

# Using geographic information systems to estimate potential pesticide exposure in Belgium

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GIS  
Agriculture  
Pesticide exposure  
Environmental health

## Key findings

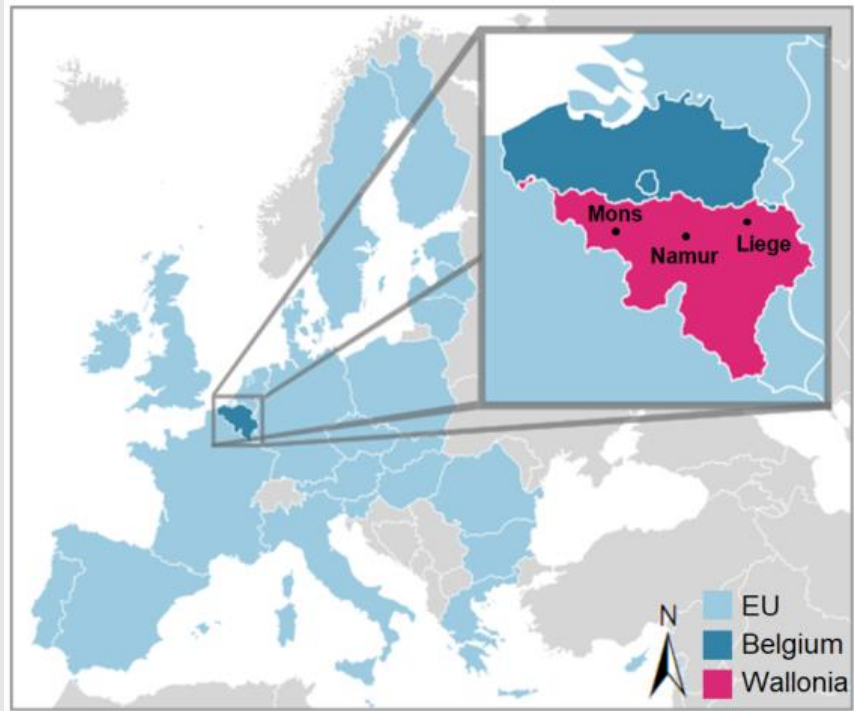
First map of modeling residential exposure to agricultural pesticides in Wallonia (Belgium)

Tool for detection of potential priority zones in order to check and reduce agricultural pesticide loads in the environment

## Background

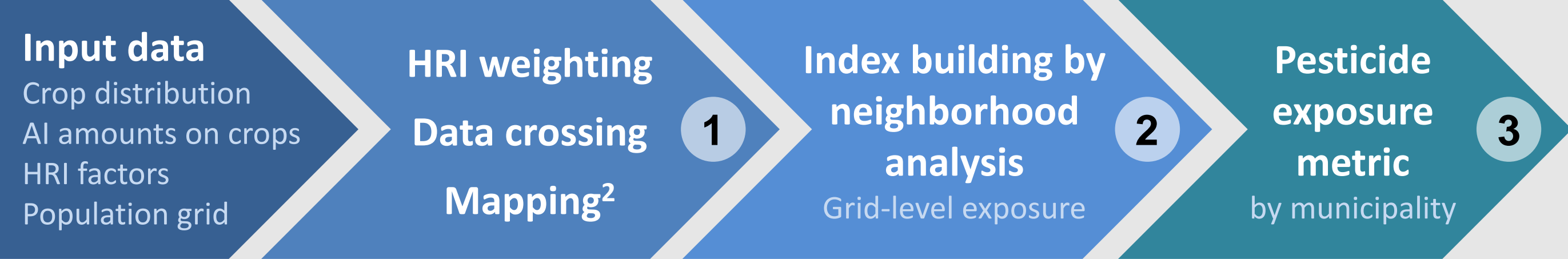
The assessment of residential exposure to agricultural pesticides is a **major issue** for public health, regulatory and management purposes. In that context, geographic information systems (GIS) approaches for mapping estimates of **agricultural pesticide exposure** were developed in this study.

