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Study: Pesticide authorisation procedures fail to adequately protect biodiversity in rivers

Before a pesticide is allowed to go on sale, it has to pass a standard EU authorisation process. However, the current procedure does not sufficiently protect the environment, according to a joint study by the University of Koblenz-Landau, the Helmholtz Centre for Environmental Research (UFZ), the University of Aarhus (Denmark), and the University of Technology, Sydney just published in the international journal *Environmental Science and Technology*. To carry out this meta-analysis, a number of globally available field studies on the effect of pesticides were compared and evaluated.

Pesticides used in agriculture can be washed into surface water during strong rain events and impair the organisms therein. The main aim of this study was hence to assess the effect thresholds of pesticides for organisms in rivers. The meta-analysis only examined field studies addressing rivers in agricultural areas and which were not subject to the discharge of sewage or industrial effluent. Eight studies from six different European countries as well as Siberia and Australia carried out between 1998 and 2010 were analysed. The studies covered periods ranging from 2½ to 36 months and considered a total of 111 different rivers.

A dose-response curve was derived from the individual studies, reflecting a correlation between the toxicity of a pesticide and the quantity of sensitive organisms in the river. This enabled comparison with the concentrations deemed harmless for the purpose of authorisation. The researchers concluded that the existing evaluation process is insufficient to sustainably protect river ecosystems from the effects of pesticides. Under concentrations which are rated as safe in standard methods, the populations of sensitive organisms were reduced by 27–61% depending on the

presence of unpolluted river stretches upstream, which can partly buffer the effects. One especially serious finding is that these effects may also reduce ecosystem functions, impairing vital ecosystem services for human society such as fish stocks and water purity.

Standard authorisation procedures are too narrow

According to the researchers, the reasons for this result are obvious. “Substance authorisation procedures only consider individual pesticides,” explained Ralf B. Schäfer from the Institute of Environmental Sciences at the University of Koblenz-Landau. Yet substances never occur in isolation. Instead, organisms are subject to mixtures of pesticides, multiple stressors and repeated exposure such as flooding. “The standard pesticide authorisation tests also largely ignore the fact that in nature animals are exposed to different sorts of stress,” declared Matthias Liess from UFZ, pointing out another registration snag. After all, stress greatly increases species’ vulnerability to pesticides. The current standard procedures for pesticide authorisation should therefore be reconsidered, say the researchers.

The new study also contradicts some earlier publications in which effect thresholds were determined by means of studies in mesocosms – set-ups with controlled research conditions in the field. The effect thresholds determined in the meta-analysis were found to be a factor of between 10 and 100 lower than those assumed in the authorisation process and calculated in several mesocosm studies. The authors attribute this discrepancy to two factors: a) previous studies only addressed individual substances and stressors, and b) suitable methods of the type since developed at UFZ to gauge threshold effects were not used during risk assessment (Ecotoxicology DOI 10.1007/s10646-011-0689-y).

In the researchers’ view, one reason why the study findings are so alarming is because according to a previous study by the University of Koblenz-Landau, UFZ and Freiberg University of Mining and Technology, pesticides are by no means di-

luted even in large rivers and lakes, and in fact are among the main pollutants there. Moreover, the new study revealed that the good chemical and ecological status of large European rivers and lakes required under the European Water Framework Directive (WFD) is unlikely to be achieved by 2015 since the levels of pollutants such as pesticides even exceed the safety limits in the authorised procedures (Environmental Science and Technology, DOI: 10.1021/es2013006) and sensitive water organisms are often killed by insecticides (Ecological Applications doi: 10.1890/10-1993.1).

Recommendations for the improved protection of rivers and lakes

Since pesticides are not going to be abandoned in agriculture in the foreseeable future, the researchers have the following recommendations in order to protect biodiversity in rivers: a) widening banks and woodlands near rivers in agricultural areas; b) building water retention basins which can almost completely remove some pesticides from water (as demonstrated by previous studies conducted by the University Koblenz Landau); c) reducing the use of pesticides in order to comply with the directive on the sustainable use of pesticides adopted by the European Parliament and the European Council in 2009.

The study:

Ralf B. Schäfer, Peter Carsten von der Ohe, Jes Rasmussen, Ben J. Kefford, Mikhail A. Beketov, Rals Schulz and Matthias Liess: 'Thresholds for the Effects of Pesticides on Invertebrate Communities and Leaf Breakdown in Stream Ecosystems'. <http://pubs.acs.org/doi/abs/10.1021/es2039882>
Environmental Science & Technology, **46**, (9) 5134–5142.

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