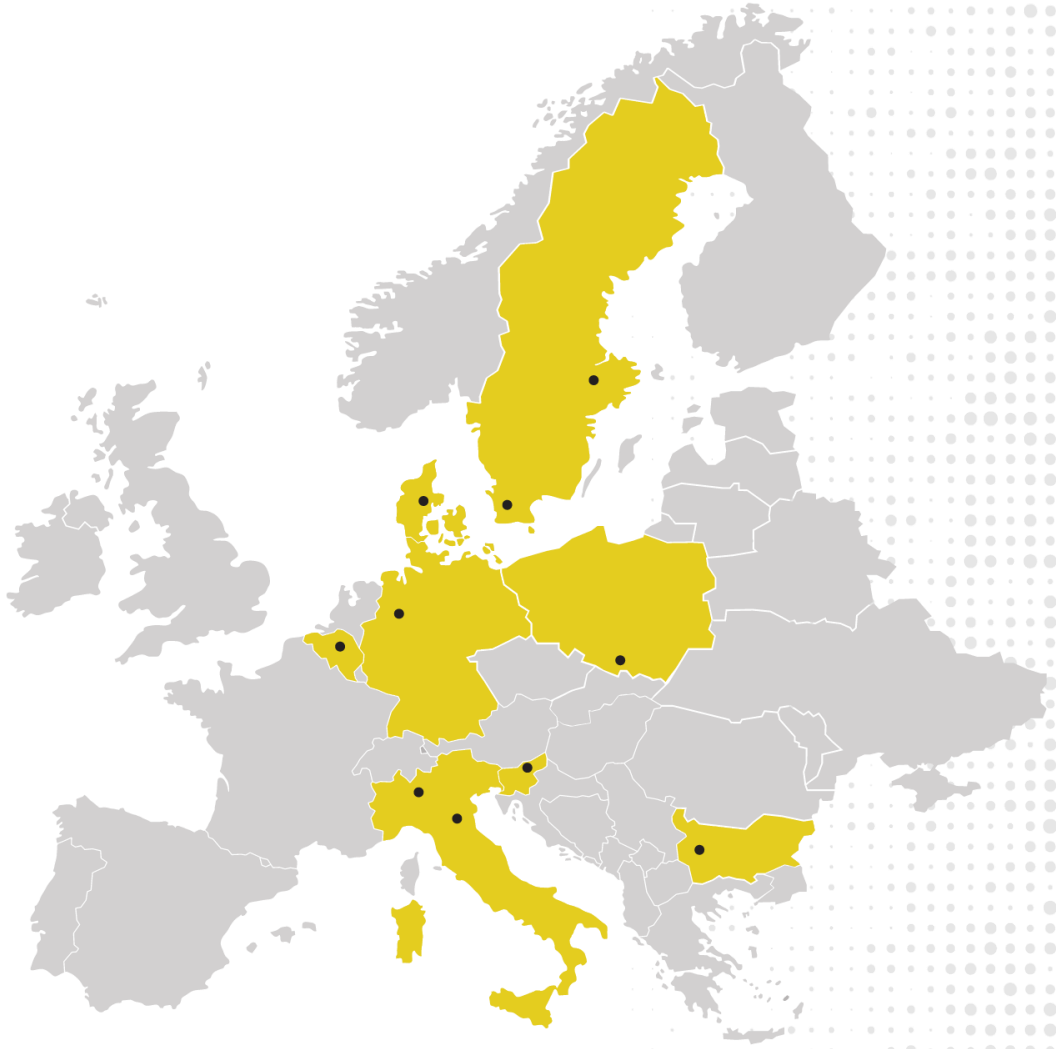
Funded by the European Union

Consortium

11 partners across 8 countries

The PollinERA consortium brings together key experts from diverse realms of knowledge – from pollinator ecology, pesticide exposure and toxicological testing, to stakeholder engagement and communications.

