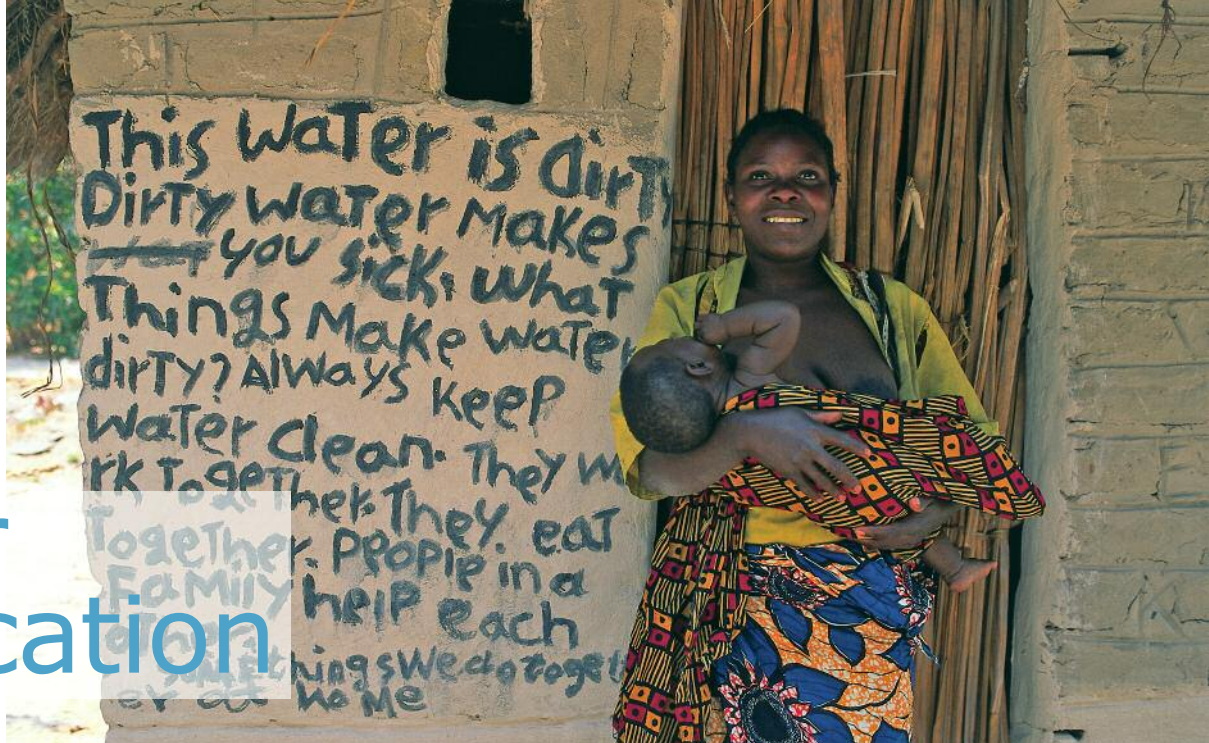


Water purification



Raising awareness about water, Bengweulu Swamps Ramsar Site in Zambia. Photo © David Rogers

Wetlands play an important role in purifying water by ‘locking up’ pollutants in their sediments, soils and vegetation. In particular, high levels of nutrients such as phosphorous and nitrogen, commonly associated with agricultural runoff and sewage effluent, can be significantly reduced by wetlands. This may prevent those same nutrients from reaching toxic levels in groundwater used for drinking purposes. It also helps to reduce the risk of eutrophication in surface-water bodies further downstream, a process that occurs when high nutrient levels cause a massive boost in algal growth, depleting oxygen and blocking out the light that other aquatic plants and animals need to survive.

Many wetland plants have the capacity to remove toxic substances that have come from pesticides, industrial discharges and mining activities. For instance, the tissues of some floating plants, especially *Eichhornia crassipes* (water hyacinth), *Lemna* (duckweed) and *Azolla* (water fern) are able to absorb and ‘store’ heavy metals – such as iron and copper – contained in wastewater. The quantity of heavy metals taken up by plants depends on a whole variety of factors (e.g. speed of water flow, size of treatment area, climate, type of plants used) but levels

are commonly many times higher in plant stems, leaves and roots than in the wastewater being treated, clearly showing the effectiveness of wetland vegetation as a ‘biofilter’.

