EUPAF—POSTER SESSION at Pesticide Symposium XVIII Cremona 2026

EUPAF - Recommendations for Linking of Exposure and Effect Risk Assessments

Dirk Nickisch[1], Olivier de Cirugeda Helle[2], Bernhard Gottesbüren[3], Hendrik Rathjens[4]

[1] RIFCON GmbH, Germany [2] Corteva Agriscience, Switzerland [3] make-sense consulting, Germany [4] Stone Environmental, Austria

INTRODUCTION

Integrated exposure and effect modelling is increasingly being used for the risk assessment of plant protection products, particularly in higher-tier approaches such as landscape-scale modelling and in non-standard use scenarios including precision application technologies. These developments require closer harmonization between exposure and effects modelling, disciplines that have historically evolved independently and at different levels of complexity.

APPROACHES TO ADDRESS PRECISION APPLICATION SPRAY PATTERNS

Two complementary concepts are proposed to facilitate the harmonization between exposure and effects modelling. The first is the definition of a **Representative Elementary Volume (REV)**[a] or **Representative Elementary Area (REA)**, defined as the smallest spatial unit over which measurements can be made that are representative of the whole system which can be used for regular patterns (see Figure 1). In broadcast applications, the REA is typically expressed as a point estimate in the soil and groundwater risk assessments. The second approach, **probabilistic risk assessment**, is recommended as a powerful alternative, especially for scenarios involving irregular application patterns (see Figure 2) or effect calculations for mobile organisms.

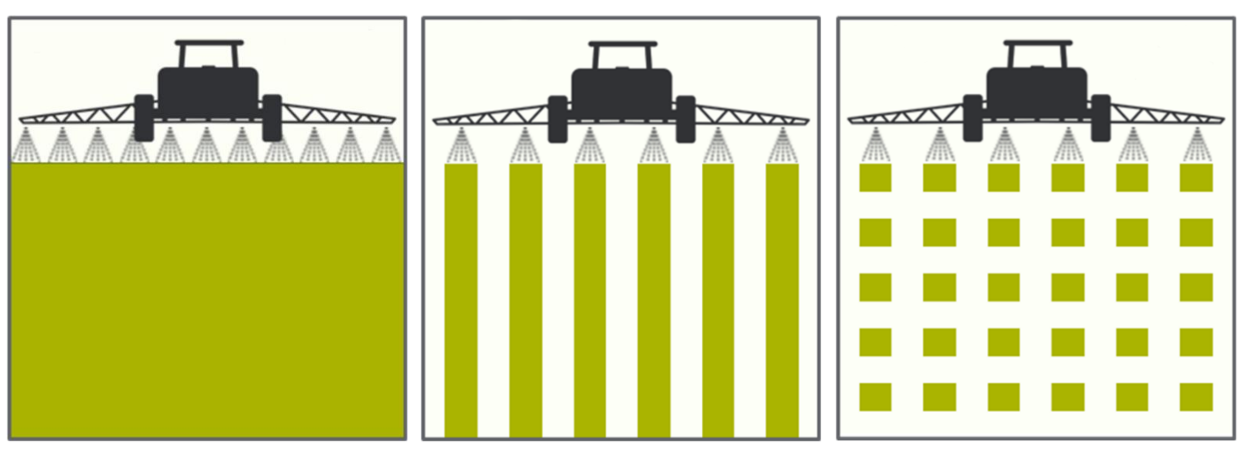


Figure 1. Schematic representation of regular spray patterns

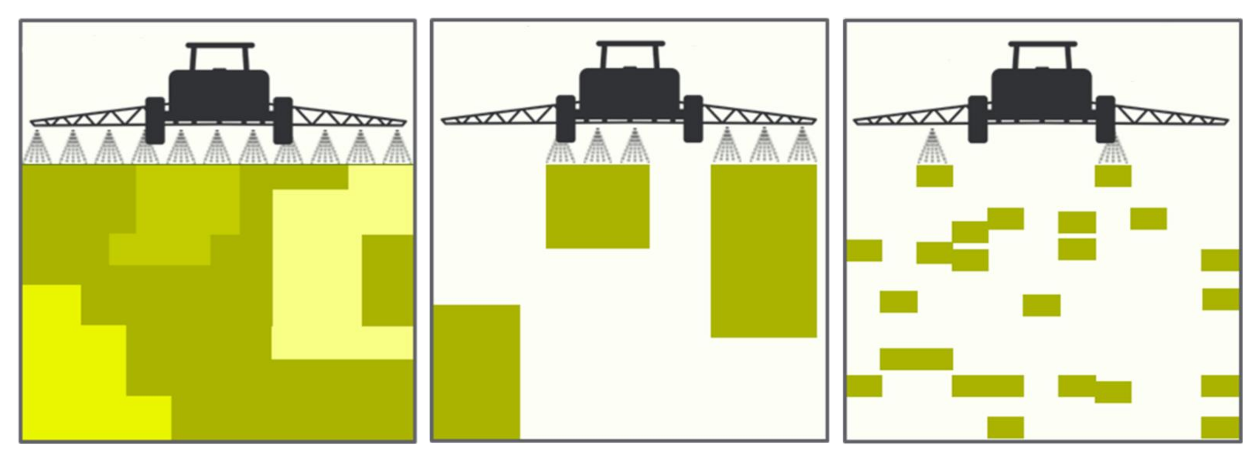


Figure 2. Schematic representation of non-regular spray patterns

EXAMPLE OF A PROBABILISTIC APPROACH

Applicability of REA approaches becomes increasingly challenging for non-regular or spatially heterogeneous application patterns. For example, in groundwater exposure assessments, it is relatively straightforward to infer that spraying only 10% of a bare field would reduce soil or groundwater contamination by approximately 90%. In contrast, this proportional relationship is far less clear when evaluating aquatic exposure and impacts on aquatic organisms or when evaluating mobile terrestrial species. An example for a probabilistic exposure approach for the estimation of impacts on non-mobile aquatic organisms after spot application is illustrated in Figure 3.

