

Advances in Risk Assessment and Management Options by the European Precision Application Task Force (EUPAF)

*Bernhard Gottesbüren, Rena Isemer, Isabelle
Christian, Edgars Felkers, Jonas Schartner,
Anne Alix, Grant Stark*

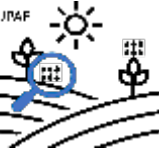
Pesticide Symposium XVIII Cremona 2026



EUPAF

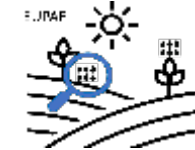


EUPAF – European Precision Application Task Force



- What is EUPAF
 - 130 experts: agricultural machinery, chemistry, farming, regulatory
 - Formed June 2023
 - Public and private sector
- What it does
 - Create a scientific platform for connecting expertise in precision applications and risk assessment and management
 - Identify use categories for precision applications and develop terminology to reflect these categories in regulatory dossiers (GAP, glossary)
 - Explores approaches for **scenario and model development**
 - Proposes risk-management and equivalence approaches
- Strategic point
 - Shaping the methodology with participation of all stakeholders while adoption is early

EUPAF Organisation



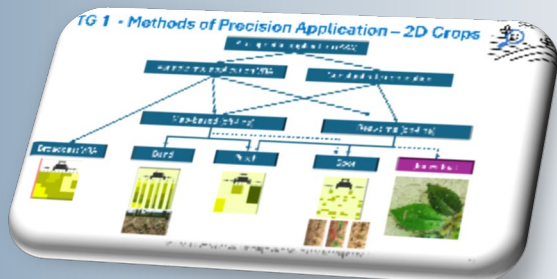
Steering Committee

Grant Stark (HSE, chair), Anne Alix (Corteva Agriscience, co-chair), Bernhard Gottesbüren (Make-Sense consulting), Peter Hloben (CEMA), Corné Kempenaar (BO Akkerbouw), Patrick Pagani (Copa Cogeca), Anne Steenbergh (ctgb), Jens Wegener (JKI), Jonas Schartner (BVL)

Task Group 1

Inventory of Precision Uses and Categories

Chairs: JC. Rousseau, E. Gil and G. Stark



Subgroups:
drones (UAVs)
3D applications

Task Group 2

GAP tables, Glossary and Handbook

Chairs: A. Pfaff and J. Dressel

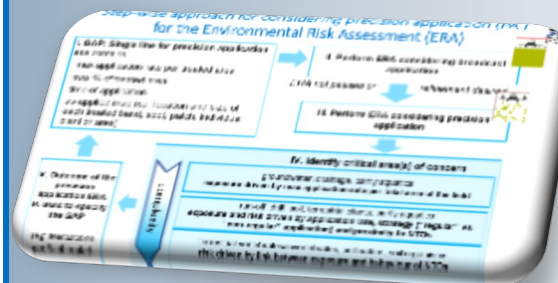
Task Group X Compliance

Chair: tbd

Task Group 3&4

Risk Assessment and Management

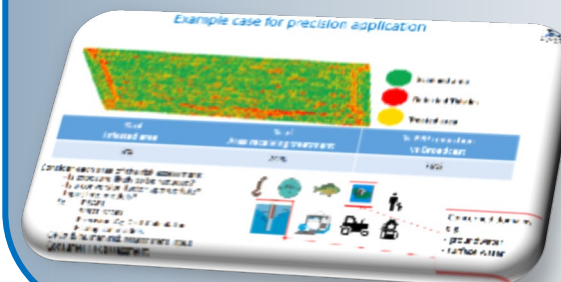
Chairs: R. Isemer and B. Gottesbüren



Subgroups:
Envi Exposure; Envi Effects
Dietary RAs; Non-Dietary RA
Flexible Risk Mitigation

Task Group 5 Case Studies for EU Compendium

Chair: A. Alix

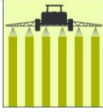
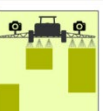
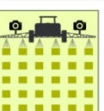
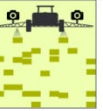
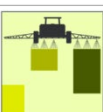
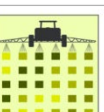
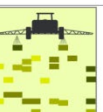
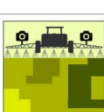
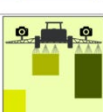
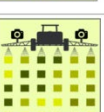
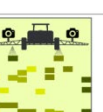


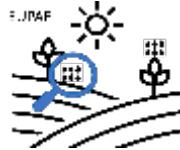
Task Group 6 Equivalence tables of tool performance

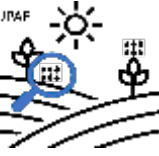
Chair: tbd

TG 1: Summary

- **Use existing ISO and EPPO definitions** where possible, but develop new standard terminology to fully describe PA techniques and technologies to assist discussion and promotion
- **Existing equipment** can be used in many cases for broadcast VRA, band and patch applications
- New sprayers/applicators are being developed for spot and individual plant application which offer **significant Use, and Risk reduction opportunities.**
- New technology developments **All Site-Specific Applications** can be performed with **Constant** or **Variable Rate Application.**
- **Broadcast spraying** may remain the application of choice for insecticides and fungicides in the near future (insects and diseases can often spread rapidly and severely affect crop yields and/or quality).

