

COMBINATION OF WASTEWATER TREATMENT WITH ENVIRONMENTAL PROTECTION



The green filter purifies between 0.8 and 1.4 liters per second, removing 86% of polluting components hereby significantly contributing to protection of Lake Fúquene.

Challenge

Pollution and eutrophication are big threats to all our water bodies. In almost all developing countries, domestic untreated sewage flows into rivers, lakes, lagoons and generally into the landscape. This issue becomes large relevance in isolated rural areas where the discharge of wastewater from communities generates not only an enormous environmental problem, stressing the ecological balance of aquatic ecosystems but also a humanitarian challenge, as local residents suffer the consequences of inadequate sanitary and hygiene conditions. In countries such as Colombia, where natural and water resources seem inexhaustible, it is an impressive paradox that some areas suffer the same effects as areas in the world where water is almost completely missing, even for basic needs.

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Study

Lake Fúquene located in the Andean mountains of Colombia is considered one of the most important inland water ecosystems in the country. Home of a large endemic diversity of birds, fishes, reptiles, macro invertebrates and mammals, this water body is a cornerstone in the ecological and sociological dynamic of the area. Its function as a reservoir situated between the river Suárez and the river Ubaté, allows flow control and reduction of flood impacts on the neighboring towns. It is the water supply for 200,000 people and a crucial water source for cattle, agriculture, fishing and extraction activities.

Nevertheless, Lake Fúquene is under massive threat due to the introduction of exotic species, biodiversity loss, contamination and aquatic macrophyte infestations, providing the Lake, which currently lacks of a protection status, with a eutrophic state. This phenomenon is directly associated to non sustainable discharge of untreated domestic and agricultural wastewater generated in the surrounding municipalities, San Miguel de Sema is one of them.

San Miguel de Sema is a town located in Fúquene basin, dedicated mainly to dairy farming and agriculture. As the rest of municipalities surrounding the lake, San Miguel de Sema discharges its wastewater in to the lake. Its inhabitants, aware of the environmental impacts a polluted lake causes, showed high interest into management alternatives aiming at restoring and protecting the lake. Against this background, the Fundación Humedales chose San Miguel as an optimal location to launch a green filter pilot project. Volume and characteristics of the wastewater and its domestic origin eased a biological treatment, a pre-existing separation sewage system that



By Julia Pérez Sillero

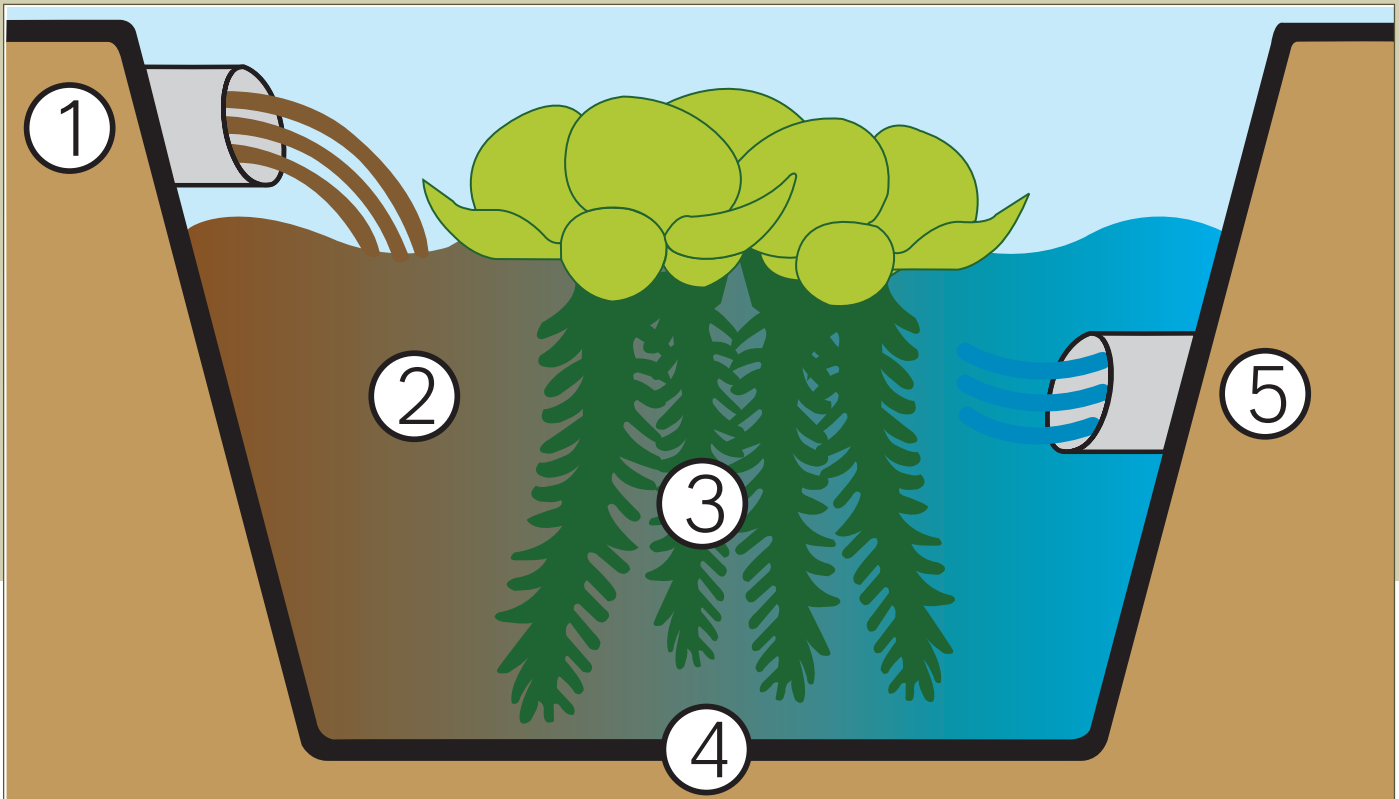


Figure 1: Water Path Inside the Green Filter

conducts the waste water flow into a single discharge point, the terrain availability and the essential local awareness, not only from the inhabitants but also from administrations and public companies, the municipal mayor received the project very positively, offering the area of an existing facultative lagoon in operation to develop the pilot demonstration project. All the efforts were focused on this municipality where the first green filter pilot project in Colombia was launched in 2013, an innovative new approach that would deliver clean water for domestic uses for the inhabitants of this community or return clean