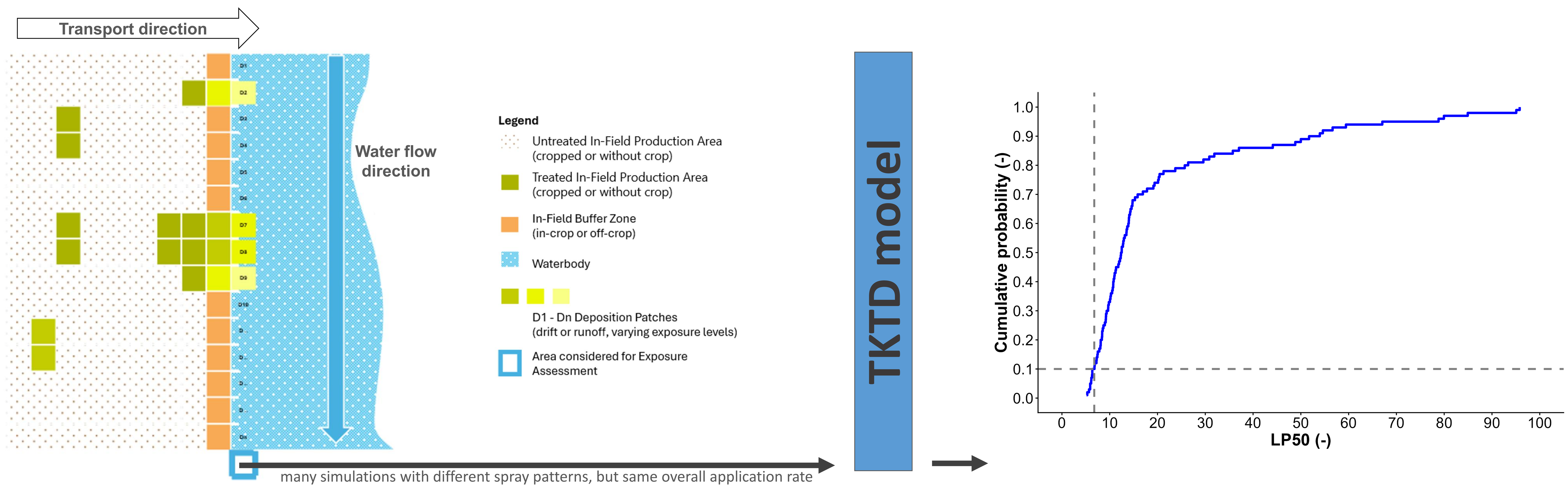


Figure 3. Illustration of in-field components and relation to off-field (non-target) aquatic landscape features with reporting of exposure within an "Assessment Segment" (like FOCUSsw Step 3). Exposure of Assessment segment can be calculated for large number of irregular spray patterns which can be used in TKTD models like GUTS[b] for the estimation of lethal profile values (LP50, blue line, right graph). LP50 is the multiplication factor of an exposure profile which will result in 50% mortality. For a pragmatic risk assessment of a non-mobile organism, the 10th percentile LP50 value (dashed line, right graph) could be used.

RECOMMENDATIONS

- The application of REV or REA concepts appears feasible and meaningful for regular exposure patterns and may help to maintain pragmatic Environmental Risk Assessment approaches.
- Probabilistic risk assessment is recommended for scenarios involving irregular application patterns or species with variable mobility.
- By explicitly accounting for spatial and biological variability and embracing uncertainty, probabilistic approaches allow for a more realistic representation of ecological exposure and effects under real-world conditions.

REFERENCES

a) Wu, M., Wu, J., Wu, J., & Hu, B. X. (2020). A new criterion for determining the representative elementary volume of translucent porous media and inner contaminant. Hydrology and Earth System Sciences, 24(12), 5903-5917.

b) EFSA Panel on Plant Protection Products and their Residues (2018). Scientific opinion on the state of the art of Toxicokinetic/Toxicodynamic (TKTD) effect models for regulatory risk assessment of pesticides for aquatic organisms. EFSA Journal, 16(8), 5377. https://doi.org/10.2903/j.efsa.2018.5377

ACKNOWLEDGEMENTS

This work was developed within the EUPAF Task Groups 3 & 4 (Environmental Exposure). We sincerely thank all contributors for their valuable input and collaboration.

CONTACT

dirk.nickisch@rifcon.de

EUPAF—POSTER SESSION at Pesticide Symposium XVIII Cremona 2026

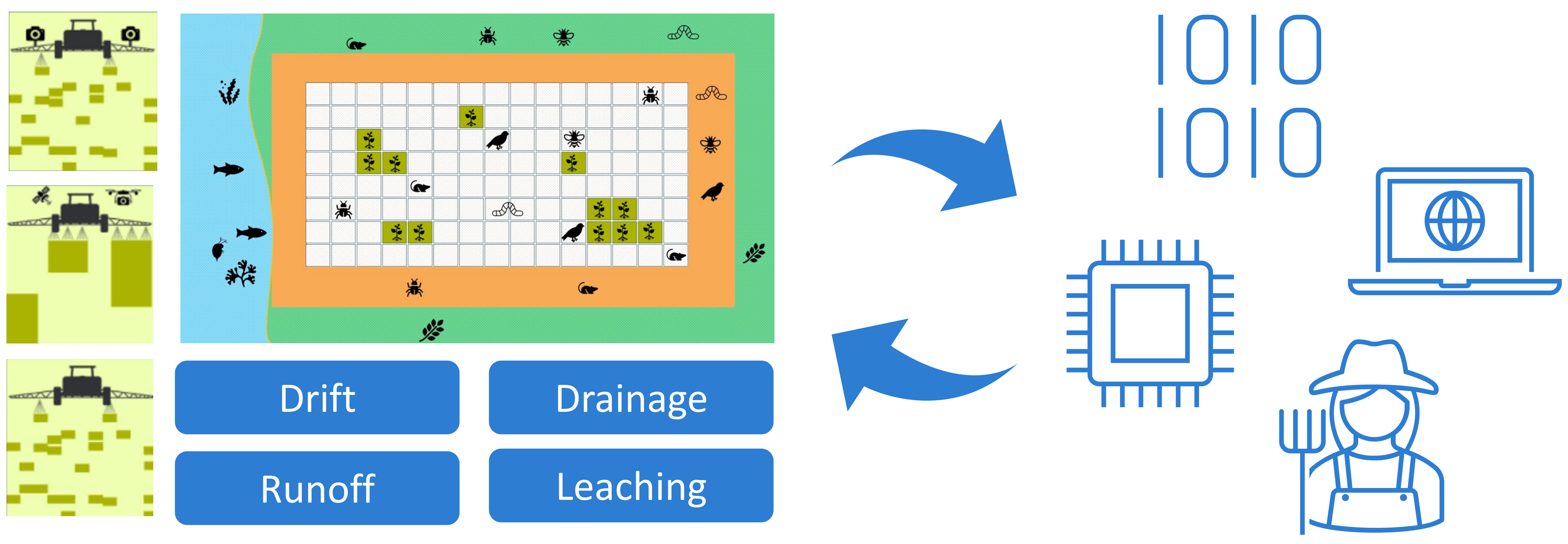
Process Models for Environmental Exposure Assessment of Precision Application: A Tiered Inventory from the EUPAF Working Group

S. Multsch[1], D. Patterson[2], S. Brignall[3], J. Strassemeyer[4], R. Sur[5], O. de Cirugeda Helle[6], B. Gottesbüren[7]

[1]BASF SE [2]Syngenta, United Kingdom [3]Enviresearch, United Kingdom [4]Julius Kühn Institut, Germany [5]Bayer AG, Germany
[6]Corteva Agriscience, Switzerland [7]Make-sense Consulting, Germany

INTRODUCTION

Precision application (PA) technologies (e.g. band, spot, patch and variable rate spraying) modify the spatial and temporal distribution of pesticide emissions after spraying compared with broadcast applications. Within the European Precision Application Task Force (EUPAF), an inventory of process-based exposure models was compiled and organized within a proposal for a tiered exposure assessment framework (PA-EXP-TIER1 to PA-EXP-TIER3) to clarify regulatory applicability and identify priorities for further development.