Geometry	broadcast	band	patch	regular spot	irregular spot	single plant
pure geometry						
geometry offline						
geometry online						
geometry VRA						
geometry offline VRA						
geometry online VRA						





TG 2: Appropriate language for communication of PA uses in GAP tables

- PA Implementation into authorization adds complexity
 - **as much as needed, as little as possible**
- Who communicates?
 - **Personas and user stories**
 - Users of PPP, risk assessors and managers, PP-counseling, chemical industry, enforcement, digital Systems, etc.
- Three deliverables:
 - Example GAP table with 2D PA uses
 - Glossary
 - GAP table handbook with pictograms
- Current versions of Example GAP, handbook and glossary can be found here:
www.bvl.bund.de/EUPAF

Prescription
application
map

Real-time
application

Field average
application
rate

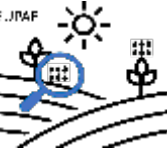
Variable rate
application

Equivalent
application
technique

Spot-
application,
non-regular

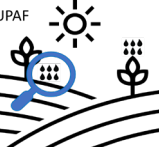
Treated
area

TG 3&4: Recommendations for the risk assessment



- Identify potential changes, adapt risk assessment and propose potential Risk Mitigation Measures for each precision application use category identified in TG1
- Four subgroups established:
 - Environmental Exposure; Environmental Effects and Risk
 - Human Non-Dietary Risk Assessment; Human Dietary Risk Assessment
- Develop a consistent tiered framework for environmental exposure, risk assessment and mitigation
 - Foster the use of simple conversion factors for possible (= factor to account for reduced application rate by PA)
 - Consider site characterization, site information and precision application specific algorithms to overcome current worst-case scenarios and assessments
 - Prescribed longer term site-specific characteristics (e.g. soil, climate, field margins, ecoregions)
- Link to document: [BVL - EUPAF - Risk Assessment and Management for Precision Application](#)

Step-wise approach for considering precision application (PA) for the Environmental Risk Assessment (ERA)



I. GAP: Single line for precision application use contains

- max application rate per treated area
- max % of treated area
- time of application
- as-applied map (*i.e.* location and size of each treated band, spot, patch, individual plant or area)

II. Perform ERA considering broadcast application

ERA not passed or refinement desired

III. Perform ERA considering precision application

IV. Identify critical area(s) of concern

groundwater, drainage, partly aquatics
exposure driven by max application rate per total area of the field

run-off, drift, soil, terrestrial plants, partly aquatics
exposure and risk driven by application rate, strategy ("regular" vs "non-regular" application) and proximity to NTOs

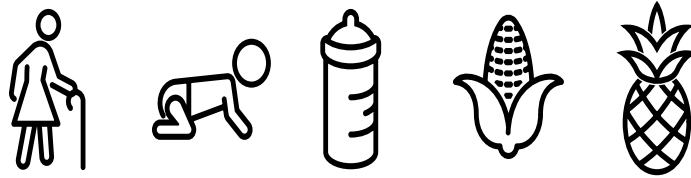
terrestrial vertebrates/invertebrates, pollinators, soil organisms
risk driven by link between exposure and behaviour of NTOs

V. Outcome of the precision application ERA is used to specify the GAP

(*e.g.* feedback on max % of treated area)

complexity

Dietary Safety

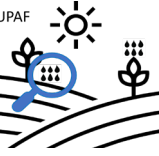


As outlined for Environmental Risk Assessments, PA uses **could be covered by broadcast labels**. This is also true for Non-Dietary Safety (next slide).

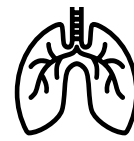
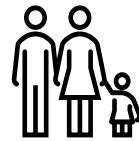
- PA on bulked 2-D crops may result in an overall reduction in residue dietary exposure which could be addressed by a conversion factor.
- For other crops (2-D non bulk commodity, 3D), the impact of PA on residue dietary exposure needs to be examined further. In some cases, adapted exposure assessment may require the generation of specific residue data.