- – Aarhus University
- – Lund University
- – Swedish University of Agricultural Sciences
- – BeeLife European Beekeeping Coordination
- – Pensoft Publishers
- – University of Osnabrück
- – Jagiellonian University
- – Institute of Nature Conservation of the Polish Academy of Sciences
- – University of Bologna
- – Mario Negri Institute for Pharmacological Research
- – Zip Solutions




ZIP SOLUTIONS
AARHUS UNIVERSITY
UNIVERSITAS JAGELLONICA CRACOVIENSIS
LUNDS UNIVERSITET
PENSOFT
POLLINERA
ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
SLU
BeeLife
European Beekeeping Coordination
UNIVERSITÄT OSNABRÜCK
ISTITUTO DI RICERCHE FARMACOLOGICHE MARIO NEGRI · IRCCS
INSTITUTE OF NATURE CONSERVATION
PAS

Background

Challenges

Significant knowledge gaps and critical procedural limitations to current **pesticide risk assessment** (RA) with the functional group represented by the **honey bee only**, which does not necessarily share other species' biological and ecological traits

Opportunities

Moving the evaluation of the risk and impacts of pesticides and suggestions for mitigation beyond the current situation of assessing single pesticides in isolation on honey bees to an ecologically consistent **assessment of effects on insect pollinators**

Aim

Combining several *in silico* models and **develop a One System framework**, taking a systems view on risk assessment and policy evaluation, including an international long-term **monitoring scheme for pollinators and pesticides**

Specific Objectives

SO1

Fill ecotoxicological data gaps to enable realistic prediction of the source and routes of exposure and the impact of pesticides on pollinators and their sensitivity to individual pesticides and mixtures.

ACTION

Reporting on the identification of pesticide sources, routes, and levels of exposure as well as acute, (sub)chronic and interactive effects of pesticides on pollinators representing different taxonomic groups.

SO2

Develop and test a co-monitoring scheme for pesticides and pollinators across European cropping systems and landscapes, developing risk indicators and exposure information.

ACTION

Pesticide and pollinator co-monitoring scheme (PPCoMS) prototype and protocols made available through the EU Pollinator Hub.

SO3

Develop models for predicting pesticide toxicological effects on pollinators for chemicals and organisms, improve toxicokinetic/toxicodynamic (TKTD) and population models, and predict environment fate.

ACTION

In silico models related to chemical structure implemented in VEGAHUB (platform for QSAR (quantitative structure-activity relationship) models) and TKTD published on EFSA's TKPlate and species model papers published in the FESMJ open collection.

SO4

Develop a population-level systems-based approach to risk and policy assessment considering multiple stressors and long-term spatiotemporal dynamics at a landscape scale and generate an open database for pollinator/pesticide data and tools.

ACTION

Documentation of the integrated systems ERA tools completed. Predictive ERA tools are co-developed and reality-benchmarked with monitoring data.