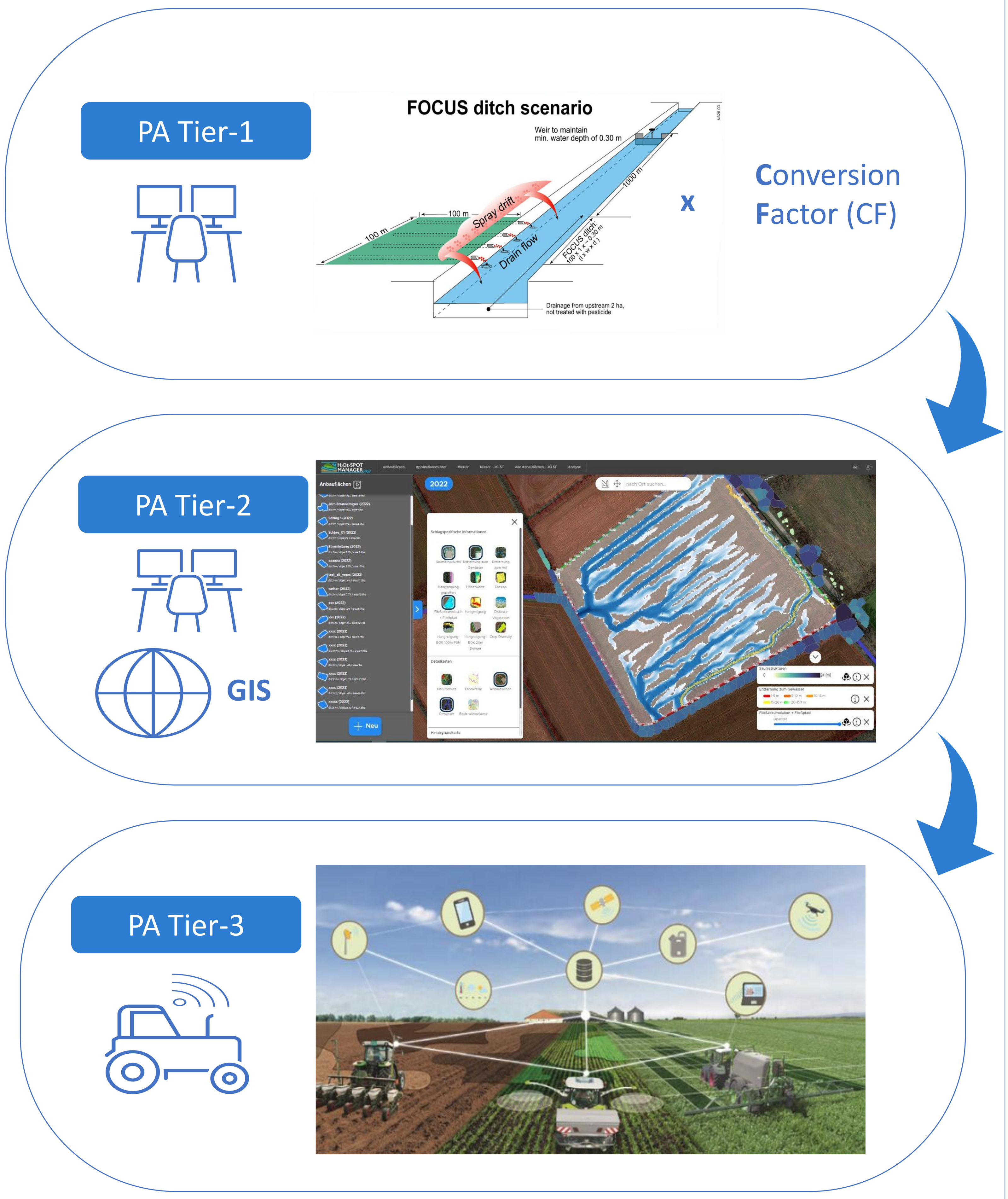
RESULTS & DISCUSSIONS

At **PA-EXP-TIER1,** PA is assessed using existing regulatory exposure models without modification, with PA represented, where appropriate, by conversion strategies based on field average application rates. This includes standard leaching models for groundwater (FOCUS PEARL, PELMO, MACRO; GeoPEARL), surface water exposure via runoff, drainage and drift (FOCUS PRZM, MACRO, Steps 1/2) combined with aquatic fate modelling (FOCUS TOXSWA, SWAN), and analytical soil exposure approaches for nontarget soil organisms under the FOCUS/EFSA framework (e.g., see FOrum for Co-ordination of pesticide fate models and their Use – FOCUS [1]).

PA-EXP-TIER2 extends standard models through predefined site-specific risk characterization (Tier2a) and/or refined conversion strategies (Tier2b). Tier2a requires harmonized geodata with quality/version control and software environments (e.g. SYNOPS [2]) that can support site specific exposure calculations and be extended by integrating standard models. Tier2b targets PA-relevant pathways, notably spray drift, through PA-specific drift curves compatible with Tier1 models.

In **PA-EXP-TIER3**, non-standard and adapted process models explicitly represent spatial heterogeneity, proximity to receptors, and local conditions at the time of application. New developments are required:

- **New / adapted regulatory models**: Examples include HYDRUS2D/3D for band/spot leaching [3], landscape scale runoff exposure to off field areas (xOffFieldSoil [4]), drift (xAquaticRisk [5]) or drainage [6] to water bodies using the xLandscape modelling framework [7]. SPOTMOD [13] calculates runoff and accounts for scattered application pattern when considering PA.
- **Metamodels**: Examples based on FOCUS models exist for stream processes [8], drainage exposure [9, 10], groundwater vulnerability [11].



- **Web services**: Tools like GeoAPEX [12] and SYNOPS-WEB [2] enable computational efficiency, scalable deployment, and integration of harmonized environmental data.

CONCLUSIONS

New developments are needed moving forward to consider all benefits of PA in regulatory modelling of exposure. This concerns various aspects:

- Development of **empirical and metamodels** for pragmatic lower tier assessments and the calculation of exposure during time of application of PPP (=online).
- Provision of the models to the user, for example via **web-services** as well as the required computing capacity via **cloud computing**.
- **Coupling of exposure and effect models** to capture environmental processes over space and time, e.g. the potential for re-colonization over time and the movement of non-target organisms across ecological habitats.
- Implementation of innovation in agriculture such as **digital labels**.

Overall, many approaches already exist which touch technical aspects, regulatory topics in risk assessment and digital innovations in agriculture. A detailed definition of required tools and data as well as a targeted development of new models is only possible if further boundary conditions are known. Therefore, a next step is to apply existing non-standard tools in proof-of-concepts, prove their practicability using study cases and define further requirements for a regulatory application.