➤ **Implications of PA for the dietary risk assessment are mostly driven by dose changes**

Precision Application in the Human Safety Risk Assessment



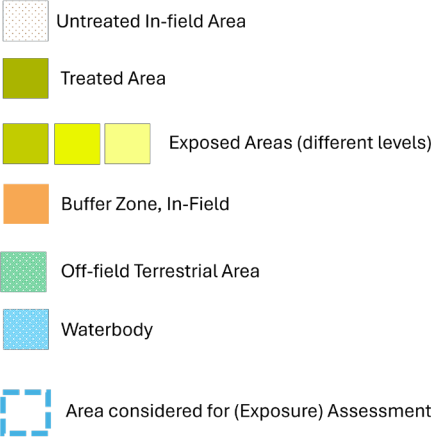
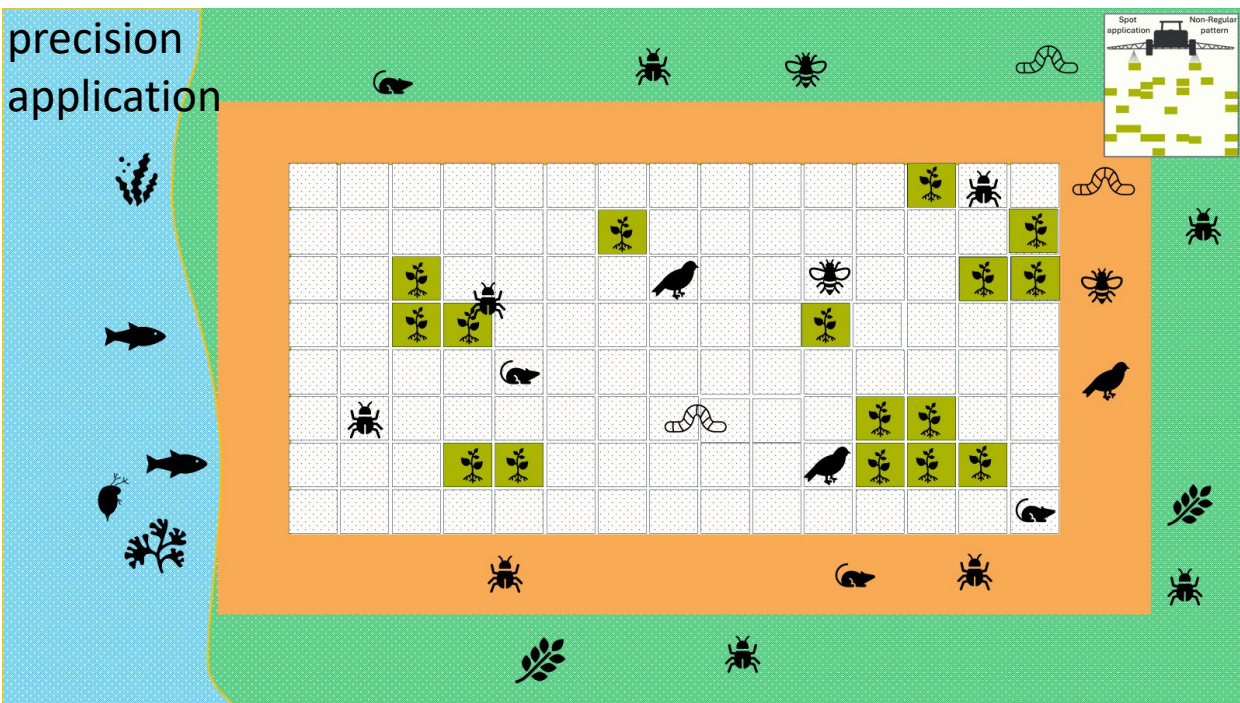
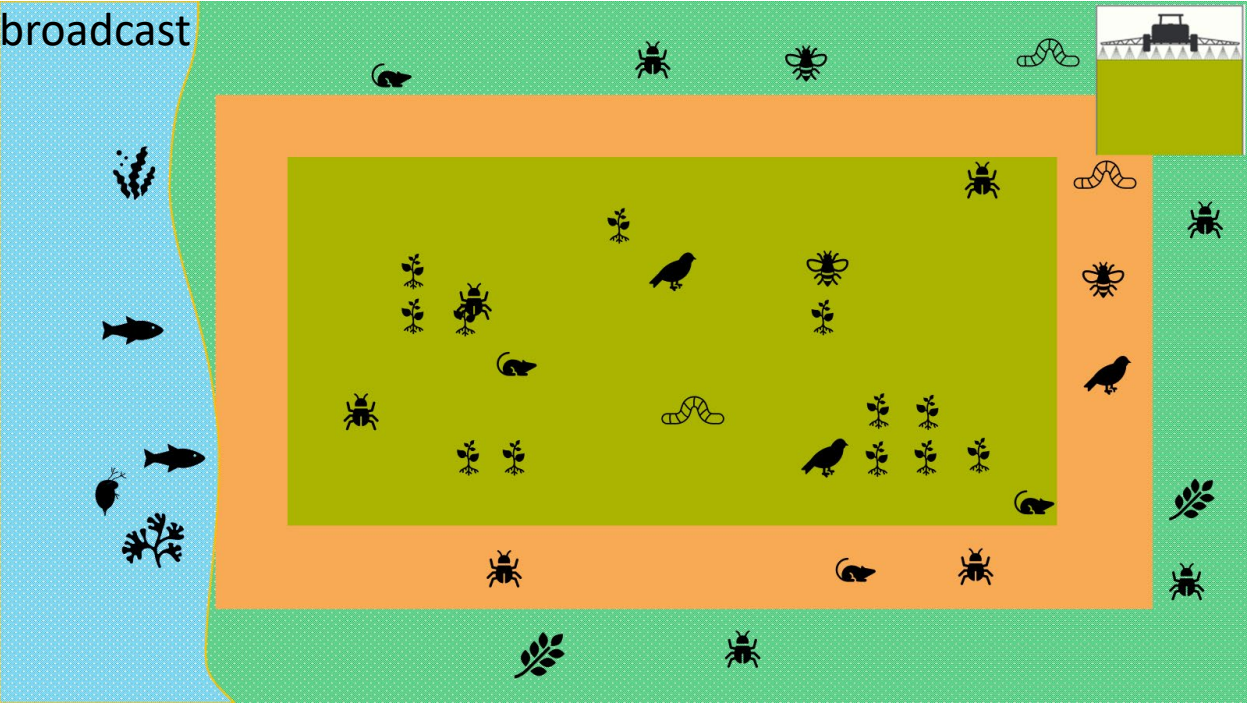
Non-Dietary Safety



