



# Peer Community In Ecotoxicology & Environmental Chemistry

## An original approach for the identification of relevant pesticides mixtures at nationwide scale

**Pierre Labadie** based on peer reviews by **Clémentine FRITSCH**  and **Patrice Couture** 

Milena Cairo, Anne-Christine Monnet, Stéphane Robin, Emmanuelle Porcher, Colin Fontaine (2023) Identifying pesticide mixtures at country-wide scale. HAL, ver. 2, peer-reviewed and recommended by Peer Community in Ecotoxicology and Environmental Chemistry. <https://hal.science/hal-03815557>

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Over the last decades, pesticides have been massively used in agriculture and their impacts on both the environment and human health are a major growing concern (Humann-Guilleminot et al., 2019; 2019 Boedeker et al., 2020). Improving the prediction of wildlife exposure to pesticides and the associated impacts on ecosystems is therefore crucial. In general, ecotoxicological studies addressing the effects of pesticides include compounds that are selected based on general use over large areas (e.g. regions, country) or specific crop types. Such a selection does not necessarily reflect the mixtures to which species of wildlife are exposed in a particular ecosystem.

In this context, Cairo et al. (2023) present an original approach to identify relevant mixtures of current-use pesticides. Their approach relies on public data concerning pesticide sales and cropping, available at a nationwide scale in France and at a relatively high resolution (i.e. postcode of the buyer). Based on a number of clearly exposed and discussed assumptions (e.g. “pesticides were used in the year of purchase and in the postcode of purchase”), their approach allowed for identifying 18 groups that were discriminated by a reduced number of pesticides. Some compounds were found in most or all groups and were termed “core substances” (e.g. deltamethrin and lambda-cyhalothrin). Other compounds, however, were associated with a limited number of groups and termed “discriminant substances” (e.g. boscalid and epoxiconazole).

The authors identified groups of molecules that are probably associated with the same mixtures, which warrants the investigation of potential synergetic effects. In addition, their approach allowed for the identification of areas where aquatic biota may be exposed to similar mixtures, which is might prove of interest to further

investigate in situ the actual impacts of pesticide mixtures on ecosystems. Note that the approach taken by the authors might be applied by others in other countries, provided a database of pesticide sales is available.

### **References:**

Boedeker W, Watts M, Clausing P, Marquez E (2020) The global distribution of acute unintentional pesticide poisoning: estimations based on a systematic review. *BMC Public Health*, 20, 1875. <https://doi.org/10.1186/s12889-020-09939-0>

Cairo M, Monnet A-C, Robin S, Porcher E, Fontaine C (2023) Identifying pesticide mixtures at country-wide scale. HAL, ver. 2 peer-reviewed and recommended by Peer Community in Ecotoxicology and Environmental Chemistry. <https://hal.science/hal-03815557>

Humann-Guillemot S, Tassin de Montaigu C, Sire J, Grünig S, Gning O, Glauser G, Vallat A, Helfenstein F (2019) A sublethal dose of the neonicotinoid insecticide acetamiprid reduces sperm density in a songbird. *Environmental Research*, 177, 108589. <https://doi.org/10.1016/j.envres.2019.108589>

## **Reviews**

### **Evaluation round #2**

**Reviewed by Clémentine FRITSCH , 14 March 2023**

As highlighted during the first round of review, this is a very nice study presented in a great manuscript. The authors have addressed the drawbacks noticed by the reviewers and corrected typos. The article is suitable for publication, I recommend it!

### **Evaluation round #1**

DOI or URL of the preprint: <https://hal.science/hal-03815557>

Version of the preprint: 1

**Authors' reply, 03 March 2023**

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**Decision by Pierre Labadie, posted 15 December 2022, validated 15 December 2022**

#### **Major revision**

Major revision needed

Dear authors,

Please find attached the two reviews that we have obtained for your manuscript. As you will see, the reviewers highlighted the originality and the quality of this work but they also raised a number of issues to be addressed. If you wish to do so, please provide us with a revised version together with a point-by-point answer to the reviewers' comments. Please outline every change made in response to their comments and provide suitable rebuttals for any comments not addressed.

Regards,

Pierre Labadie

Reviewed by **Clémentine FRITSCH** , 30 November 2022

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Reviewed by **Patrice Couture** , 08 December 2022

This is an important paper, I would even say a much awaited paper, that paves the way for environmentally-relevant ecotoxicological studies on the effects of pesticide mixtures on wildlife. As the authors correctly point out, although several ecotoxicological studies have examined pesticide mixtures, the pesticides in the mixtures are usually selected based on general use over large territories or countries, or targeting some crop types, and may not correspond to relevant mixtures to which particular species of wildlife are exposed. The approach that the authors take is highly innovative and useful. It makes use of the postcodes of pesticide buyers for 279 different molecules in France. After making a number of well explained and reasonable assumptions, they group the 5,361 postcodes in 18 groups that are discriminated by a small number of pesticides. Some pesticides, like glyphosate, are found in most or all 18 groups and called core pesticides, but others are associated to just one or a few of these groups and termed discriminant pesticides. The approach allows associating each of the 18 groups to a specific crop, or assemblage of crops, hence, for example, differentiating Brittany from the Southern regions, where vineyards are concentrated.

The limitations of the study are well explained and dealt with in the cautious interpretation of the data. For example, it may be that a pesticide purchased in a given postcode area at a given date is not used in the year or in the postcode in which it was purchased. The authors eliminated chemicals purchased by the SNCF that centralizes its purchases for use across the French territory. Overall, the data are credible and the conclusions prudent.

The power of this study is that this approach will allow ecotoxicologists to study mixtures of pesticides to which a given species is likely exposed in a given part of its distribution range. The approach taken by the authors is sufficiently well described to be applied by others in other regions and countries where a database of pesticide sales is kept.

From an ecotoxicological perspective, this study is exciting and opens new avenues to research on the impacts of pesticide use at the landscape level. The approach could even be coupled with georeferenced data on biodiversity to further orient studies of the effects of these mixtures.

I do not have the competence to make a judgment on the statistical approach, and that part will need to be assessed by someone with the relevant expertise.

Finally, the style is clear and the English is excellent. A pleasure to read. I attach a pdf to indicate a few corrections.

[Download the review](#)