REFERENCES

1. EU Commission / Joint Research Centre. https://esdac.jrc.ec.europa.eu/projects/focus-dg-sante.
2. Strassemeyer J. et al. (2017): SYNOPS-WEB, an online tool for environmental risk assessment to evaluate pesticide strategies on field level. Crop protection. 2017 Jul 1;97:28-44.
3. Li, S. and Jene, B., (2022): Evaluation of the effect of band application on groundwater concentration using two-dimensional leaching modelling. SETAC.
4. Schad, T. et al. (2024): A spatiotemporally explicit modeling approach for more realistic exposure and risk assessment of off-field soil organisms. Integrated Environ. Assess. and Manag., 20(1), pp.263-278.
5. Buddendorf, W.B et al. (2023): Aquatic risks at the landscape scale: a case study for pyrethroid use in pome fruit orchards in Belgium. Environmental Science & Technology, 57(41), pp.15608-15616.
6. Multsch S. et al. (2024): New insights into aquatic risk assessment at catchment scale: experiences from scenario development and model application. XVII Symposium on Pesticide Chemistry. Piacenza.
7. Bub S. (2026). https://github.com/xlandscape/.
8. Adriaanse, P.I. et al. (2017): The effect of the runoff size on the pesticide concentration in runoff water and in FOCUS streams simulated by PRZM and TOXSWA. Science of the Total Environment, 584, pp.268-281.
9. Lindahl, A. et al. (2024): A web-based pesticide risk assessment tool for drinking water protection zones in Sweden. Journal of Environmental Management 357. 120700.
10. He, Q. et al. (2023): Drainflow prediction for Germany: using data-driven approach. SETAC Europe 33rd Annual Meeting. Dublin.
11. Tiktak, A. et al.(2006): Mapping Ground Water Vulnerability to Pesticide Leaching with a Process-Based Metamodel of EuroPEARL. Journal of Environmental Quality, 35(5), 1682-1694.
12. Pan, F. (2023): GeoAPEX-P, A web-based, spatial modeling tool for pesticide related environmental assessment. Environmental Modelling & Software, 167, p.105747.
13. Sur, R. et al. (2026) "SPOTMOD: Simulation of run-off exposure from precision application by mechanistic modelling with VFSMOD." *SETAC Europe 36th Annual Meeting*. SETAC.

CONTACT
sebastian.multsch@basf.com

EUPAF — General considerations on environmental risk assessment of 3-D (canopy) precision application of plant protection products in orchards and vineyards.

Olivier de Cirugeda Helle[1], Bernhard Gottesbüren[2], Tom Bals[3], Hendrik Rathjens[4]
[1]Corteva Agriscience, Switzerland [2]Make-sense Consulting, Germany [3] Independent Consultant, UK
[4] Stone Environmental, Austria

INTRODUCTION

Precision application (PA) is transforming the environmental risk assessment (ERA) of plant protection products (PPPs) in complex bush/tree/3-D systems such as orchards and vineyards. PA better targets PPPs within the 3-D crop canopy—via GPS-guided sprayers, LiDAR mapping, remote sensing and application technique/technology options such as face-to-face (F2F) sprayers. Better spray targeting, and timing, result in improved spray efficiency and reduced off-target losses (*e.g.* Xun *et al*., 2023). Established ERA frameworks must evolve to capture this heterogeneity. A tiered framework that integrates 3-D precision application into regulatory ERA is outlined.

Key drivers & the scientific challenge

- The core challenge is measuring 3-D PPP distribution and its efficacy and effects on non-target organisms and environmental compartments.
- Current ERA schemes simplify 3-D application into 2-D deposition, reducing accuracy.
- Advanced tools—CFD, spatially explicit risk mapping, and probabilistic exposure models—are needed to simulate 3-D PPP distribution.

MATERIALS & METHODS

Regulatory frameworks (*e.g.* FOCUS, EFSA) assume uniform pesticide application and 1-D exposure via drift deposition and runoff factors. In 3-D crops like orchards, spray deposition is spatially uneven, depending on canopy structure, growth stage, weather and application technology. To improve realism, a tiered framework is proposed, ranging from standard regulatory scenarios to site-specific 3-D modelling. A Deposition–Pathway Profiling Database and the Target Application Equivalence concept are pursued, with a conventional axial-fan sprayer as a reference.

Main components

- Tier 1–3: from standard assessment to spatially explicit 3-D modelling.
- Options tested: profiling database and target application equivalence.
- Reference: traditional axial-fan sprayer (unadjusted) – EPPO Code 3AIRBM.
- Deposition pathways: foliar interception, in-field ground loss, and off-field drift (airborne and sedimented).

RESULTS & DISCUSSION

What the evidence shows

3-D precision application directs more of the applied dose to the canopy and reduces off-target losses, *e.g.* marked reductions in ground and airborne drift and pesticide savings of up to 43% (Xun *et al*., 2023). Localised Precision Applications may target only specific parts of the crop canopy, *e.g.* the grape bunch zone [see EPPO PP 1/239(3) (2020) as a key document (covering both dose transformation and localised applications)], or indeed specifically target only infected areas, the fruit, etc. The key consequence for risk assessment is a shift in how the applied mass is partitioned across deposition pathways: on-target deposition (efficacy and consumer risk), direct in-field ground loss and off-field ground drift (soil and non-target terrestrial exposure) and airborne drift (operator, bystander, pollinator, and longer-range transport) (Figure 1). For environmental exposure, immediate attention focuses on direct ground loss and ground drift, the pathways most relevant to soil, groundwater, and off-field non-target organisms. A tiered assessment framework of environmental exposure for applications to 3-D crops is proposed (Figure 2).

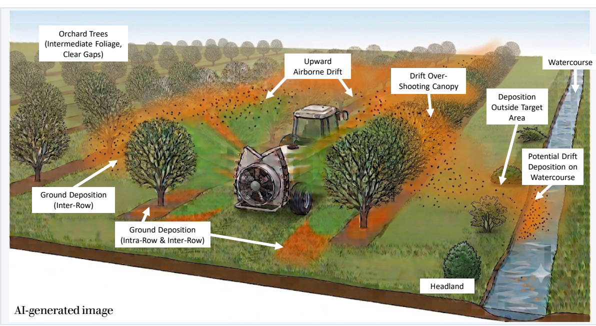


Figure 1. Schematic for axial fan airblast sprayer in a globular tree crop with intermediate foliage

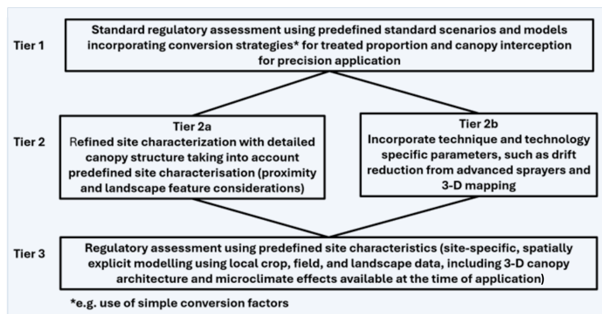


Figure 2. Proposed tiered assessment framework of environmental exposure assessment for applications to 3-D crops

What it means for risk assessment

- Current frameworks so far generally assume uniform, field-wide application limiting the scope to credit precision application techniques.
- Representing 3-D applications requires a true mass balance across row, inter-row, and off-field losses (f_{row}; $f_{inter\text{-}row}$; $f_{off\text{-}field}$) plus canopy interception — and, critically, airborne drift, which the current mass-balance approach omits and therefore does not yet close the balance. (1)
- Regulatory defaults are retained and refined only where needed — *e.g.* drift evidence or in-field partitioning via canopy and inter-row collectors.
- Two pragmatic strategies are emerging: a deposition-pathway profiling database (piloted with Performance Pulvé, WUR, JKI), and a "target-application-equivalence" concept allowing a technique with equal-or-lower local deposited dose than a reference sprayer to rely on the existing risk assessment.
- Crop type matters. Approaches must distinguish "wall" production (vines, pome fruit) from "globular" crops (citrus, olives).

