

Science for Environment Policy

New method to prioritise pesticides based on their environmental and human health risks and on monitoring results at river-basin level

Researchers have developed a new approach to hierarchise pesticides based on their risk to or via the aquatic environment, which has been implemented in the Pinios River Basin of Central Greece. The analysis indicated that a number of pesticides were found in concentrations that could cause negative impacts on aquatic ecosystems. The results provide detailed information to inform decisions regarding the monitoring of pesticides in the Pinios River Basin and outline an approach that could be used in other watersheds.

Under the [Water Framework Directive](#) (WFD)¹, EU Member States are required to identify River Basin Specific Pollutants (RBSP) — pollutants that are present in significant quantities within a river basin or sub-river basin— and to set environmental quality standards (EQSs) for them. An EQS is the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment. Member States should also take actions to meet these quality standards. The first deadline for this was at the end of 2015. At a country level, Greece has produced a list of 60 river-basin-specific pollutants with their related EQSs, which includes 30 pesticides.

Various methods of [risk assessment](#) have been devised to evaluate the potential risk of chemicals to the environment. In this study, the researchers aimed to develop a prioritisation approach for pesticides in order to identify RBSPs. The proposed prioritisation method is based on factors such as the frequency and intensity of their occurrence above environmental thresholds, their spatial distribution and their risks to humans and aquatic organisms (calculated by comparing the exposure – as Maximum Measured Environmental Concentration (MEC_{max}) — to the Predicted No Effect Concentration (PNEC)).

The study was based in the Pinios River Basin, Thessaly, central Greece, one of the main agricultural areas of the country. Water samples were collected at 102 sampling sites² — including: rivers; water reservoirs; dams; streams; ditches; and irrigation/drainage channels — located in five river sub-basins (2 382 samples collected, over a 29-month period, resulting in 7 088 data sets). Sampling sites were selected to cover the entire basin and to allow the tracing of pesticide movement through the watershed. Chemical analysis looked for 302 pesticides, including 30 of 31³ priority substances within the EQS Directive⁴. An assessment was then completed to characterise the environmental risks of these pesticides and to identify RBSPs.

The analysis detected at least one occurrence of 119 of the pesticides analysed, and concentrations for 41% of the compounds detected were higher than the respective lowest PNEC values. Furthermore, concentrations of certain compounds were rated respectively as 'of extremely high concern' (risk ratio above 1 000 — 9 pesticides), 'of very high concern' (risk ratio above 100 — 5 pesticides) and 'of high concern' (risk ratio above 10 — 16 pesticides) as they were found at levels that could cause negative ecological impacts. The prioritisation approach resulted in 71 pesticides being identified as RBSPs for the Pinios river basin; 13 of which are found in the EQS Directive. The sensitivity of the analytical methods used in the study was inadequate to determine toxic risks for 32 of the pesticides; consequently, the researchers also consider these potential candidates for RBSP status.

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1. Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32000L0060>

2. The acquisition of the monitoring data was funded in the frame of the EU-co-financed program of [Rural Development of Greece \(2007–2013\)](#) (9091/16-4-2010).

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3. 30 of the 31 priority substances regarded as pesticides, calculated taking into account the CAS numbers of the pesticides in column three of Annex II of the Directive.

4. Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32013L0039>

The study did not consider the combined effects of several pesticides being present in waterways, which could underestimate the actual risk posed by the simultaneous presence of these (and other) chemicals. The researchers suggest that the prioritisation approach outlined in this study could be used in other river basins to aid in the identification of RBSPs, in order to support an appropriate definition of 'good ecological status' of water bodies under the WFD.