- Similarly, as outlined for the Environmental Risk Assessment, **each area (Operator / Re-entry worker/ Bystander/ Resident) needs specific considerations** (various scenarios related to crop, technology, human behaviour need to be addressed).
 - Different populations employ different exposure calculation approaches (e.g. operator quantile regression v worker simple multiplication of high percentiles).
 - Different scenarios are driven by different parameters (total applied amount v concentration v independent of application rate and distribution).
- Probabilistic modelling is discussed as an approach to address the need for testing a huge diversity of specific exposure situations.

➤ **Implications of PA for the non-dietary risk assessment necessitate the recognition of field-specific data/information**

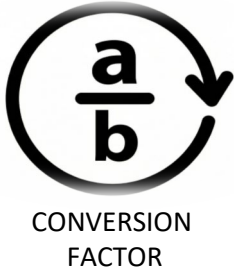
Environmental Risk Assessment for Broadcast Applications at Constant Rate and Precision Application



Risk assessments consider diverse areas (soil, groundwater, drift, run-off, drainage, non-target arthropods, birds and mammals, pollinators, non-target plants *etc.*)

	Birds
	Mammals
	Aquatic Vertebrates
	Aquatic Invertebrates
	Pollinators
	Non-Target Arthropods
	Soil Organisms
	Non-Target Terrestrial Plants
	Aquatic Plants/Algae
	Crop
	Pests (Weeds/Fungal Diseases/Insects)

Conceptual Tiered Approach for Environmental Exposure Assessment including PA

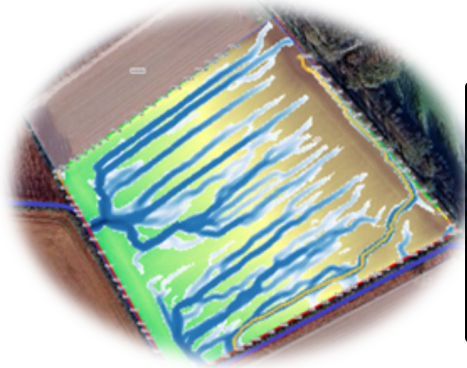


Tier 1
Standard Regulatory Assessment using a conversion factor

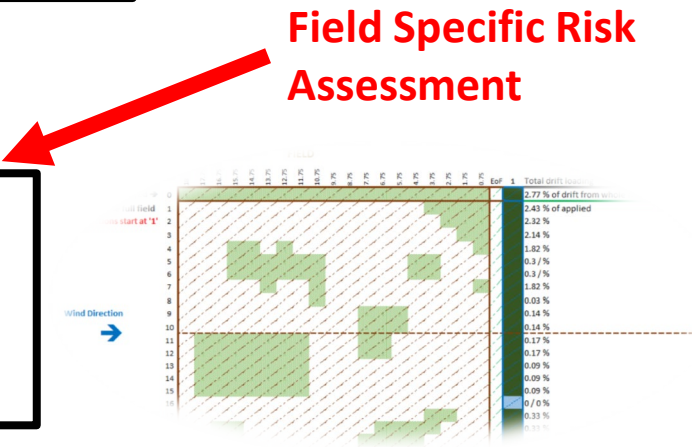
Tier 2a
Standard Regulatory Assessment using pre-defined characterisation of sites

Tier 2b
Standard Regulatory Assessment using refined conversion strategies

Tier 3
Regulatory assessment using predefined site characteristics, local site information available at the time of application and models adapted for precision application

