

# Science for Environment Policy

## Health of European streams revealed by leaf breakdown

**A recent study**, which assessed 100 streams across Europe, reveals that a key ecosystem process, leaf litter breakdown, is slowed when nutrient concentrations in the water are either very low or very high, has the highest potential at moderate nutrient concentrations and is inhibited in heavily polluted waters, implying that the relationship between nutrient levels and ecosystem processes, such as leaf litter breakdown, is complex. The researchers suggest that including an assessment of the functioning of ecosystem processes can make an important contribution to the overall evaluation of stream health.

**Leaves from trees and other plants** that enter streams are an important nutritional resource for stream-dwelling organisms. Microbes, such as bacteria and fungi, and benthic macroinvertebrates, such as insect larvae, feed on the leaves and, in the process, help break them down and recycle the plant nutrients. Macroinvertebrates, in turn, are food for predators higher up the aquatic food web. However, aquatic ecosystems around the world are being polluted, for example, by excessive nutrient inputs from intensive agriculture and fertiliser use, in addition to pollutants deposited from the air, which is affecting the decomposition of leaves.

To assess how nutrient levels affect this important ecosystem function, the researchers, partly-funded under the EU RIVFUNCTION project<sup>1</sup>, investigated the breakdown rate of leaf litter from two common trees, the oak and the black alder, in 100 streams across nine European countries: France, Ireland, Poland, Portugal, Romania, Spain, Sweden, Switzerland and the UK. The nutrient concentrations varied widely across the stream sites, and therefore represented streams with very low to excessive nutrient inputs.

The overall decomposition rate of both leaf litter types, and by macroinvertebrates, in particular, was slow at both low and high nutrient levels, enhanced at moderate nutrient concentrations and inhibited at high nutrient levels consistent with heavily polluted waters. In addition, an analysis of Irish streams revealed that the highest decomposition rates occurred where the variety and abundance of stream invertebrates was the greatest.

This implies that both low and high nutrient levels can impair leaf litter breakdown, a key aquatic ecosystem process. Low nutrient concentrations do not necessarily support sufficient microbes and invertebrates to make use of the leaf litter resource, whilst the polluting effects, such as oxygen depletion, associated with high nutrient levels, counteract the benefits of a greater supply of nutrient resources.

The European Commission's Water Framework Directive<sup>2</sup> was established to protect and improve the surface, coastal and groundwaters in Europe, with the aim of having conditions that most closely resemble the natural state of the water bodies. Assessing the health of stream ecosystems typically involves monitoring physical and chemical conditions, in addition to changes in the variety and abundance of biological communities found in rivers and streams.

This study reveals that the relationship between structural properties (e.g. species diversity or water chemistry) and functional (e.g. leaf litter breakdown) conditions in freshwater ecosystems is complex. To give a more comprehensive picture of the overall health of aquatic ecosystems, the researchers suggest that assessments of both structural and functional measures are undertaken. In addition, more research is needed to try to define what is the 'normal' range of processing for a given set of environmental conditions and community properties.



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2. See: [http://ec.europa.eu/environment/water/water-framework/index\\_en.html](http://ec.europa.eu/environment/water/water-framework/index_en.html)