European Commission

Science for Environment Policy

Pesticide risk assessments could be made more realistic with ecological scenarios

A method for developing ecological scenarios for assessing pesticides' risks to aquatic wildlife has been developed. It is based on the selection of vulnerable taxa according to biological trait information, exposure conditions and environmental properties. The method should help decision makers define what to include in ecological models used for future pesticide risk assessments and is proposed as a way to increase the ecological realism of pesticide risk assessment.

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Environmental risk assessment (ERA) is conducted with computer models and experiments to judge whether a new pesticide could have any negative ecological effects before it is placed on the market or used in fields. Computer-model simulations used for pesticide-effect assessments require scenarios that describe the environmental context in which they are applied.

However, this study argues that these scenarios often do not capture all relevant ecological processes or patterns of pesticide exposure that should be taken into account to provide a realistic worst-case evaluation. Its authors propose a framework for developing more realistic ecological scenarios for environmental risk assessment of pesticides, focusing on important ecological characteristics of aquatic species.

In agreement with current procedures for pesticide exposure scenarios, developed by the European Commission's FOCUS (the FOrum for Co-ordination of pesticide fate models and their USe), the first step in the framework is to define the edge-of-field water body habitat (i.e. streams, ditches and ponds) and climatic region.

The next stage in the framework is to decide which species to focus on, as it is not possible to assess risks to all species. Factors to consider when choosing this 'focal species' include the probability of exposure, its sensitivity to pesticides and potential to recover from exposure, based on available toxicity and biological trait information. Biological traits which affect recovery vary by species but may include number of offspring, swimming capacity or flying strength – which allow colonisation of new areas.

The characteristics of the reference species' environment are then defined. These may include the temperature and pH of water, local agricultural practices, such as soil tillage and pesticide risk mitigation measures (e.g. buffer strips), and the nature of the landscape – whether habitats are connected or fragmented, for instance.

To show how the framework works in practice, the researchers created an ecological scenario to assess the aquatic risks of lambda-cyhalothrin in Dutch ditch ecosystems. This pesticide is widely used on potato crops in the Netherlands. From a list of 332 types of macroinvertebrate found in studied ditches, the researchers decided to focus on the alderfly (*Sialis lutaria*). This species was identified as both sensitive and vulnerable to the class of pesticides under study, and abundant enough to be considered representative of those ecosystems. There are also sufficient data available on its biological traits for analysis. These include its life cycle, its crawling and swimming ability, and its prey and predators.

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Environmental factors considered in the scenario included the amount and frequency of lambda-cyhalothrin application on crops, how the pesticide spreads in ditches and how it is absorbed into sediment. The researchers point out that the pesticide is highly absorbed by sediment, where alderfly larvae live. The larvae also eat other sediment-dwelling creatures, which may also contain the pesticide. In addition, the timing of pesticide application coincides with a phase of the adult alderfly's life when it lives on land.

Earlier studies, which used standard model ecosystems, have concluded that alderflies are not particularly vulnerable to lambda-cyhalothrin. However, these studies did not sufficiently consider the effects of the pesticide in sediment, and in particular, its effects on a particularly vulnerable stage of the alderfly's larval development which could lead to long-term population decline, the researchers suggest.

The study's authors say that these ecological scenarios should be standardly developed for: 1) the main climate regions in the EU; 2) the main aquatic landscape units accounted for in ERA (i.e. ditches, streams, ponds); and 3) the main pesticide groups, differing in their toxic mode of action, that are currently applied. The systematic definition of ecological scenarios will help modellers and risk evaluators to define what combination of species should be accounted for, as well as the appropriate selection of biotic and abiotic parameters, and their levels of uncertainty, that should be included in ecological models used for future pesticide risk assessments.