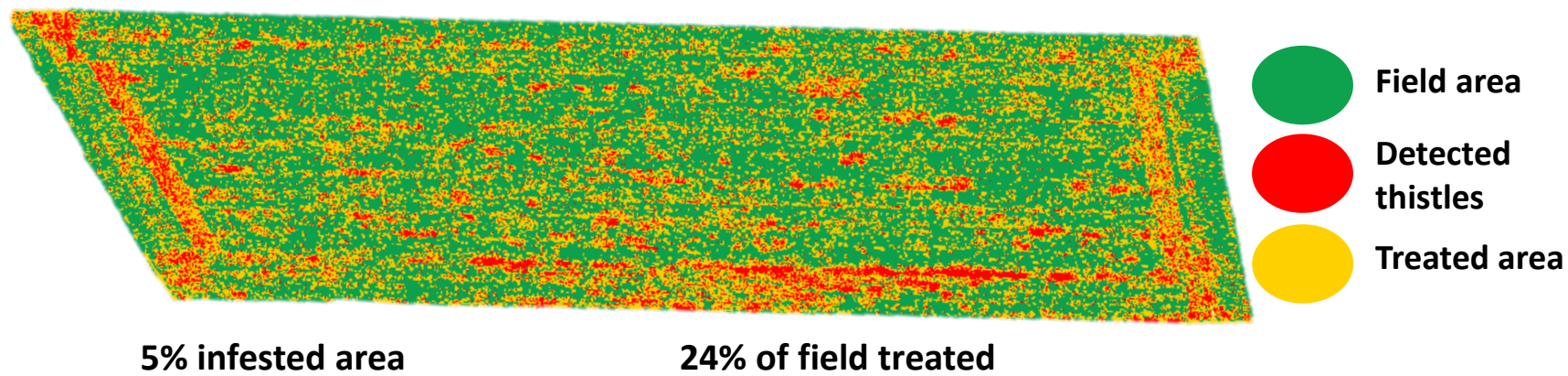


site-specific data
e.g.
soil properties
presence of drains
presence of non-target habitats
target to be controlled
equipment specific data
wind conditions
...



Tier 1 – Conversion Factor

- Scale exposure using the field-scale rate reduction
- Example (provided by Corteva)

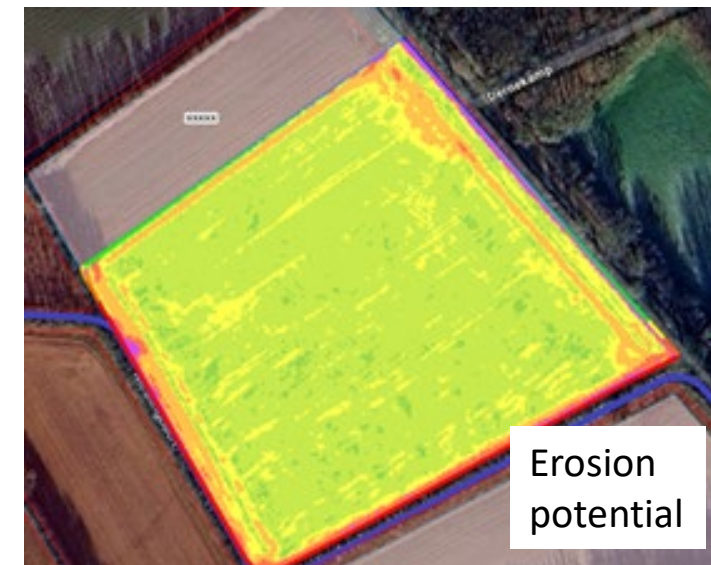
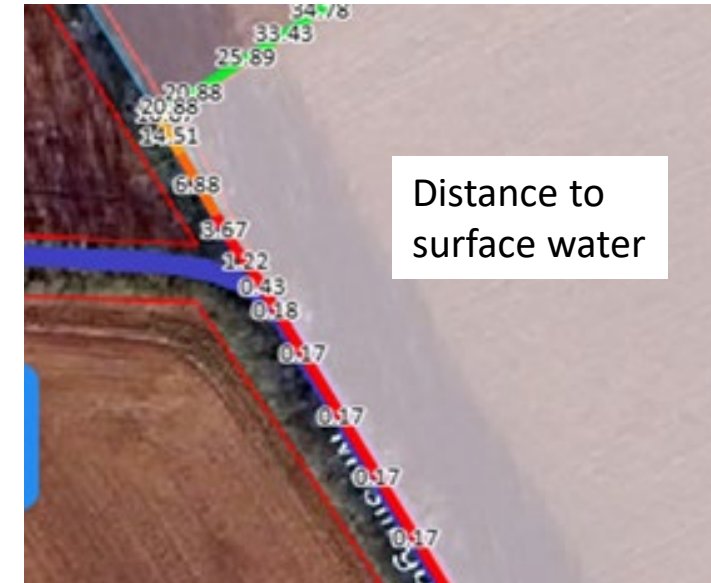


Compartment	Conversion Factor
Groundwater (leaching)	Works
Drainage	Works
Runoff	Partly (proximity to water body and spatial pattern may matter)
Drift	Partly (proximity to edge of field and spatial pattern may matter)

