Modelling of exposure and effects at the medium edge-of-field and field scale (EL-ME)

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BACKGROUND & CONTEXT

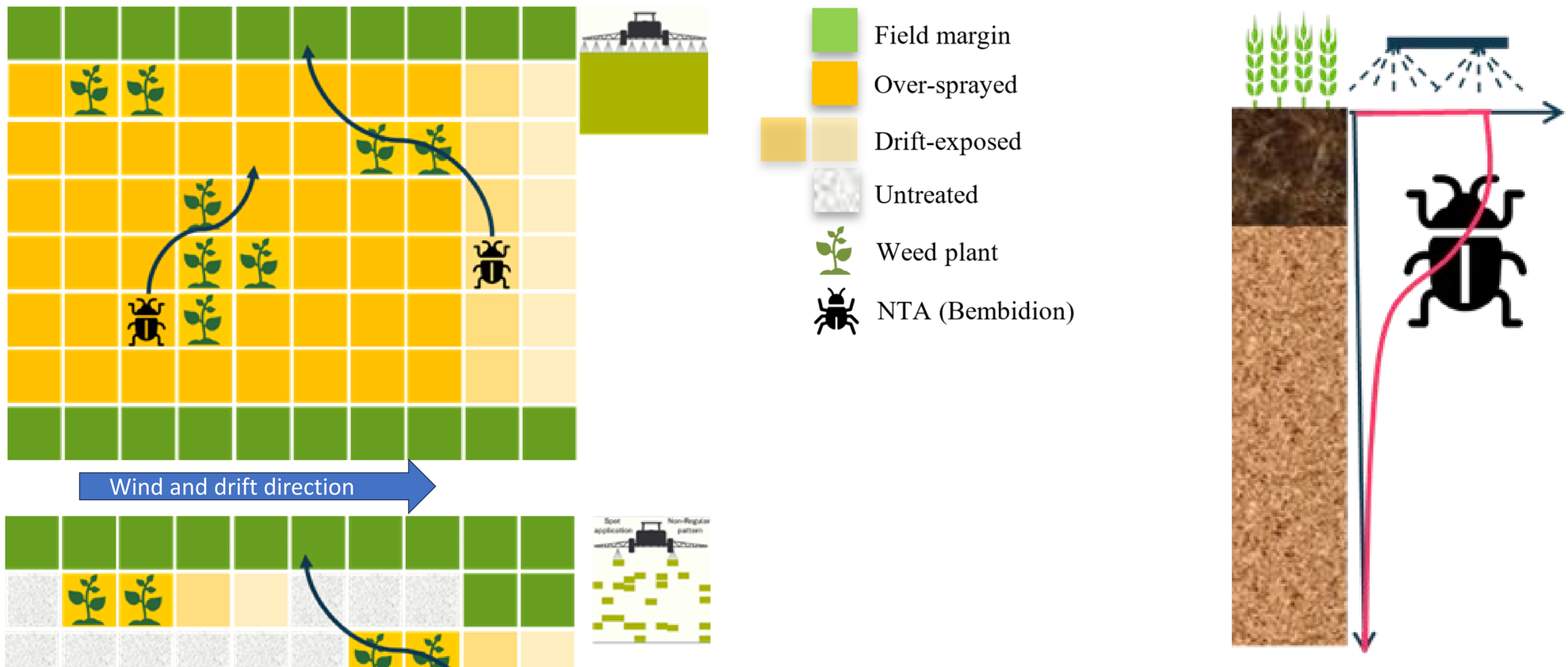
The medium scale in ELINK-2 is the scale of a single agricultural field and its immediate surroundings (field margins), thus covering the basic spatial unit for regulatory risk assessment of pesticides. The medium scale is specifically designed to assess the impact of exposure heterogeneity and ecological realism. The EL-ME modelling is fully aligned with the large-scale (EL-LA_Terra) and small-scale (EL-SA) modelling, applying the same basic parameterization regarding environmental (weather, soil, topography etc.) and agronomic (crop, pesticide treatments, crop rotation etc.) aspects.

MATERIALS & METHODS

Standard regulatory exposure models are used to address the medium-scale exposure routes relevant for the investigated species, the ground beetle Bembidion: in-field soil deposition from direct application and spray drift, as well as off-field soil deposition from spray drift; in addition, temporal and spatial variation of substance concentrations in soil will be calculated. To predict the effects of applied pesticides, similar ecological models are used across spatial scales, with aligned parameterization.

One special aspect of the medium-scale approach of EL-ME is the explicit consideration of precision application: various patch application patterns based on real-world application maps are used to represent realistic in-field heterogeneity of exposure. Standard broadcast application is modelled to represent homogeneous baseline exposure for comparison.

Each exposure scenario will be combined with a simple (fixed effect threshold, ecology not considered) and with a more ecologically realistic (population modelling, ecology explicitly considered) effect modelling scenario. Currently, certain limitations of the Bembidion model (e.g., movement implementation, population regulation via density dependence) are addressed to ensure the model is fit for purposes of ELINK2.



Conceptual approach of EL-ME modelling: Exposure on and in soil predicted with standard regulatory exposure models considering direct overspray and spray drift (top right), effects on non-target arthropods and arthropod populations predicted with the Bembidion model in a broadcast application scenario (top left) and a precision application scenario (bottom left); both scenarios are modelled with simple and with complex ecology.

HIGHLIGHTS OF EL-ME

- Predicting the effects of pesticides on a non-target arthropod and arthropod population at field-scale
- Linking exposure and effect modelling in a common data framework across scales
- Heterogeneity of exposure based on realistic precision application patterns
- Impact of exposure heterogeneity and level of ecological detail on modelling results

The ELINK EL-ME approach provides a robust analysis of the feasibility and plausibility of combined ecological modelling at the highly relevant field scale, under heterogeneous exposure situations, and will reveal gaps and deficiencies that require further work.

CONTACT

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