

# Science for Environment Policy

## Constructed wetlands boost biodiversity: evidence from Italy

**Constructed wetlands are used in many countries as green infrastructure to treat waste water**, but may also be biodiversity hotspots, a new study suggests. This study reports on a constructed wetland in an urban area of Italy, which increased the number of plant taxa — including several plants of conservation concern — by over 200%. The researchers say the ability of constructed wetlands to enhance biodiversity could support local development.

**Wetlands — areas saturated with water, such as swamps, peat bogs and marshes** — are natural purifiers of water. The aquatic plants they contain can remove toxic substances, including [pesticides](#), heavy metals and industrial effluent. Wetlands are one of the most [biodiverse](#) types of ecosystems, and constructed wetlands are no exception.

Designed to mimic these natural systems, constructed wetlands are utilised in Europe and worldwide to treat waste water. They can remove nutrients, trace elements and microorganisms and — as long as enough space is available — offer a low-cost alternative to traditional waste water treatment. Constructed wetlands have been used in Europe for over 20 years<sup>1</sup>.

This study was based in the Mediterranean basin, where many countries have used constructed wetlands to reduce water pollution. It focused on the EcoSistema Filtro (ESF), a constructed wetland in Sardinia, built in 2004 to filter treated waste water. The ESF is situated inside the [Molentargius-Saline Regional Natural Park](#), an area of international importance due to its outstanding biodiversity (it is part of both [Natura 2000](#) and the [Ramsar Convention on Wetlands](#)). The ESF, which is a 37-hectare free water surface system, purifies waste water to feed the park's freshwater basins.

The researchers charted the plants growing in the wetland for eight years (2005–2013), surveying three plots twice each year, during the main flowering periods. A walking survey was also conducted at least once a month to collect species data. The researchers compared the data collected in different years to evaluate the changes in flora as the wetland ecosystem evolved.

Plant colonisation began soon after the construction of the wetland and followed a constant and gradual rise, with the highest increase occurring in years one and two. Over the eight years studied (except for 2006/2007, when plants were mechanically removed from the wetland as part of management procedures) there was a continuous increase in species richness. The number of taxa (groups of populations, such as different species) increased by an average of 14% every year.

In the final year of the study, the researchers noted 275 different types of plant (an increase of 224% compared to the first year). The flora of the wetland accounted for over half (54%) of the entire regional park's flora, including many native (endemic) species. Six different groups of endemic plants took advantage of the saline, nitrogen-rich habitat provided by the wetland.

*Continued on next page.*



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**Source:** De Martis, G., Mulas, B., Malavasi, V. & Marignani, M. (2016) Can artificial Ecosystems enhance local Biodiversity? The case of a constructed Wetland in a Mediterranean urban context. *Environmental Management*. 57 (5): 1088–1097. DOI: 10.1007/s00267-016-0668-4

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1. Haberl, R. (1995). Constructed wetlands in Europe. *Water Science and Technology*, 32(3): 305–315

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2. Lewis, L., Behling, E., Gousse, H., Qian, E., Elphick, C., Lamarre, J., Bêty, J., Liebezeit, J., Rozzi, R. & Goffinet, B. (2014). First evidence of bryophyte diaspores in the plumage of transequatorial migrant birds. *PeerJ*, 2, p.e424.

3. Viana, D.S., Gangoso, L., Bouten, W. & Figuerola, J. (2016) Overseas seed dispersal by migratory birds. *Proceedings of the Royal Society B: Biological Sciences*, 283 (1822): 20152406

The researchers also identified a significant proportion of alien species, which in 2013 accounted for 12% of all flora in the wetland. The non-native plants included *Cortaderia selloana*, an invasive grass introduced to Europe from South America. The authors suggest these plants colonised the wetland from surrounding areas where human activity has led to an increase in the number of alien species. The alien species did not appear to have a negative impact on the endemic species, however, which persisted in the wetland. Six per cent of the plants were of conservation concern, including two species on the [IUCN Red List of Threatened Species](#).

The researchers suggest the wetland developed such high plant diversity due to its location (between a freshwater and saltwater basin) and because it provides an ideal habitat for several migratory bird species, which can transport seeds and plant fragments<sup>2,3</sup>.

This unique constructed wetland, which is within a natural park but also surrounded by a bustling urban area, provides a nature-based solution with multiple environmental benefits, including filtering water and storing carbon. In under 10 years, it has also become a reservoir of genetic diversity, and thus provides the additional benefit of preserving and enhancing biodiversity.

This study illustrates the positive impact artificial ecosystems can have on local biodiversity and stresses the importance of protecting wildlife when operating a water-treatment system (avoiding management procedures such as mechanically removing plants, as occurred in the ESF in 2006/7). The researchers suggest sites such as this can drive [sustainable development](#) in [urban](#) areas.