- 76% reduction compared to broadcast application
- A single conversion factor is defensible where exposure is proportional to the average field rate

Tier 2 – Landscape and Technology Refinement

- **Tier 2a – Refine the landscape used in the scenario for risk assessment**
- From generic worst-case to predefined, regionally realistic conditions
 - Topography (slope)
 - Soil properties
 - Weather data
- Higher level of realism
 - Can be more vulnerable than default



Tier 2 – Landscape and Technology Refinement



Ecorobotix ARA (<https://ecorobotix.com>)

- **Tier 2b – Refine the technology used for exposure assessment**

Replace standard assumptions with equipment-specific evidence

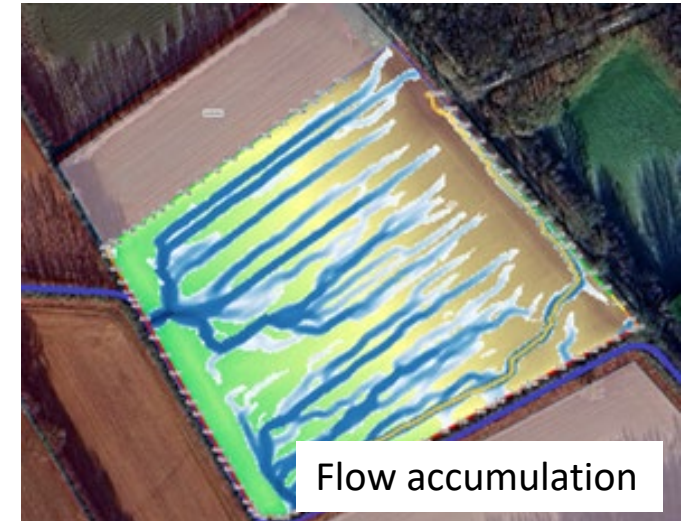
- ISO 22866-compliant drift trials
- Ultra precise sprayer

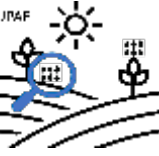
Already regulatory reality

- Netherlands and Germany adopted a 95% drift reduction for the ecorobotix ARA

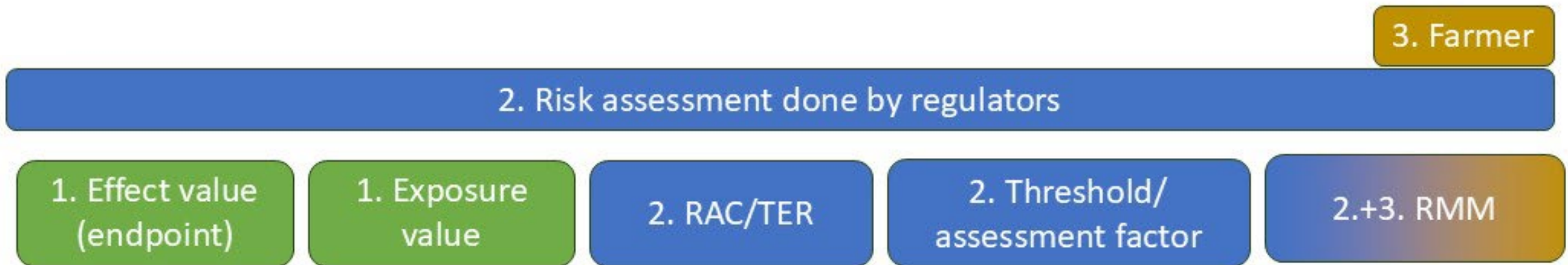
Tier 3 – Field Specific Assessment

- Apply landscape refinement (Tier 2a) to a specific field
 - Topography, slope, weather data
- Add site-specific data using web-services (e.g., JKI SYNOPS-GIS)
 - Presence of drains
 - Presence of non-target habitats
 - Equipment specific data
 - Weather conditions at time of application
 - Actual field edge and riparian zone
 - Drone imagery of infested area

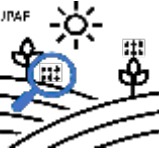




For plant protection product registrations, **risk assessments (RA)** are **conducted before the application takes place** assuming a max. area treated/max. total dose per treated site and crop/season/year as defined by the GAP in a realistic worst-case approach.