## Materials and Methods



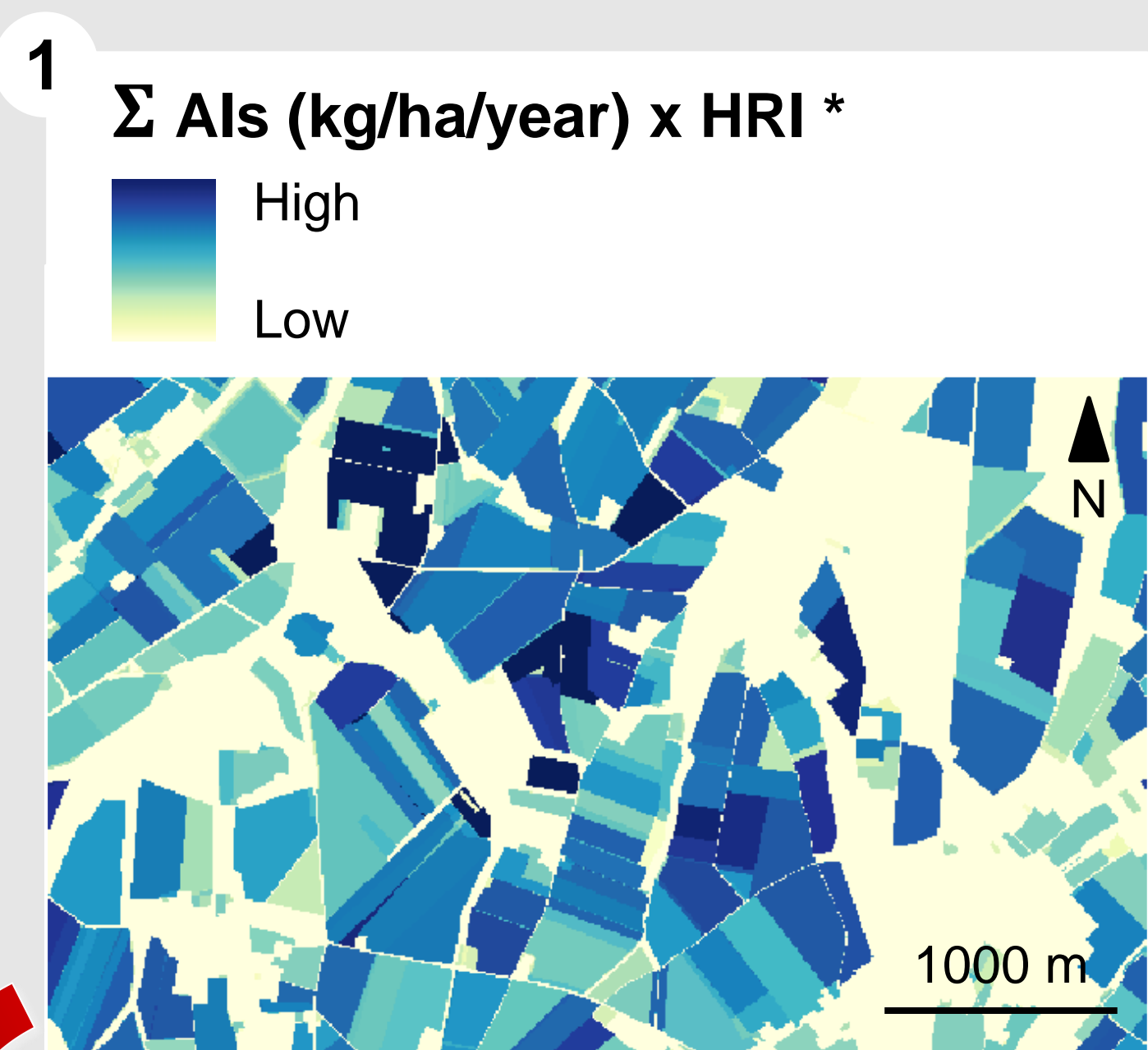
Data on pesticide **application rates**, high-resolution annual datasets of the geographic **distribution of crops**, and the 100x100m **grid population** dataset were used to complete this analysis in Wallonia (Belgium) over the period 2015-2019.

**Pesticide exposure metrics** were estimated using a buffer-based exposure model by **neighborhood analysis** in ArcGIS. The model takes into account both proximity to crops, estimated amount of pesticides and acreage treated. The weighting factors established for **Harmonized Risk Indicators (HRI)** under Directive 2009/128/EC<sup>1</sup> were applied to the estimated amounts of active ingredients (AIs) in order to align with the European approach. Then, a **population weighted method** was used to 'up-scale' the exposure data to administrative levels to match up with public health datasets.



## Results

- The results provide the first map of **modeling residential exposure** to agricultural pesticides for the entire region of Wallonia.
- The **northern part** of the Sambre-Meuse axis shows more intensive agriculture and the highest pesticide weighted exposure indices.
- Such GIS approaches help to characterize pesticide exposure for **residents** living close to agricultural lands but also in non-domestic environments such as **schools, nurseries**, etc.