CONCLUSIONS

- 3-D precision application may improve application efficiency and reduce environmental loading.
- Current ERA frameworks developed for 2-D systems may not be fully applicable to spatially heterogeneous 3-D crop systems and precision agriculture. To address this, ERA should better reflect the actual deposition and exposure patterns that occur within such three-dimensional canopies. Where mass balance is referenced, its current limitations should also be acknowledged.
- Future work should distinguish between wall and globular production systems, clarify dose reference concepts such as g a.s. ha^{-1} versus Leaf Wall Area and generate field and modelling data to refine exposure models, address remaining uncertainties for human-health and ecological risks, and support updated regulatory guidance.

REFERENCES

- Xun, L. *et al.* (2023) Advanced spraying systems to improve pesticide saving and reduce spray drift for apple orchards. Precision Agriculture 24(4): 1526–1546.
- EPPO PP 1/239(3) (2020) Dose expression for plant protection products https://pp1.eppo.int/standards/PP1-239-3
- EUPAF publication on Flexible Risk Mitigation in field/arable/2D crops https://www.bvl.bund.de/SharedDocs/Downloads/04_Pflanzenschutzmittel/01_EUPAF_Information/Subgroup_Flexible_Risk_Mitigation_EUPAF_Approach.html

FOOTNOTE

(1) Note, however, that ISO 22866 does not mandate airborne drift measurement, and its optional measurements are inadequate for assessing losses in bush/tree/3-D crop spraying

ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to **Neil Mackay** for his invaluable support, guidance, and assistance throughout this exercise. His contribution, insight, and willingness to help were greatly appreciated and played an important role in the completion of this work.

CONTACT

olivier.de-cirugeda-helle@corteva.com
www.eupaf-project.eu
@eupaf

Recommendations for Development of Environmental Exposure Scenarios for Precision Pesticide Applications

Hendrik Rathjens[1], Oliver de Cirugeda Helle[2], Sebastian Multsch[3], Dirk Nickisch[4], David Patterson[5], Jörn Strassemeyer[6], Robin Sur[7], Bernhard Gottesbüren[8]

[1]Stone Environmental, Austria · [2]Corteva Agriscience, Switzerland · [3]BASF SE Agricultural Solutions, Germany · [4]RIFCON GmbH, Germany · [5]Syngenta, Product Safety Europe, UK · [6]Julius Kühn-Institut (JKI), Germany · [7]Bayer AG, Crop Science Division, Germany · [8]make-sense consulting, Germany

INTRODUCTION

Precision application (PA) reduces pesticide inputs, but EU exposure assessment, built on the FOCUS framework [1], assumes uniform, full-field treatment. Integrating PA requires concepts that extend this framework without disrupting its consistency. This work aims to:

- Establish a **tiered structure** that progressively refines exposure assessment from conversion/reduction factors (Tier 1), through GIS-based regional scenarios and technology-specific refinements (Tier 2), to field-specific assessment (Tier 3).
- Provide concepts for **translating real-world precision spray patterns** into regulatory scenarios.
- Outline a **development pathway** that accommodates the diversity of PA technologies and remains applicable across European regulatory zones.

MATERIALS & METHODS

The framework is assembled from four conceptual building blocks:

- **Conversion & reduction factors** – Reduced field-scale rates within standard models, preserving backward compatibility with registration.
- **Representative Elementary Area (REA)** – The minimum spatial scale at which exposure is relevant for effect assessment, accounting for organism mobility.
- **Statistical pattern descriptors** – Coverage ratio, spatial distribution, and edge metrics translate real spray patterns into idealized scenarios.
- **Data sources** – Harmonized EU/national GIS datasets and web services; ISO 22866 trials (drift) [2]; as-applied maps, drone imagery, LiDAR, meteorology (field-specific).

RESULTS & DISCUSSIONS

The framework combines a tiered structure, statistical characterization of spray patterns, and regionalized GIS scenarios.

