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Benefits of constructed wetland ecosystem services worth more than double the costs

The economic benefits of the ecosystem services provided by constructed wetlands far outweigh the costs of maintaining them, new research has confirmed. Analysis of a wetland that treats the third largest lake in Florida, US, shows that it provides ecosystem services worth $1.79 (€1.64) million per year, against costs of less than half that figure.

Eutrophication, an excess of nutrients within water, has become a significant environmental problem. Nitrogen and phosphorus pollution enters waterways as a result of run-off of agricultural fertilisers, and can be damaging for aquatic wildlife.

Wetlands, which filter pollutants from water before they reach lakes, streams and oceans, can mitigate this problem. Although they occur naturally, artificial wetlands can also be constructed, and are now in use all over the world.

This study assessed the effectiveness of a large constructed wetland in the US. The researchers assessed the ability of the marsh flow-way in Florida, which filters Lake Apopka — the third largest lake in the state — to remove phosphorus from lake water.

The researchers assessed the flow-way's performance over nine years of operation (2003–2012). Water samples were collected weekly and analysed for phosphorus content. The researchers also carried out performance calculations and economic cost analysis.

Their comprehensive assessment revealed that the flow-way, which treats around 30% of Lake Apopka's volume every year, removed on average 2.6 metric tonnes of phosphorus annually – equivalent to 26% of incoming phosphorus.

The annual operation and maintenance costs of the wetland were on average $455 000 (€416 537), equivalent to a cost of $177 (€162) per kilogram of phosphorus removed.

Interestingly, the researchers found that phosphorus removal varied by season. In cool periods (from September to May) removal was greater than warm periods (June to August). Based on this finding they devised a seasonal operating regime, using low flows in the warm season, which increased cost-effectiveness.

As well as reporting performance costs during its past operation, the researchers also predicted the costs for 25 years of running the wetland (nine years of past performance plus 16 years of forecasted performance). They compared costs to those of similar systems, finding that the marsh flow-way is cost competitive.

Constructed wetlands provide many ecosystem services, such as providing good water quality and maintaining biodiversity, but quantifying their monetary value can be challenging.

Using estimates provided by ecological economics, which give monetary value to ecosystem services such as water pollution control, the researchers were able to estimate that the marsh flow-way provides a value of $1.79 (€1.64) million per year, many times greater than its annual running costs.

However, the researchers say that this is a crude estimate, which should be used to give an idea of the benefits of a wetland approach rather than a precise valuation.

As well quantifying costs and performance, the researchers also considered the ecological benefits of the wetland to assess management of the flow-way. The authors recommend that, when assessing system performance, wetland managers use a cost benefit approach that considers ecosystem services. They say this could lead to more effective and more sustainable water resource management.

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