One System Framework

SO1

Multiple chemicals

SO2

Monitoring

Multiple matrices

ONE SYSTEM

SO3

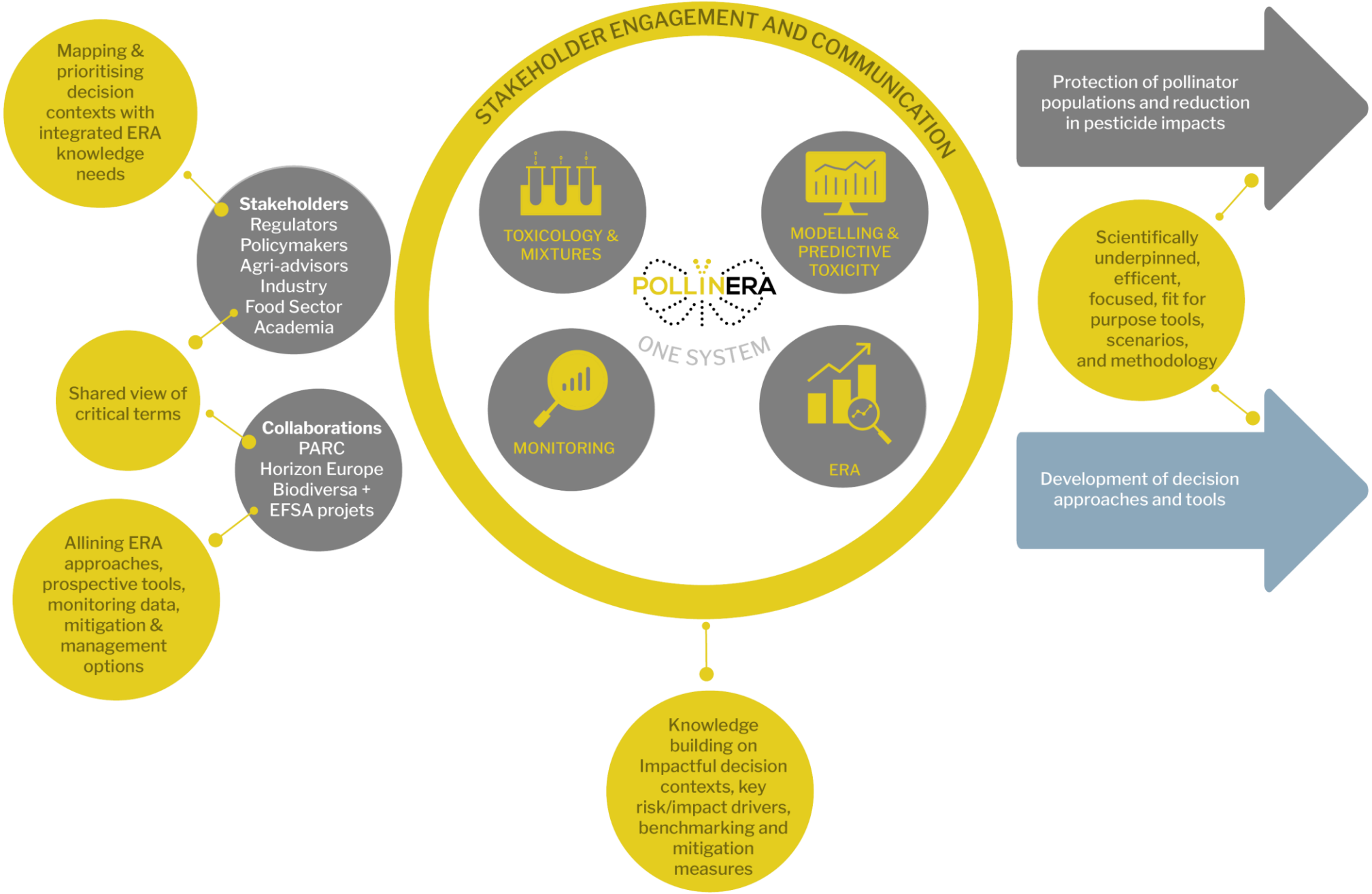
Multiple models

SO4

Multiple policies

Multiple landscapes

Approach

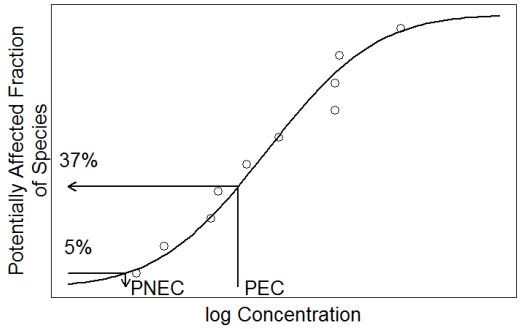

Mapping & prioritising decision contexts with integrated ERA knowledge needs
Stakeholders
Regulators
Policymakers
Agri-advisors
Industry
Food Sector
Academia
Shared view of critical terms
Collaborations
PARC
Horizon Europe
Biodiversa +
EFSA projets
Allining ERA approaches, prospective tools, monitoring data, mitigation & management options
STAKEHOLDER ENGAGEMENT AND COMMUNICATION
TOXICOLOGY & MIXTURES
MODELLING & PREDICTIVE TOXICITY
POLLINERA
ONE SYSTEM
MONITORING
ERA
Knowledge building on Impactful decision contexts, key risk/impact drivers, benchmarking and mitigation measures
Protection of pollinator populations and reduction in pesticide impacts
Scientifically underpinned, efficent, focused, fit for purpose tools, scenarios, and methodology
Development of decision approaches and tools

Work Packages

WP1

Pollinator Exposure and Sensitivity

Following a traits-based approach to **determine species' vulnerability to pesticides** by linking specific traits (morphological, physiological, ecological) to external exposure and intrinsic sensitivity;