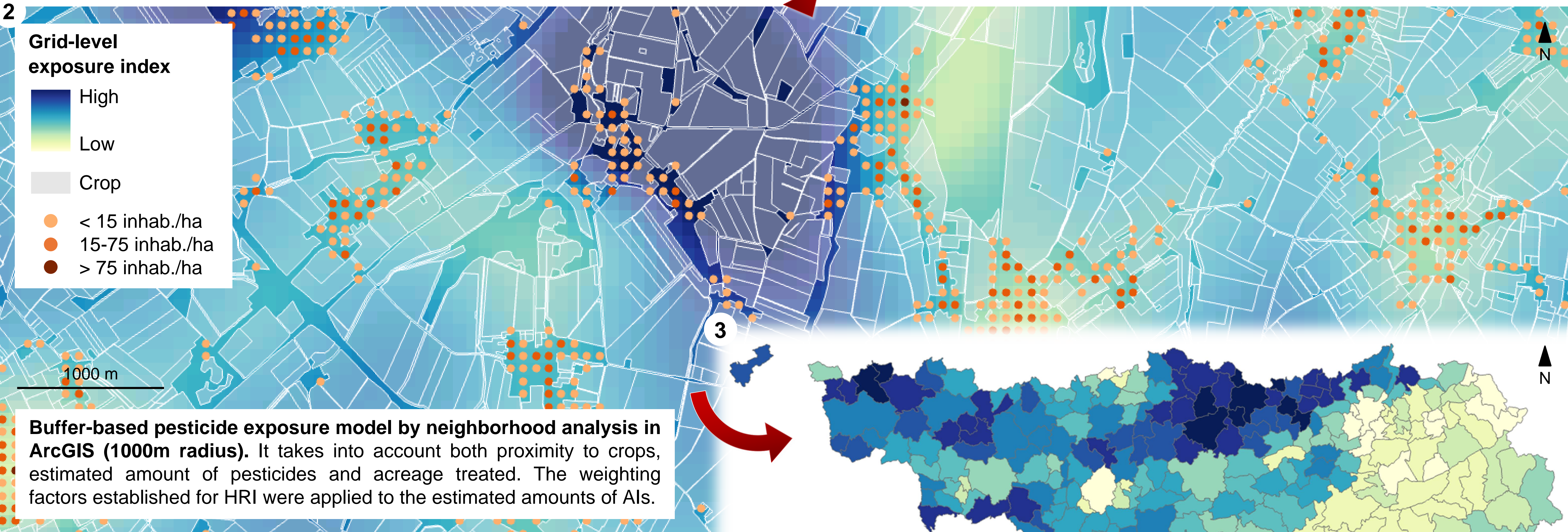


\*Amounts (kg of AIs/ha) weighted by HRI factors

Top **5** major crops most impacted by pesticides \*

Orchards	(0,2%)
Potatoes	(4,7%)
Beets	(4,9%)
Chicory	(0,7%)
Peas	(1,0%)

(of agricultural area)

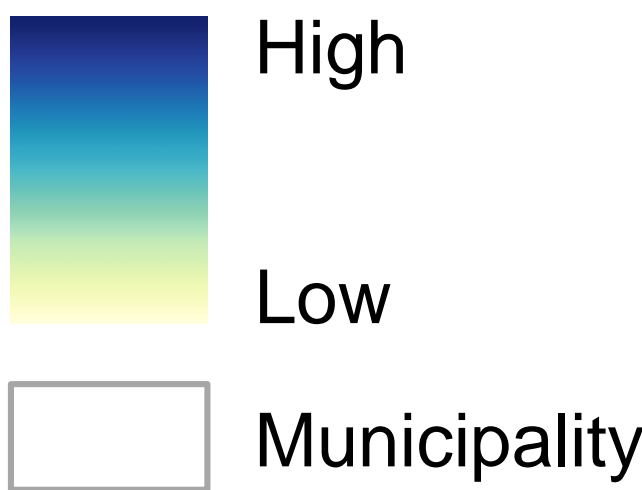


**Buffer-based pesticide exposure model by neighborhood analysis in ArcGIS (1000m radius).** It takes into account both proximity to crops, estimated amount of pesticides and acreage treated. The weighting factors established for HRI were applied to the estimated amounts of AIs.

## Conclusions

- ✓ This research work on exposure characterization to agricultural pesticides using GIS models gives a **valuable basis for research** and environmental health actions in Belgium.
- ✓ Maps **highlight areas** where human biomonitoring and epidemiological studies should be implemented **to investigate** the impact of potential environmental exposure to pesticides.
- ✓ Using this information, policymakers will be able to detect **potential priority zones** and take action to **check and reduce** agricultural pesticide loads in the environment.

## Pesticide exposure



**Pesticide exposure metric by municipality.** The grid-level exposure information was aggregated to match the area level of municipality. The metric is estimated as the average exposure of the municipality population.

## References:

- <sup>1</sup> Eurostat, 2021b. Methodology for Calculating Harmonised Risk Indicators for Pesticides under Directive 2009/128/EC - 2021, edition.
- <sup>2</sup> Habran, S., Philippart, C., Jacquemin, P. & Remy, S. (2022). Mapping agricultural use of pesticides to enable research and environmental health actions in Belgium. Environmental Pollution, 301 (119018).
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