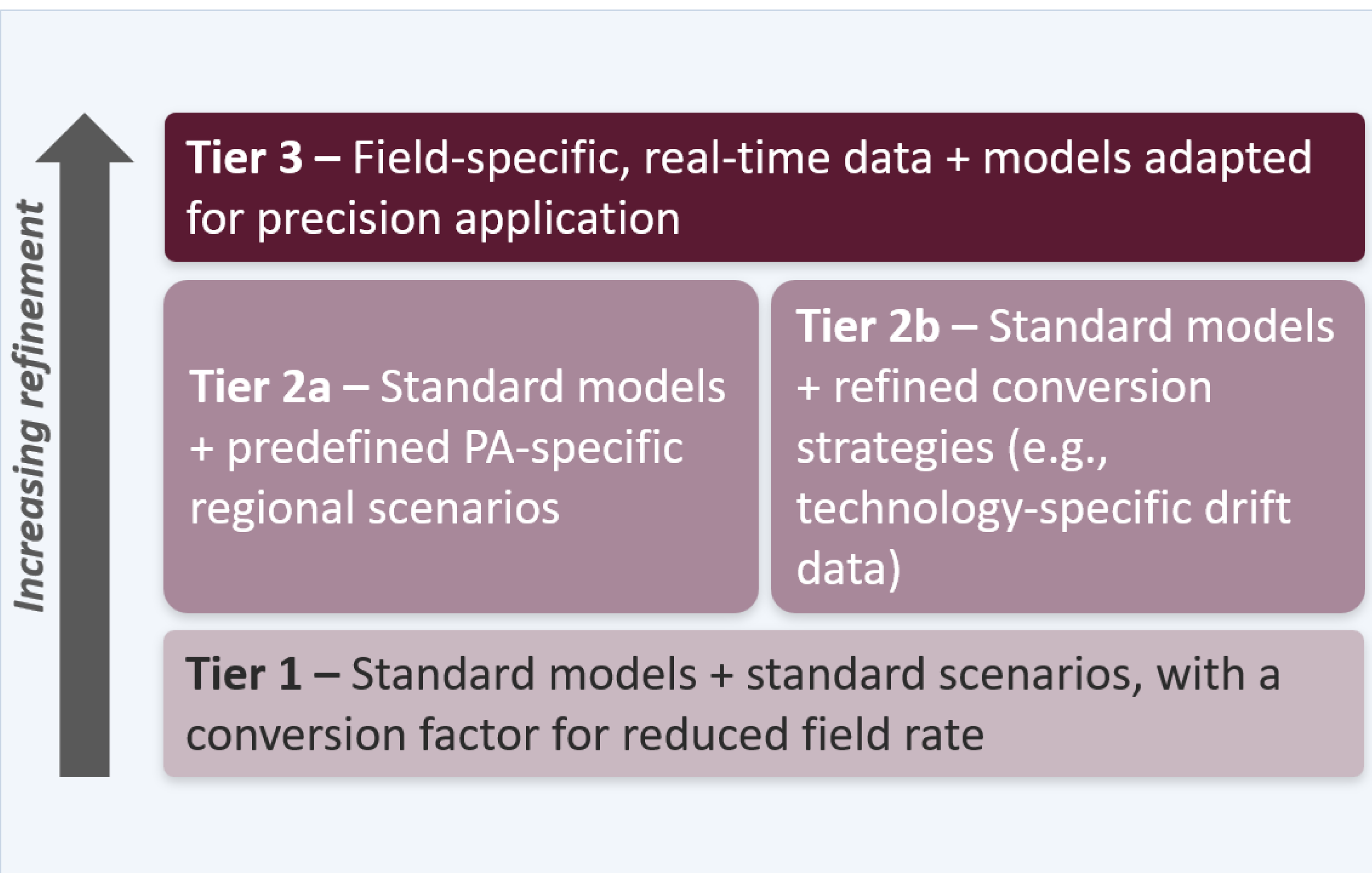


Figure 1. The four tiers of the exposure and scenario development framework.

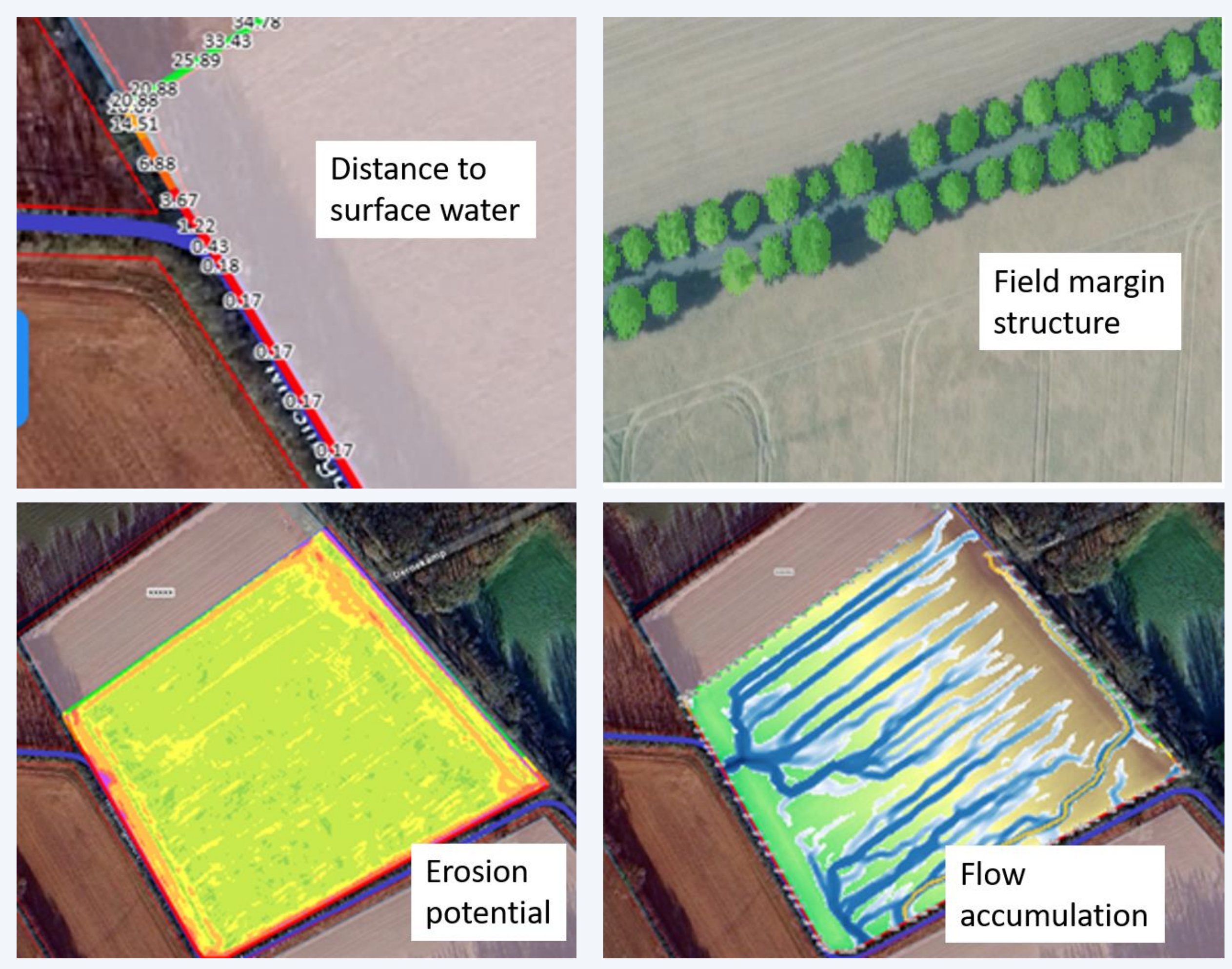


Figure 2. Examples for landscape (Tier 2a) and field specific refinements (Tier 3).

- **Regulatory consistency** – At lower tiers, reduced field-scale rates are captured through conversion/reduction factors within standard FOCUS models to ensure backward-compatibility with established registration procedures.
- **Pattern classification** – Spray patterns are characterized statistically (coverage, spatial autocorrelation, patch & edge metrics) and mapped to idealized scenarios for bridging real applications to label categories and GAP tables.
- **Worked example –** Spot-sprayed thistles in sugar beet resulted in a 76% application mass reduction [3] and exposure assessments confirm a proportional reduction, depending on the pathway.
- **Regulatory Practice** – Tier 1 conversion factors have already been adopted (with conditions) in some member states for groundwater, drainage, runoff, and drift.
- **Guiding principle** – A conversion factor can be used where exposure and effects are proportional to the average field rate. Spatial modelling is required where the distribution of spraying patterns are relevant and where the organism to protect is mobile.