Assessing critical pesticides (singularly or in combination) to **identify potential interactions that may lead to deviations from dose addition** (potentiation, synergism, antagonism) **and potential time-reinforced toxicity properties**;

WP1

Pollinator Exposure and Sensitivity

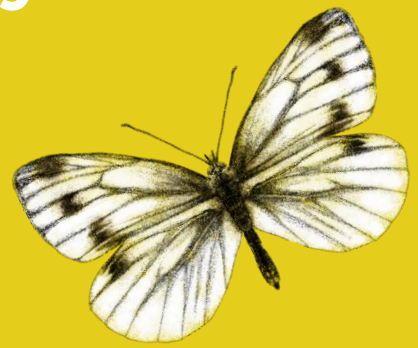
WP1 will **generate toxicological data to calibrate the models in the other WPs**, including targeted experiments to support TKTD models, and develop standardised ecotoxicological tests for new test organisms suitable for the risk assessment.

Final products:

- Standard operating procedures (SOPs) for pesticide toxicological testing of different insect pollinator taxa, and mapping of pollinator taxa sources and routes of exposure
- Potential usage as OECD Guidelines or Guidance Documents in the ERA

WP2

Predictive Toxicology



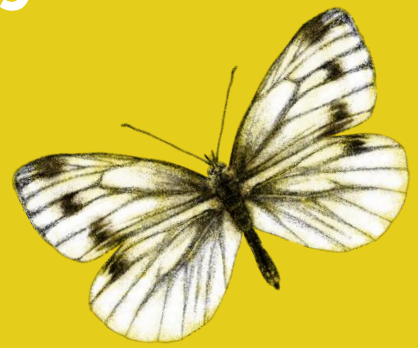
Using machine learning to **develop *in silico* models to assess the effects of pesticides and other pollutants towards pollinators**;

Including theoretical information on the modes of action and experimental values on related substances (read-across) **within the machine learning models**;

Implementing and making the developed models freely available within the open-source platform (VEGA Hub).

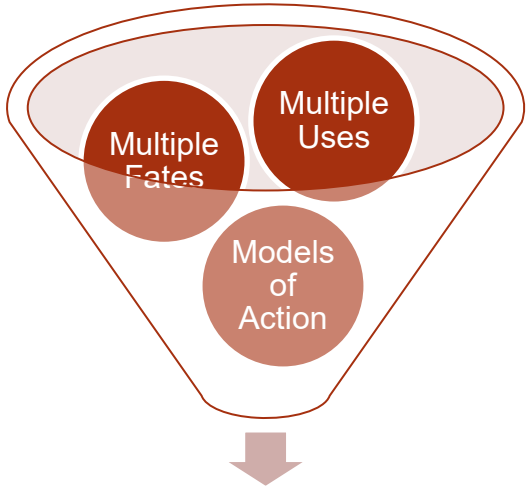
WP2

Predictive Toxicology



Providing the **simulated data** needed **to drive the other models** in the absence of actual ecotoxicological data from the laboratory;

Developing models to **group substances (CAGs) according to their common mode of action, use, and fate**;



WP3

Pollinator Modelling

Developing **TKTD models that integrate multiple exposure pathways** and linking to the pollinator species models;

Developing **pollinator species models**, representing the key pollinator groups (wild bees, butterflies, hoverflies, and moths), in ALMaSS, consisting of **two hoverflies, one butterfly, and one moth**;

Preparing **existing bee species models** (honey bee (*Apis mellifera*), bumble bee (*Bombus terrestris*), and solitary bee (*Osmia bicornis*) **and new pollinator species models for the integration of TKTD models**;

