XCROPPROTECTION: A SPATIOTEMPORAL COMPONENT TO SIMULATE PROSPECTIVE AND RETROSPECTIVE PPP APPLICATIONS IN REAL WORLD LANDSCAPES

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NTRODUCTION

There seems broad consensus that chemical crop protection will have to be more targeted. Risk assessment and risk management questions come up which require **operational instruments** to model real-world chemical plant protection and its environmental impact, e.g., holistic view to risk, multiple stressors analysis, risk assessment recovery option (EFSA 2013), Environmental Impact Reduction, insect decline causal analysis and biodiversity enhancement.

THE CROPPROTECTION COMPONENT – A MODULE IN XLANDSCAPE

xLandscape

A framework to build landscape models that operate **spatiotemporally explicit**.

OPEN SOURCE \rightarrow **VISIT US ON GITHUB:**

Model:

https://github.com/xlandscape/xCropProtectionDemo **Documentation**:

https://xlandscape.github.io/xCropProtectionDemo

LANDSCAPE SCENARIOS

• **Real-world land use** scenarios represent natural variability of land use composition,

- Fundamental modular design allows composition of landscape models from modules (Components).
- **Components** can be derived from using existing models (e.g., exposure, effect) or by building new ones.
- xOffFieldSoilRisk is an example for a landscape model derived from xLandscape (Schad et al, 2023). (Presentation today @15.15, 3.03.C.T-04)

Preparation	xOffFieldSoil						1	Analysis
	(Exposure/Efate				Effect		Risk Analysis
Ag/Landscape.Mgmt	Ag/Landscape.Mgmt	xDrift				Collembola		AEs
Crop Cultivation	xPProtection	xPRZMeu				Earthworm		Mapping
Environment	Environment	xPRZMus	RunoffFilter1	PECsoil1		TKTD/GUTS		Graphs
Soil Hydrology	Weather	xPRZMlite	RunoffFilter2	PECsoil2		RQ/SSD		Descriptive Statistics
Spatiotemporally Explicit Modeling Framework Interfaces • Control • MonteCarlo • Dimensions • Scales • Semantics								

Calendar

Caledar

Target Crop

op Protection

Calender

mporal Validity

The CropProtection Component

- Simulates applications of plant protection products on fields within a given landscape.
- Multiple PPP uses in multiple crops can be simulated, comprising
 - typical PPP spray sequences, e.g., as recommended by plant protection services,
 - chemical and alternative plant protection measures,
 - prospective PPP use scenarios or retrospective PPP use survey data.

DESIGN – REFLECTING REAL-WORLD OBJECTS AND AGRICULTURAL PRACTICE

The CropProtection Component uses objects as occurring in reality:

- the **Plant Protection Product** (PPP), containing **active substances**, lacksquare
- their **application** using **application technology** and **tank mixes**,
- on agricultural fields, considering risk mitigation options.

landscape structure, environmental and agricultural conditions and their dynamics

• Basically, any land use scenario can be used, ranging from simple local edge-of-field to large geographic regions

Example scenario North-Rhine Westphalia (Germany) >300,000 fields

Model Parameterizatior (XML, Excel)

The user defines **Crop Protection Calendars**, guided by

- agricultural practice of pest control measures
- and crop protection plans by official advisory services, farmers, or PPP producers.



PROCESSING

- CropProtection operates spatiotemporally explicit. Typical units are [*day*] and [*field*].
- Actual PPP uses are sampled (Monte Carlo) from Crop Protection Calendars (e.g., using advisory of survey data), on the basis of spatiotemporally explicit land use data.



OUTPUT AND MODEL INTEGRATION

ndication 1

Indication

- Raw model results comprise the specific PPP use at individual fields in space and time, application technology, mitigation measures, etc.
- Output is linked to subsequent components, e.g., exposure and effect models





An application contains: PPP Application rate Application window Technology In-field buffer In-field margin





OUTLOOK

- **Exchange with the regulatory** scientific community
- Integration of CropProtection into existing landscape models
- User friendly interface (web browser)

EFSA PPR Panel (EFSA Panel on Plant Protection Products and their Residues), 2013. Guidance on tiered risk assessment for plant protection products for aquatic organisms in edge-of-field surface waters. EFSA Journal 2013;11(7):3290, 268 pp. doi:10.2903/j.efsa.2013.3290.

Schad, T., Bub, S., Wang, M., Holmes, C. M., Kleinmann, J., Hammel, K., Ernst, G., & Preuss, T. G. (2023). A spatiotemporally explicit modeling approach for more realistic exposure and risk assessment of off-field soil organisms. Integrated Environmental Assessment and Management, ieam.4798. https://doi.org/10.1002/ieam.4798



xCropProtection is available on GitHub, including code, scenarios, input files and documentation: https://github.com/xlandscape/xCropProtectionDemo

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