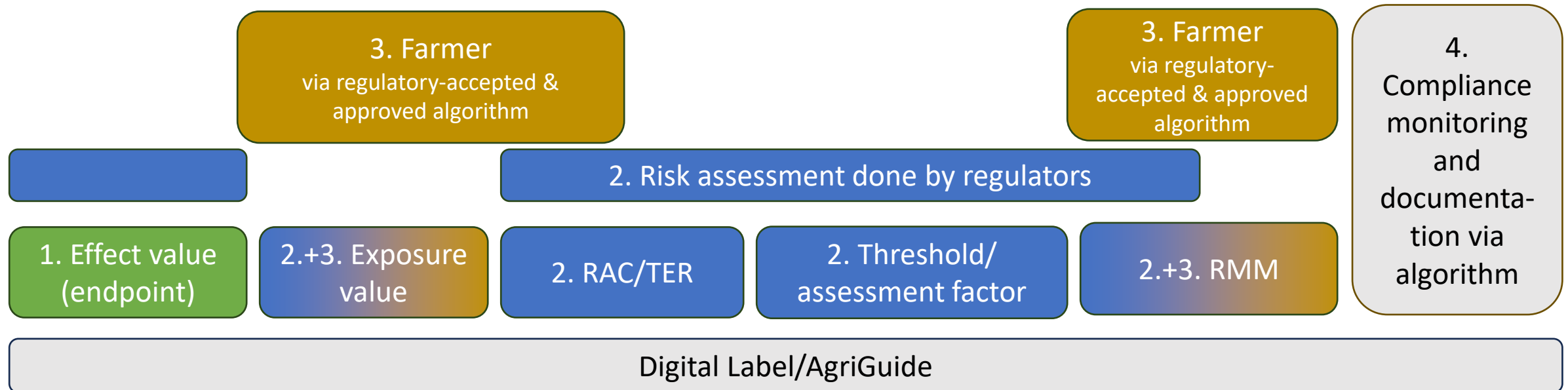


Numbers (1., 2., 3., 4.) indicate the order of processes and /or data provisioning in time. Colors in boxes indicate the stakeholder responsible for providing the information and /or performing the process with **green = applicant**, **blue = regulator**, **brown = farmer**. RAC = Regulatory Accepted Concentration; TER = Toxicity Exposure Ratio



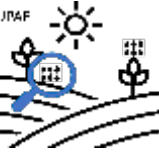
Flexible Risk Mitigation

ensures safe conditions of use are met (*e.g.* maximum exposure values) while enabling an adaptation of the RMMs to spatial and temporal site-specific characteristics/information (*e.g.* wind-direction-based buffer zones)

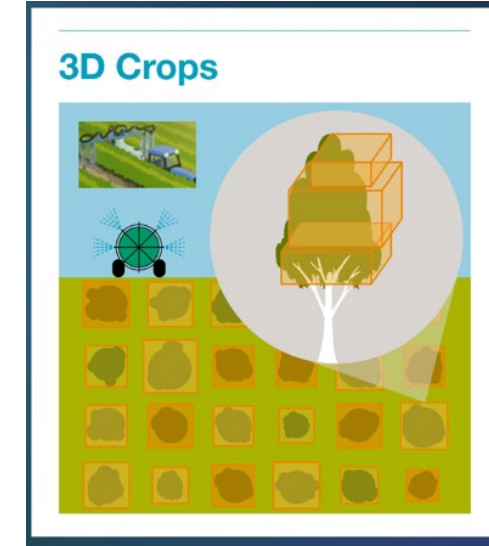


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“Further” Task Subgroups in EUPAF

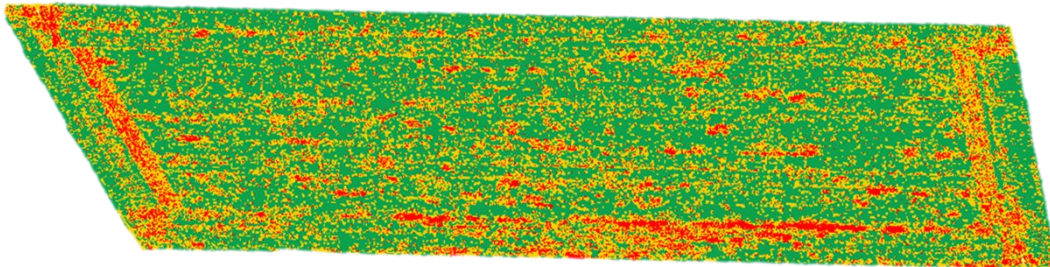


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TG 1.2 3D-Crops

TG 1.1 Drones (UAV application)

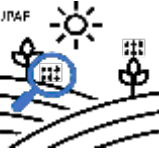


TG 5: case studies



TG 1.3 Flexible risk mitigation

Discussion on Precision Application in Regulatory Context



- **EU COM**

1. [Compendium of Conditions of Use to Reduce Exposure and Risk from Plant Protection Products March 2024](#)
2. Stakeholder Workshop Dec. 2025 on the status of precision application
3. Stakeholder Workshop on “Compliance” in 2026

- **European Member States**

Workshop on Precision Application in Env. Risk Assessment 26-28. November 2025

- **New EFSA Initiative on Precision Application Techniques.**

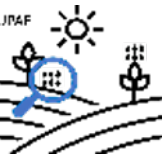
Establishment of a dedicated subgroup under the Pesticide Steering Network, primarily composed of MSs experts and EFSA staff (pot. involvement of other experts at a later stage)