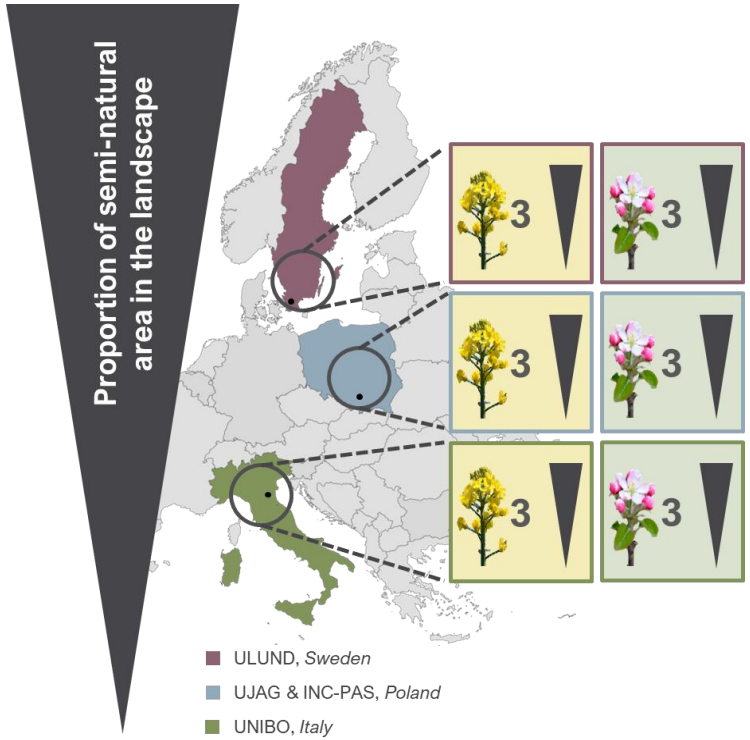
Integration of TKTD models within the pollinator species models.

WP4

Monitoring and Risk Indicators

Developing and testing a **co-monitoring scheme for tracking pesticide exposure and communities of key pollinator groups** across European cropping systems;

Developing **pesticide risk indicators** for these pollinators.



WP5

Systems Approach for Pollinator ERA and Policy Support

Integrating the toxicology, *in silico* toxicological models, animal modelling, and monitoring into a **framework for systems ERA for pollinators**;

Evaluating how these tools might assist in drawing management from all relevant policy instruments together to **maximise synergy and increase the impact of the systems ERA for pollinators**;

Exploring alternative approaches in ERA scenarios and models to **identify relevant risk drivers and ensure robustness and generic applicability of tools and ERA outcomes** for high-level decisions;

Adopting a system perspective thus **optimising resource use, reducing risk, and ensuring data and knowledge reusability** across regulatory and societal sectors.

WP6

Communication, Dissemination and Exploitation

Ensuring the broad recognition of project results by supplying PollinERA with a strong **visual identity and coherently tailored promotion**;

Setting up a **clear, relevant, and effective Plan for Exploitation and Dissemination of Results, including a communication strategy and an engagement strategy**, the update of the same and the delivery of the corresponding activities and reporting thereof;

Stimulating discussion on new policies or implementation of existing ones based on PollinERA results;

Maximising the visibility, reputation, as well as project impact, with a **clear pathway towards selected Key Exploitable Results**.

WP7

Project Management

Providing the methods, tools, and infrastructure to manage the project efficiently;

Facilitating internal communication and collaboration to ensure PollinERA reaches its objectives and fulfils its contractual commitments;

Facilitating the coordination with an external advisory board used to help guide the project.










Study Species

Bees

Osmia bicornis
(Red mason bee)

Bombus terrestris
(Buff-tailed bumblebee)

Apis melliferra
(Honeybee)

Scientific illustrations by Denitsa Peneva

Hoverflies

Sphaerophoria scripta (Long hoverfly)

Eristalis tenax (Common drone fly)

Scientific illustrations by Denitsa Peneva

Butterfly

Pieris napi (Green-veined white)

Moth

Noctua pronuba (Large yellow underwing)

Scientific illustrations by Denitsa Peneva

PollinERA expected results

New and Improved Methods

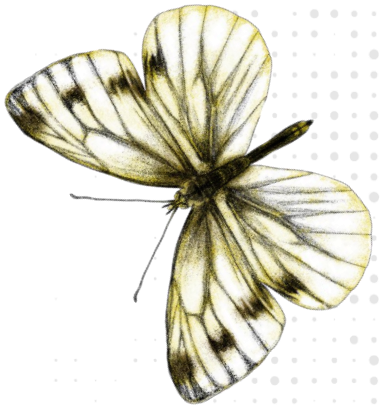
Pesticide **testing protocols** for non-bee pollinators, **co-monitoring schemes** for environmental contamination and pollinators, development of cumulative assessment groups (**CAGs**) of pesticides for ERA, *in silico* **prediction of toxicological effects** for novel pesticides and mixtures for the protection of pollinator communities.

