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Relevance of multiple pressures, related stressors and their interactions in European River Basin Management

Key points

- 39% of Europe's freshwaters are affected by more than one pressure.
- Diffuse pollution and hydromorphological degradation prevail.
- In the absence of single, dominant pressures River Basin Management needs to derive tailor-made solutions.
- Data, knowledge, models and tools for tailor-made solutions in River Basin Management are available.
- Key to successful River Basin Management under multi-stress conditions is the revitalisation of riparian zones.

50% of Europe's water bodies are degraded

European surface water bodies are not meeting quality targets defined by policies. About 50% of the surface water bodies are classified to be in a moderate to bad status, with these shares ranging up to 100% in some Central European countries. The status of water bodies, which do not achieve good status, needs to be improved by appropriate management measures, which are laid down in River Basin Management Plans. The share of ecological status classes, however, did not change significantly between the first and second RBMPs issued in 2009 and 2015, respectively. There are many possible reasons for this lack of progress: assessment methodologies are often not fully comparable between both plans, measures need time to be defined and implemented, and once measures have been implemented the biota need time for recovery.

The role of multiple pressures

In addition, Europe's waters are affected by multiple pressures, the management of which poses challenges to water management. Overall, 39% of the European water bodies are affected by more than one pressure; this is particularly relevant for transitional waters (53%) and rivers (43%) (Figure 1). Among the pressures, hydromorphological degradation and diffuse pollution are by far the most abundant. Water bodies simultaneously affected by several pressures are less likely to achieve "good ecological status", the target defined by the EU Water Framework Directive.

"Pressures" include diffuse pollution (e.g. with nutrients, fine sediments or pesticides), point source pollution (e.g. with sewage) and hydromorphological degradation (e.g. river straightening, removal of riparian vegetation).

"Stressors" are generated by pressures: Diffuse pollution generates enhanced nutrient concentrations, hydromorphological degradation leads to habitat loss or flow alteration.

Types of stressor interactions

Additive: $1+1 = 2$

Synergistic: $1+1 = 3$

Antagonistic: $1+1 = 0$



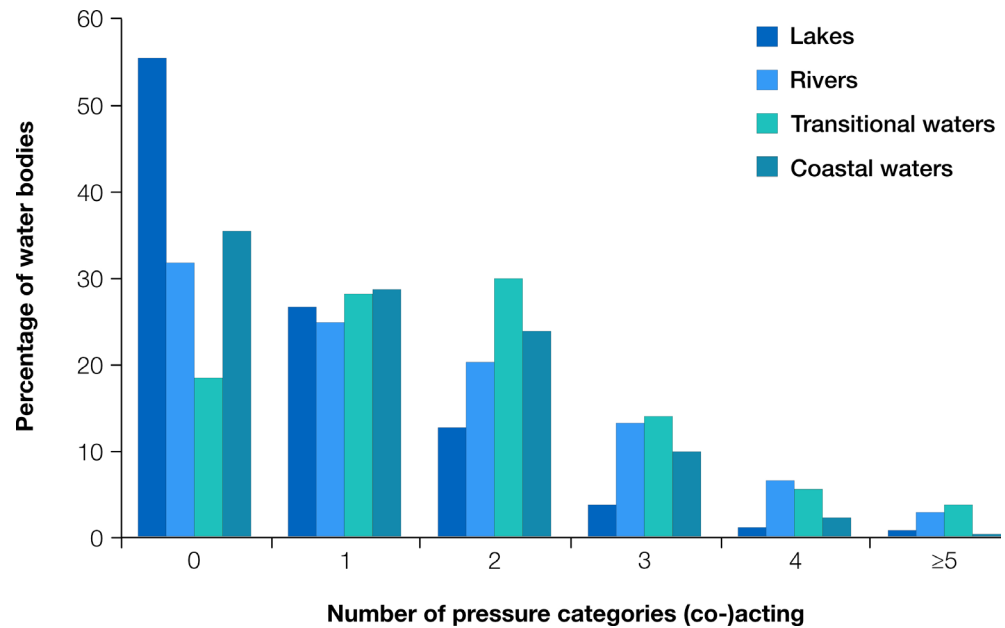


Figure 1: Percentage of water bodies affected by no, one or multiple pressure categories. Pressure categories cover point source pollution, diffuse pollution, water abstraction, physical alteration, hydrological alteration, continuity disruption and other pressures.



Management of multiple pressures and related stressors

For single pressures, there is usually a straightforward management strategy. Several of the “success stories” in environmental management and environmental protection are related to the management of single pressures, e.g., water quality has been greatly increased in most part of Europe due to wastewater treatment. Multiple pressures, however, are more challenging to manage, for a variety of reasons: they may interact in unpredictable ways; there might be a clear hierarchy, with just one out of several stressors affecting ecological status; however, once the intensity of this pressure has been reduced, the mode of interaction between the pressures and related stressors might change again.

Tailor-made management strategies for multiply-stressed water bodies

There is no “one-size-fits-all” solution for the management of water bodies affected by multiple stressors. Management plans, therefore, always need to analyse, which pressures (and resulting stressors) affect the ecological status of the water body to be addressed. Data, knowledge, models and tools for deriving tailor-made management strategies are available for almost all European catchments:

- On a large scale, the MARS Scenarios Analysis Tool gives an indication on which stressors are relevant in more than 100,000 European sub-catchments.
- The data on the Biological Quality Elements sampled in the framework of the River Basin Management Plans provide an indication on the causes of degradation.
- Data on stressors and on Biological Quality Elements can jointly be analysed by a range of tools, e.g. by the MARS Diagnostic Tool, to identify stressors acting on ecological status.

Such data- and knowledge-based management strategies are the most likely to be successful.

MARS Scenarios
Analysis Tool
<https://mars-project-sat.shinyapps.io/mars-sat/>

MARS Diagnostic Tool
<http://www.freshwaterplatform.eu/index.php/mars-diagnostic-tools.html>

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Riparian management as a key to success

The most relevant and abundant pressures affecting Europe's water are diffuse pollution and hydromorphological degradation. Particularly for rivers, these pressures cannot be successfully addressed by restoring single, short river stretches. A successful and low intensity management method is to provide riparian buffer strips along a significant proportion of the river network, which address both diffuse pollution (by minimising the input of nutrients, fine sediments and pesticides) and hydromorphological degradation (by allowing the generation of riparian and in-stream habitats).

More information on the EU MARS Project is available at: www.mars-project.eu

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