CONCLUSIONS

What has been done so far

- PA breaks the uniform-application assumption underlying current RA
- A tiered adaptation allows integration into existing regulatory frameworks
- A conversion factor can be a pragmatic solution (already accepted)
- Statistical metrics can classify real spray patterns into idealized scenarios

What remains

- PA spray patterns require new exposure modelling approaches
- Scenario development to better link exposure and effects
- Pre-application estimation of treated area is an open challenge (logistically and for exposure estimations)

REFERENCES

1. FOCUS (2001). FOCUS Surface Water Scenarios in the EU Evaluation Process under 91/414/EEC. Report of the FOCUS Working Group on Surface Water Scenarios, EC Document Reference SANCO/4802/2001-rev.2, 245 pp.
2. ISO 22866:2005. Equipment for crop protection – Methods for field measurement of spray drift. International Organization for Standardization, Geneva.
3. Alix, A., Bui, T., Bürling, K., de Cirugeda Helle, O., Daniels, M., Guth, V., Meregalli, G., Pilling, E., Rogissart, E. (2024). Case study – Example of a spot application on thistles in a sugar beet field. Linking the practice to the GAP table and implications for the risk assessment. Piacenza Symposium 2024.

ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to **Neil Mackay** for his invaluable support, guidance, and assistance throughout this exercise. His contribution, insight, and willingness to help were greatly appreciated and played an important role in the completion of this work.

CONTACT

hrathjens@stone-env.com

EUPAF—POSTER SESSION at Pesticide Symposium XVIII Cremona 2026

EUPAF – GIS Data as a Basis for Exposure Modelling in Precision Plant Protection Applications

Jörn Strassemeyer[1], Burkhard Golla[1], Sebastian Multsch[2], Olivier de Cirugeda Helle[3], Hendrik Rathjens[4]

[1]Julius Kühn-Institut (JKI), Germany · [2]BASF SE, Germany · [3]Corteva Agriscience, Switzerland · [4]Stone Environmental, Austria

INTRODUCTION

Precision application (PA) creates spatially variable pesticide use patterns. To assess environmental exposure realistically, regulatory models need georeferenced information on **field-scale** weather, soil, topography, surface water, field geometry / land use, remote sensing / LiDAR, phenology and local landscape features

- **Need**: data must be available at suitable spatial and temporal resolution, quality-controlled and reproducible.
- **Challenge**: availability, spatial and temporal resolution, access and quality differ across Europe.
- **Objectives**: a) inventory suitable GIS sources and define how they can support the EUPAF PA-EXP tiers through harmonised data services; b) propose a tiered GIS-data concept and demonstrate operational web services for plot-specific exposure modelling.

MATERIALS & METHODS

We inventoried GIS sources at field, national and European scale and mapped them to the PA-EXP tiers. The guiding principle is to use the best available data source and provide model-ready parameters through interoperable services.

FIELD / LOCAL DATA
Sensors · local weather · soil analysis
application records · drone / LiDAR
PA-EXP-TIER-3

NATIONAL / REGIONAL DATA
Weather grids · soil maps · DTM
surface water · LPIS / land use
PA-EXP-TIER-2a / 3

EUROPEAN DATA
E-OBS · EuroCrops · SoilGrids
EU-DEM · Copernicus
fallback

WEB SERVICE
1 Check availability
2 Check quality / version
3 Derive model parameters
4 Return JSON / XML
→ exposure model

PA-EXP-TIER-1 uses predefined regulatory scenarios; site-specific GIS is introduced in Tier 2a and Tier 3.

RESULTS & DISCUSSIONS

GIS data inventory: From European to field scale

Candidate data sources were identified for every major environmental input domain needed for plot-scale exposure modelling. The main challenge is harmonisation of resolution, access, quality and version control — not a general lack of data. Suitability is tier- and use-specific: field-scale assessments require sufficient spatial/temporal resolution, documented provenance, QA and reproducible access. Not every source is equally suitable in every country or for every model.

Two implementations demonstrate that heterogeneous spatial data can be transformed automatically into plot-specific, model-ready inputs.

Data Domain	European	National / Regional	Field	Status
Weather	E-OBS, MARS	DWD / KNMI grids & stations	Local station, machinery / sensors	✓
Field geometry & land use	EuroCrops, EU Crop Map	LPIS, ATKIS / topographic data	FMIS, field polygon, as-applied map	✓
Surface water	OSM Water, HydroSHEDS, CCM	National hydrography / water datasets	Surveyed / local water features	✓
Soil	ESDB, LUCAS, SoilGrids	BÜK200, BK50, national soil maps	Soil analyses and local profiles	✓
Topography	EU-DEM / Copernicus DEM	DGM / DTM, national LiDAR	Drone / local LiDAR	✓
Remote sensing & landscape	Sentinel, Planet	Orthophotos, national LiDAR / Digital Twin	Drone / LiDAR, field-margin survey	✓
Phenology	C2D2, satellite time series	National phenology models / grids	Observed crop stage, sensors / imagery	✓