- **EUPAF Overview on regulatory acceptance of conversion factors for PA (Sept 2026)**
(see next slide)

Regulatory acceptance of conversion factors (Sept `26)



Compartment	Transport Process	Conversion Factor	Entity
Groundwater	Leaching	Conversion factor / adjustment factor for % treated area	EUPAF, EU MS RA, UK, AT, BE, DE
Surface water	Drainage	Conversion factor for % treated area	EUPAF, UK, AT
	Drainage	Conversion factor for band application and regular spots	EU MS RA
	Drainage	Conversion factor spot application for % treated area (up to 40%)	BE
	Runoff	Conversion factor for % treated area	AT
	Runoff	1. Conversion factors for PA are accepted for groundwater assessment in many European member states 2. For transport processes to surface water the situation is still a bit more heterogeneous regarding the use of conversion factors	
	Runoff		
	Runoff		
	Runoff		
	Runoff	Conversion factor spot application for % treated area (up to 40%)	BE
	Drift	Conversion factor for band application and regular spots otherwise use appropriate model	EUPAF
	Drift	buffer distances > 2m adjustment factor based on treated % area buffer distances < 2 m, no adjustment factor	UK
	Drift	No adjustment factor	AT
	Drift	Conversion factor spot application for % treated area (up to 40%)	BE



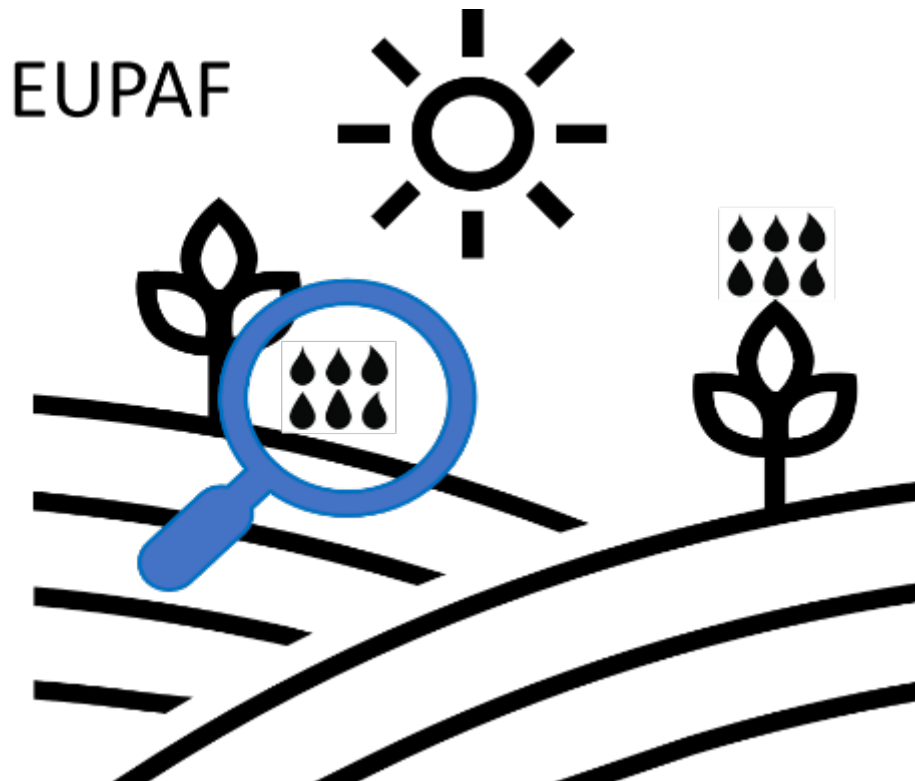
Summary and Conclusions

- Evaluation of PA risk reduction and mitigation potential needs a **tailor-made risk assessment for the PA use category and the area under concern.**
- PA Environmental risk assessment depends on **use rate and spatial characteristics** (e.g. proximity to sensitive non-target features) **and behavior of non-target organisms.**
- EUPAF proposes **options for each area of the risk assessment** to fit PA within the **current regulatory procedures** and also designs a **scheme for the future.**

EUPAF aims to support the integration of PA in the agricultural tool-box and as a risk mitigation measures by initiating development of EU-harmonized approaches for a PA risk assessment.

Thank you!

- Have a look at EUPAF posters:



Contacts:

bernhard.gottesbueren@make-sense.consulting

[BVL - EUPAF](#)



EUPAF Poster at this Symposium

1. **Process Models** for Environmental Exposure Assessment of Precision Application: A Tiered Inventory from the EUPAF Working Group
2. EUPAF – **GIS Data** as a Basis for Exposure Modelling in Precision Plant Protection Applications
3. Recommendations for Development of **Environmental Exposure Scenarios** for Precision Pesticide Applications
4. EUPAF - Recommendations for **Linking of Exposure and Effect** Risk Assessments
5. EUPAF — General considerations on **environmental risk assessment of 3-D (canopy) precision application** of plant protection products in orchards and vineyards.