Science for Environment Policy

Acid mine drainage effectively remediated by natural wetlands

Natural wetlands can provide effective long-term remediation of contamination from abandoned mines, new research suggests. The study examined a natural wetland receiving water from a copper mine in the UK, and showed that the water's acidity and levels of toxic metals were significantly reduced once it had passed through the wetland.

13 February 2014
Issue 361

Subscribe to free weekly News Alert

Source: Dean, A. P., Lynch, S., Rowland, P. *et al*. (2013). Natural Wetlands Are Efficient at Providing Long-Term Metal Remediation of Freshwater Systems Polluted by Acid Mine Drainage. *Environmental Science and Technology.* DOI: 10.1021/es4025904.

Contact:
andrew.dean@manchester.ac.uk

Read more about:
Chemicals, Water

Water draining from abandoned mines is often highly acidic and contaminated with toxic metals. Such contamination is widespread across the globe, harming wildlife and reducing water supplies for agriculture and human consumption. Remediation can be difficult, but specially constructed wetlands have proved a cost-effective method that also boosts biodiversity. However, little is known about the remediation abilities of natural wetlands, especially over long time periods.

In this study, researchers assessed the remediation capacity of a natural wetland in Wales, UK. The wetland is known to be over 100 years old, and is fed by a river contaminated with drainage from a copper mine that was abandoned in 1911.

Researchers monitored the wetland for more than 14 years, over three periods: 1997-2003 (excluding 2001), 2004-2007 and 2009-2010 and in 2011, measuring levels of toxic metals and acidity in the river and wetland. In 2003, as part of flood risk management, the mine drainage was diverted away from the river, and pollution levels, while still significant, were much reduced. This provided a unique opportunity to examine how remediation progressed when contaminant inflow was reduced.

The results show that during 1997-2003 (before the diversion), acidity was high (pH 2.5) in the river, and there was no change as it passed through the wetland; only far downstream did it reach a less acidic pH of 5.3. However, the wetland significantly reduced the levels of toxic metals dissolved in the water. Concentrations of iron, zinc and copper were reduced by the wetland by 55%, 64%, and 37%, respectively. After the diversion, the efficiency of metal remediation significantly improved, and the wetland also reduced the acidity of the river water: the monitoring in 2011 showed that, just 700m into the wetland, source concentrations were reduced by 92% (iron), 83% (zinc) and 94% (copper), and the pH was 5.5.

The researchers examined the plant life that might be absorbing some of these toxic elements. The three most common plants in the wetland are soft rush (*Juncus effusus*), common reed (*Phragmites australis*), and common cottongrass (*Eriophorum angustifolium*). Of these, the soft rush was found to absorb the highest levels of the three metals with the concentration of iron reaching 88.7 milligrams per gram (mg/g) of plant tissue, compared to 19.8 mg/g found in rushes grown in unpolluted areas. High concentrations of the metals were observed in the organic sediments around the roots of the plants in the wetland, confirming their vital role in capturing the metals.

The remedial impact of the wetland on water quality was also associated with positive effects on biodiversity. By the end of the project, pollution-sensitive invertebrate groups, such as stoneflies (order *Plecoptera*), mayflies (order *Ephemeroptera*), and freshwater shrimps (family *Gammaridae*), were observed at sites downstream of the wetland.

The researchers conclude that natural wetlands have the potential to provide an important long-term remediation service for mine-waste pollution, and that their stability and longevity can contribute to their efficiency.