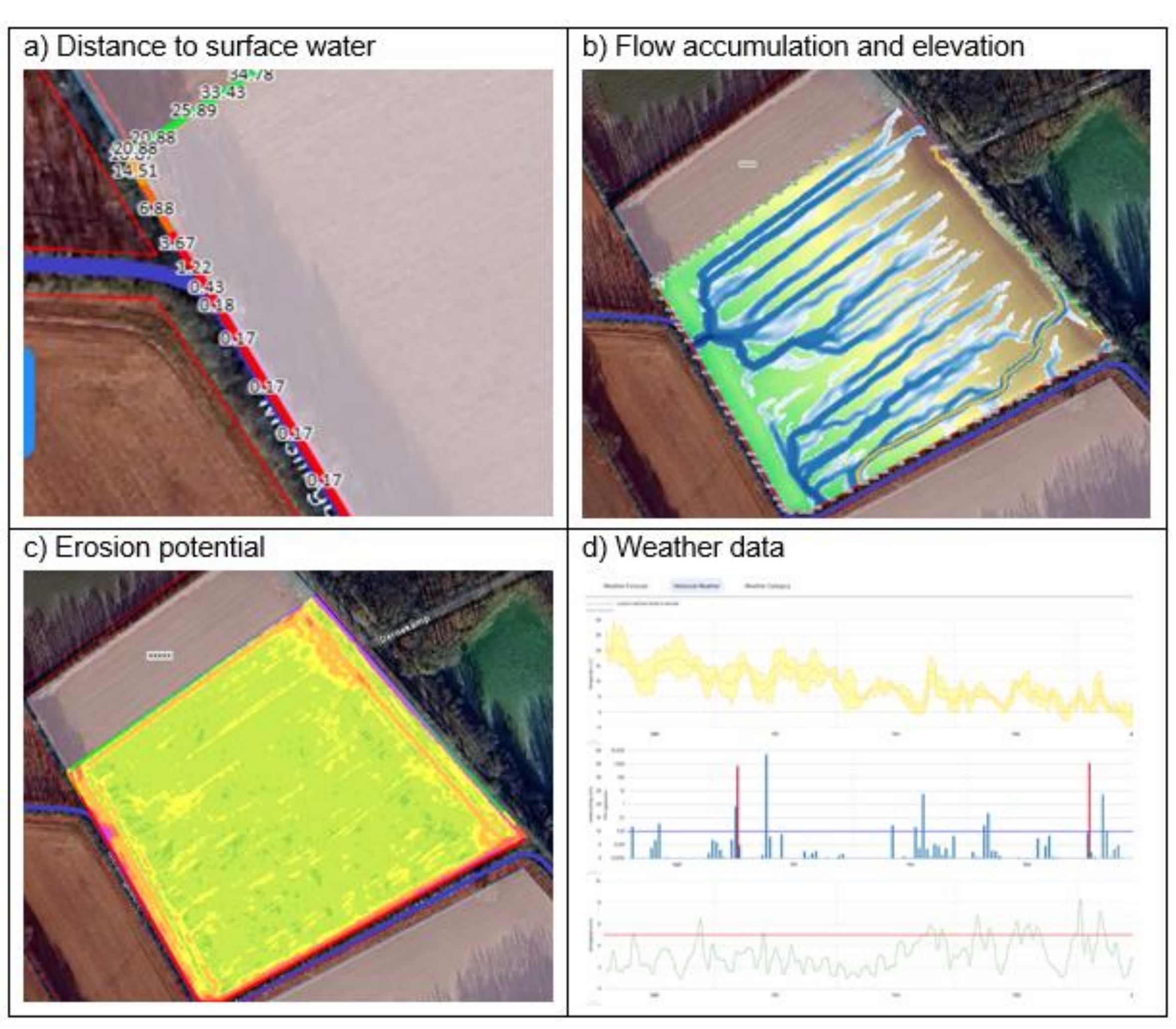
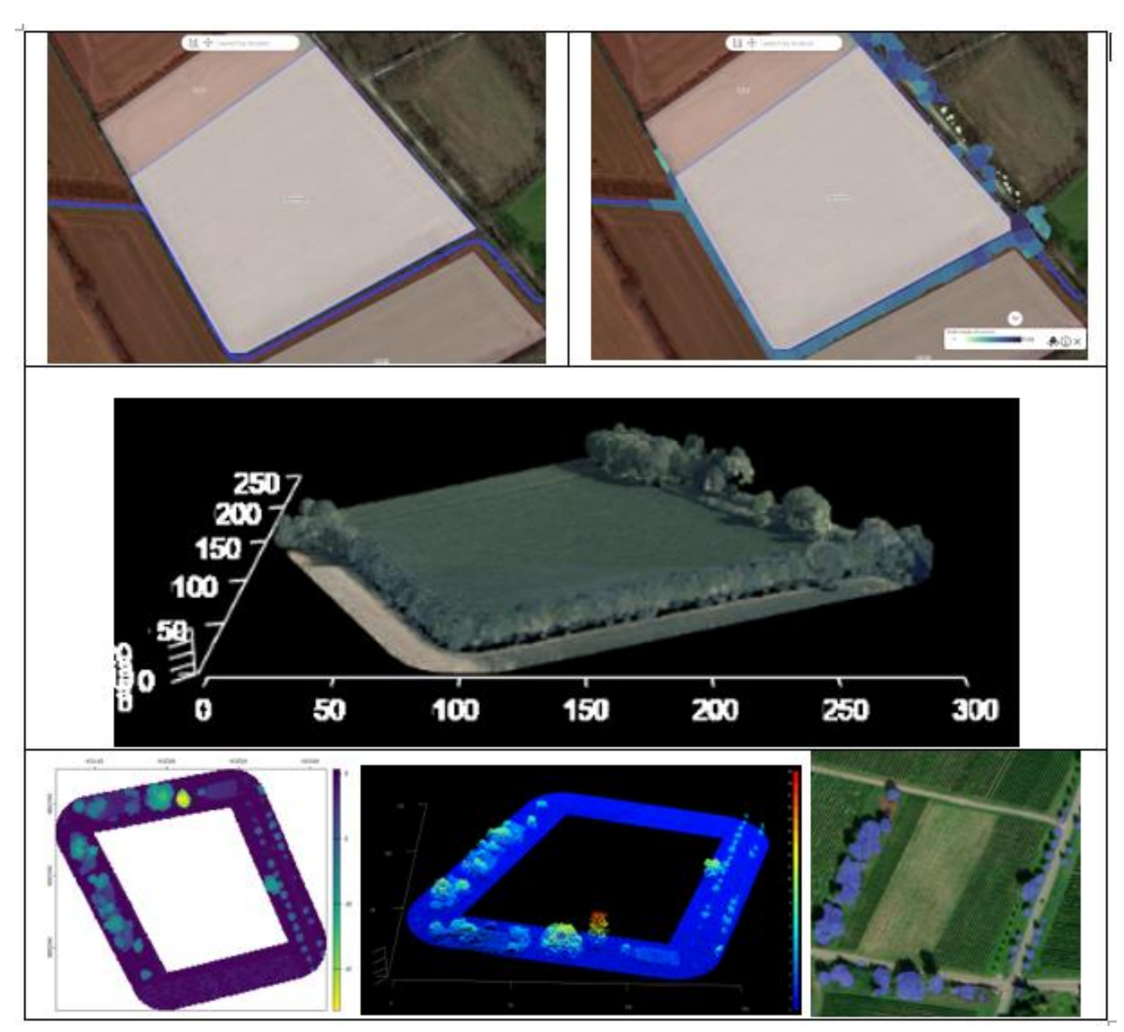


Figure 1. SYNOPS-WEB: automated derivation of field-specific exposure inputs from GIS and weather services.

- SYNOPS-WEB derives plot-specific distance to surface water, terrain/flow accumulation, erosion potential and weather data from a field geometry.
- LiDAR services extract surrounding vegetation structures and parameters such as height and density for off-field exposure assessment.
- Harmonised interfaces decouple exposure models from heterogeneous data providers and substantially reduce manual parameterisation.
- The same concept can bridge predefined regional scenarios (PA-EXP-TIER-2a) and highly local, application-time information (PA-EXP-TIER-3).



CONCLUSIONS

- TAKE-HOME: Harmonised GIS data and interoperable web services are enabling infrastructure for field-specific PA exposure assessment.
- Use the best available data — local first, national/regional second, European fallback — with explicit quality and version control.
- Next step: establish accepted European/national services and data standards that can support regulatory PA-EXP-TIER-2a and PA-EXP-TIER-3 workflows.

REFERENCES

1. Strassemeyer J. et al. (2017). SYNOPS-WEB, an online tool for environmental risk assessment to evaluate pesticide strategies on field level. Crop Protection 97, 28–44.

2. Cornes R. et al. (2018). An ensemble version of the E-OBS temperature and precipitation datasets. JGR Atmospheres 123.

3. Schneider M. et al. (2023). EuroCrops: the largest harmonized open crop dataset across the EU. Scientific Data 10, 612.

ACKNOWLEDGEMENTS

Developed within EUPAF Task Group 3&4 – Environmental Exposure. We thank all contributors to the GIS-data inventory and the SYNOPS-WEB / LiDAR workflows.

CONTACT

joern.strassemeyer@julius-kuehn.de
synops.julius-kuehn.de
EUPAF Task Group 3&4

Open SYNOPS-WEB