07 June 2018
Issue 509
Subscribe to free weekly News Alert

Source: Szöcs, E., Brinke, M., Karaoglan, B. *et al.* (2017). Large scale risks from agricultural pesticides in small streams. *Environmental Science & Technology*, 51: 7378-7385. DOI: 10.1021/acs.est.7b00933.

Contact: schaefer-ralf@uni-landau.de

Read more about:
Agriculture, Biodiversity, Chemicals, Emerging risks, Water

European Commission

Science for Environment Policy

Agricultural pesticides found in small streams in Germany

Small streams are important refuges for biodiversity, yet knowledge of the effects of agricultural pesticides on these freshwater bodies is limited. Researchers have used national monitoring data to determine the number of small streams in Germany where regulatory acceptable concentrations (RACs) of pesticides are exceeded. An analysis of data covering almost 500 pesticides and over 2 000 small streams suggests that agricultural land use is a major contributor of pesticides to streams. Overall, RACs were exceeded at 26% of sampled streams, and exceedances were 3.7 times more likely if a stream was near agricultural land. This finding may have implications for environmental monitoring and agri-environmental measures.

Agricultural pesticides that end up in streams via spray-drift, edge-of-field runoff or drainage may affect freshwater biota and ecosystem functioning. To date, research on the effects of pesticides on small streams has been scarce. Most studies have focused on larger water bodies, while those that have looked at small streams have typically been limited to just a few sites. However, comprehensive data on small-stream pesticide contamination exist at the European level, since they are collected as part of national monitoring programmes set up for the surveillance of water quality in compliance with the Water Framework Directive (WFD).

Monitoring data from Germany were compiled and analysed to evaluate the risks that agricultural pesticides pose to small streams. Pesticide monitoring data from sampling sites classified as small streams (those with catchment sizes below 100 km^2) from across the country were used. The data set contained 1 766 104 measurements of 478 pesticides and their metabolites (breakdown products), which were found in 24 773 samples taken from 2 301 sampling sites from 2005 to 2015[1]. Using this data set, it was possible to analyse exceedances of RACs nationally, to investigate the influence of agricultural land use, catchment size, rainfall and seasonal variation on pesticide concentrations, and to calculate the current risk posed by pesticides to small streams in Germany.

The findings showed that a quarter (26%) of all streams sampled contained levels of one or more pesticides that exceeded RACs[2] at least once during the 10-year monitoring period. Agricultural pesticide use appears to be a major contributor to these high concentrations because streams were 3.7 times more likely to exceed a RAC if they were close to agricultural land and the detection of pesticides in samples increased following rainfall (likely due to pesticide runoff) and from April to June (when pesticides are typically applied). The highest extent of exceedance of RACs was found for neonicotinoid insecticides[3]. Taken together, these results suggest that agricultural pesticides pose a threat to small streams and their biodiversity.

From a policymaking perspective, if EU Member States are to comply with the Directive on the Sustainable Use of Pesticides 2009/128/EC, national action plans (NAPs) for the sustainable use of plant protection products[4] should take account of the effects of pesticides on small streams. In addition, the researchers highlight that current monitoring protocols are largely based on grab samples (single samples taken at a specific time or over a short period of time), which can under- or overestimate pesticide risk in surface waters by failing to reflect variations in concentrations caused by seasonal or weather-related changes. The researchers, therefore, recommend that current pesticide monitoring guidelines be refined to account for these variations.

Environment

1. Data set contains samples aggregated by region. Multiple samples were collected from multiple sites over the monitoring period, with large variation between regions (e.g. 7 samples collected from one site in Lower Saxony versus 9 141 samples taken from 606 sites in Saxony). For further information, see Table S1 in the study's supporting materials.

2. RACs are specific to compounds. The measured concentration divided by the RAC is given as the risk quotient (RQ). Determining whether the RAC is exceeded (RQ>1) may be difficult if the limit of quantification of the analytical method is higher than the RAC. Figure 6 in the paper shows the highest RQs observed, and the percentage of quantified samples. Table S5 in the study's supporting material provides more information.

3. Morrissey, C. A., Mineau, P., Devries, J. H., *et al.* (2015). Neonicotinoid contamination of global surface waters and associated risk to aquatic invertebrates: A review. *Environment International*, 74: 291–303. DOI: https://doi.org/10.1016/j.envint.2014.10.024

4. e.g. UK National Action Plan for the Sustainable Use of Pesticides (Plant Protection Products) (2012)