Improving the health and quality of rivers and water bodies

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Geographical research monitoring how river plants and insects trap, modify and retain fine sediments in rural watercourses has enabled the Environment Agency to assess the ecological health of UK rivers and streams, and to identify where remediation measures are most needed.

Challenge

The volume and movement of fine sediment, plays an important role in controlling the levels of some contaminants, such as pesticides and nutrients from fertilisers, in rivers and other water bodies.

Monitoring and mitigating contaminants is an important part of efforts to achieve 'good ecological status' for rivers, streams and bodies of fresh water, under the EU Water Framework Directive.

Solution

A research team led by Dr Geraldene Wharton, Queen Mary University of London, as part of NERC's Lowland Catchment Research Programme (LOCAR) investigated how river plants and the insects that live on them, trap, modify and retain the fine sediments which make their way into rural watercourses.

Monthly field measurements of discharge, flow velocities and sediment accumulations, alongside mapping of in-stream vegetation, were taken over a two-year period at a number of sites in the Frome and Piddle river catchments in Dorset. This revealed:

- Macrophytes (submerged large plants) play an important role in the ecological health of streams and other water bodies. *Ranunculus* sp. (water crowfoot) which is the dominant macrophyte and is typically abundant in nutrient-rich chalk streams during the spring and summer months, modified the instream environment by altering river flows and trapping sediments.
- 'Trapped sediments' release significant amounts of methane. This raises concerns about the health of chalk streams and indicates negative side effects of agricultural practices beyond well-known fertiliser enrichment, pesticide/herbicide application and losses in biodiversity.

Benefits

Solving problems

Using LOCAR's findings, the Environment Agency developed and refined a software tool, called LEAFPACS, to predict what the community of macrophytes should be in any river or lake, which helps assess the site's actual ecological health.

This supports the monitoring of river quality as part of the Water Framework Directive (WFD) implementation.

The first management cycle of EU WFD ended in 2015, and a summary update on water quality progress was released in 2018. Although the 2015 targets were not met, LOCAR research improved understandings of catchment function and how to judge the health of rivers, with results used by the Environment Agency and Thames Water to underpin freshwater body management decisions.

The research also helped the Environment Agency to identify where remediation measures were needed and saved money on the costs of monitoring and implementing the WFD.

At the conclusion of the LOCAR programme, it was estimated that the programme as a whole would provide public-sector savings in the range of £73K to £365K per annum, totalling between £2 million to £9 million over the life of the current Water Framework Directive.

The LOCAR end-of-project report identified several cost-saving benefits from the programme, including for the private sector, where Thames Water used LOCAR results to help identify sustainable and cost-effective water sources.

Combining systems / data

Further work by Dr Wharton and work on fine sediment erodibility by Robert Grabowksi has supported the REFORM project, which generated tools for cost-effective river assessment and restoration.

This will help researchers better understand degradation and restoration in rivers and allow catchment planners to use the REFORM hydromorphology framework to characterise the dynamics of river degradation.

Further reading

Robson, Lymperopoulou & Rae (2008) on functional neighbourhoods