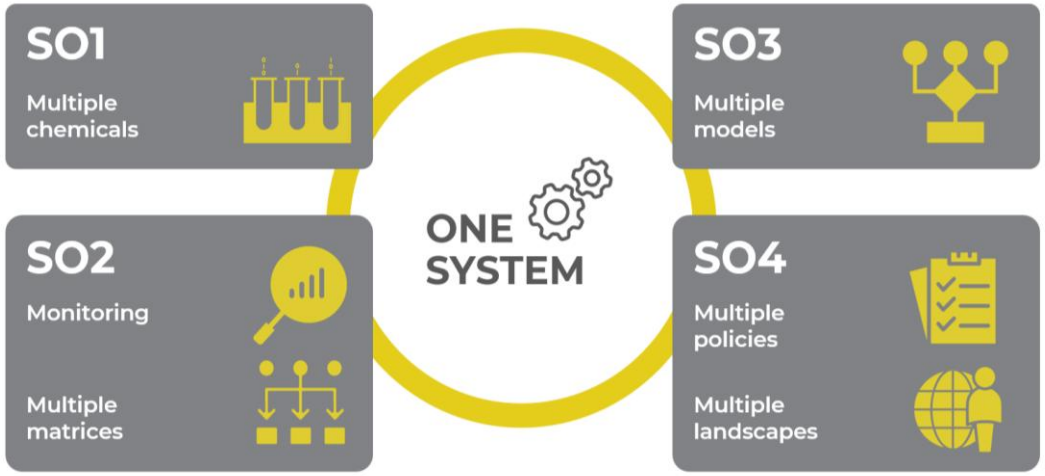
Knowledge Gaps Filled

Information on **sources and routes of pesticide exposure** for key pollinator groups, the **pollinator sensitivity** to single pesticides and combinations, and support for ERA and TKTD modelling including **chronic toxicity and sublethal effects** of **single and multiple chemicals**.

ERA Toolset

Population and landscape modelling and **environmental scenarios** for authorisation and landscape management of pesticides; **focal organism suggestions** for RA. Development of **risk indicators based on cumulative risk** (toxic load), initial identification of harmful pesticides, and an **Open Science curated resource** for pollinators and pesticide data.





- Ecologically realistic – includes context
- Multiple stressors
- Links monitoring and modelling
- Uses real landscapes and farming
- Complex tools with a simple interface

PollinERA Outcomes

The immediate impacts after PollinERA

Exploitation of Knowledge

Better understanding of pollinator/pesticide interactions and predictive toxicology used to support risk assessment, policy, and science by **filling data gaps** on pollinator ecotoxicology and **methods provision** for future development.

Results and methods **feed into PARC & Biodiversa+**. This forms the basis for a tool for ranking pesticides based on risk.

Open Science

Open access for toxicological and risk assessment data, methods, *in silico* tools, and protocols, linked to EFSA Knowledge Junction, JRC Knowledge centres, GitLab, and EU Pollinator Hub.

Adoption of PollinERA toolset and methods

Monitoring, testing, and *in silico* tools for ERA on insect pollinators validated by OECD and adopted by EFSA and Member States.

Implementation of a systems approach for evaluating pesticide impacts on wild pollinators to support policy initiatives and targets, as well as using risk indicators to track progress.

Use of the **PollinERA One System** to identify and implement mitigation measures in agricultural systems and policies.

Synergies

Funded by
the European Union

PollinERA and WildPosh's shared ambition is to provide better understanding of the exposure routes and toxicological and ecological impacts of chemical pollution on terrestrial biodiversity and ecosystems.

To maximise impact and ensure sustainability of results, the two projects will unfold in close collaboration. Some collaboration mechanisms include **joint communication activities and events, joint data management strategy and alignment of activities to solidify the quality of final outputs**.

PollinERA will continue to explore collaboration opportunities with other pollinator initiatives like Safeguard, ANTENNA, RestPoll, etc.

POLLINERA

Thank you for your attention!

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