Eichhornia crassipes, a native of South America, is a ‘Jekyll and Hyde’ of the wetland world, helpfully removing toxic substances in some wetlands but proving to be a costly adversary in many areas where it has been introduced (e.g. Lake Victoria in East Africa) because of its phenomenal growth rate. Indeed all non-native water plants used for wastewater treatment – particularly those that float – require careful management to prevent them from invading natural wetland ecosystems.

Fast-growing plants that are rooted in wetland soils, such as *Typha* (cattail) and *Phragmites* (reed), have also been used effectively to treat water polluted with nutrients and heavy metals.

In brief...

- ◆ Wetlands play an important role in purifying water by ‘locking up’ pollutants in their sediments, soils and vegetation.
- ◆ Some floating plants, e.g. *Eichhornia crassipes* (water hyacinth) can absorb and ‘store’ heavy metals such as iron and copper.
- ◆ The natural ability of wetlands to ‘filter’ and clean water has been used to treat wastewater from industry and mining, as well as sewage.
- ◆ At least one-third of the sewage from the Indian city of Kolkata (population 10 million) is treated effectively by the East Kolkata marshes, which also support the livelihoods of 20,000 people.
- ◆ In Chesapeake Bay, USA, the natural water-filtering capacity of oysters is being used as one means of improving water quality.
- ◆ New York City found that harnessing the ecosystem services provided free of charge by wetlands was more cost effective than building conventional water treatment plants.

Water purification...

Using the purification capacity of wetlands, the Indian city of Kolkata (Calcutta) has pioneered a system of sewage disposal that is both efficient and environmentally friendly. Built to house one million people, Kolkata is now home to over 10 million, many living in slums. But the 8,000-hectare East Kolkata Wetlands Ramsar Site, a patchwork of tree-fringed canals, vegetable plots, rice paddies and fish ponds – and the 20,000 people that work in them – daily transform one-third of the city's sewage and most of its domestic refuse into a rich harvest of fish and fresh vegetables.

For example, the Mudialy Fishermen's Cooperative Society is a collective of 300 families that lease 70 hectares into which wastewater from the city is released. Through a series of natural treatment processes – including the use of *Eichhornia crassipes* and other plants for absorbing oil, grease and heavy metals – the Cooperative has turned the area into a thriving fish farm and nature park. In 2005/06, the Cooperative sold fish worth over US\$135,000 and shared income of more than US\$55,000 among its members.

Some wetland animals may also help with water purification. In Chesapeake Bay, on the east coast of the United States, the restoration and management of oyster beds is one of many different approaches being taken to tackle the Bay's pollution problem. As oysters filter water for food, they also remove nutrients, suspended sediments and chemical contaminants, improving water quality and boosting its clarity, which benefits seagrasses and other aquatic species. A single oyster can filter more than 200 litres of water per day.

The economic value of the purification function of wetlands can be huge. In 1997, New York City found that it could avoid spending US\$3–8 billion on new wastewater treatment plants (with US\$700 million in annual operating costs) by investing just US\$1.5 billion in land purchase and conservation management measures to protect wetlands in the watershed – wetlands that would do the job of purifying the public water supply for free.

In Florida, the Everglades Nutrient Removal Project involved a 1,544-hectare constructed (artificial) wetland designed to reduce the amount of phosphorus entering the Everglades – a Ramsar Site – from agricultural runoff. Since flow-through operations began in the mid-1990s, observations indicate that the outflow of total phosphorus concentrations, on average, have been about five times lower than inflow concentrations.

Of course nature has its limitations, and it would be wrong to consider that wetlands can deal with whatever types and quantities of waste we humans can produce. This was vividly demonstrated by two environmental disasters in Europe, in which storage reservoirs holding toxic wastewater from mining failed. In southern Spain, in 1998, more than 5 million cubic metres of sludge laden with heavy metals poured into the Guadiamar River, threatening the world-famous Doñana wetlands (a Ramsar Site). Over 4,500 hectares were affected and the clean-up bill for the regional government reached EUR165 million. Less than two years later, in Romania, 100,000 cubic metres of wastewater containing cyanide and heavy metals flowed into a tributary of the Danube River, contaminating 1,000 kilometres of river ecosystems in Romania, Hungary, Serbia and Bulgaria.



Reeds, like these in Poyang Lake Ramsar Site, China, remove pollutants from the water.
Photo © Crawford Prentice



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