water to the natural water bodies as conservation strategy and an excellent alternative for waste water management in the region.

A Nature Based Solution

Following an innovative biomimicry approach, the so-called green filter is a cost effective solution to sewage treatment based on natural processes of contaminant degradation in wetlands. Green filter consists of a grid of open channels planted with floating aquatic macrophytes receiving wastewater after a basic primary treatment Figure 1. (1) The roots of the macrophytes function as a

substrate for bacteria and form the core part of the filtering process. (2) The water gets in contact with the roots and bacteria. (3) The organic material is mineralized into nutrients which are used by plants for a photosynthetic process. These mechanisms of contaminants removal are the same that occur in natural wetlands, a combination of complementary bacterial metabolic routes which vary in abundance according to the depth of the water column. (4) Solids collide with the roots and are trapped or deposited into the ground. When the Green Filter is correctly maintained the efficiency of such a type of treatment is similar



Artificial Floating Wetlands in Lake Sampaloc., Philippines



Water Path Inside the Green Filter



Running Green Filter in Susa



Constructing Activities in San Andrés Ixtlán, Mexico

to those of conventional wastewater treatment techniques. The filtering process can remove 80 to 95% of the BOD, up to 80% of nutrients (P and N) and up to 90% of all pathogens, preventing the development of odors and diseases. (5) Eventually, water is usually released into a natural water body or might be used for farming activities.

The advantages of those alternative efficient systems are multiple; implementation with low infrastructure, operation and maintenance costs and no use of energy or chemical products. Furthermore, they contribute to the landscape aesthetics and attract species associated with natural wetlands thereby increasing the biodiversity and creating new habitats. Last but not least, the secondary products generated, biomass removed from the channels, can be used to make compost or paper. The sludge can also be processed by drying it into bio-solids or fertilizer. Those characteristics make green filters a suitable system for sewage treatment adapted to socioeconomic conditions in rural areas.

Awarded Experience

After two years of operating with excellent results, the pilot green filter in San Miguel de Sema was honored with the first great prize during the XII Planeta Azul awards in June 2015. The Planeta Azul awards aims at raising awareness in Colombia on the need to preserve and protect the valuable natural resources. To achieve this goal, the ecological contest “National Ecology Award Planeta Azul: Water, principle of life” with a strong focus on water has been launched in 1993. The constructed wetland treatment plant helps to mitigate the negative effects of sewage released into Lake Fúquene, which was one of the major threats jeopardizing the water body. San Miguel’s mayor stated that the project represents a creative, innovative, and reliable solution to treat domestic wastewater. The water analysis gives

clear evidence to the environmental advantages of this alternative system. The green filter purifies between 0.8 and 1.4 liters per second, removing 86% of the polluting components hereby significantly contributing to the protection of Lake Fúquene. The project is a perfect example of how, with little resources, reliable solutions can be implemented, generating an enormous positive impact in water and life quality.

Transfer of Best Practices

The proven success of the pilot project in San Miguel de Sema raised interest and triggered demand from other communities in the area. Three other wetlands are being constructed between 2014 and 2016 in Colombia. A second plant in Susa is already in operation and was officially inaugurated in June 2015. This green filter with a size of 3,400 m² is the largest constructed wetland in Colombia. About 1,000 households are connected to this sewage purification system.

The effectiveness of this technology has been spread among partners of the Living Lakes Network, and the interest on the implementation in rest of the world has grown beyond the initial picture, been transferred to different areas and under different scenarios. In Philippines at the shoreline of lake Sampaloc in San Pablo City, a floating wetland green filter, installed by the friends of the Seven Lakes Foundation, is cleaning parts of the wastewater of surrounding households. In Mexico, the NGO Corazón de la Tierra is carrying out construction activities for a green filter which will supply clean water for a population of 5,000 inhabitants in the community of San Andres Ixtlán. The community, situated south of Laguna de Chapala and north of lake Zapotlán, is internationally recognized by RAMSAR. The Green filter will have an effective cleaning area of around 8,000 m². A project in South Africa in a community in the region Plankenbrug-

Stellenbosch is under preparation by Wildlands Conservation Trust. More green filter plants are forecasted for 2015 and 2016 in Nicaragua (with World Vision and FUNDAR), Paraguay (with Fundación Moisés Bertoni), Guatemala (with Vivamos Mejor), Honduras (with Rotary Cub) and Jordan (with ECOPEACE). In total, about 7,000 people already benefit from improved water quality.

Green Filters Supporters

With the common objective to protect aquatic and wetland habitats, multiple and fruitful synergies among different stakeholders have made possible the development of the green filter projects described. Global Nature Fund (GNF), the German Federal Ministry for Economic Cooperation and Development (BMZ), the German and Swiss companies Kärcher GmbH and Co. KG GmbH and Sika, Foundation Ursula Merz as well as public utility companies like the Colombian CAR came together for the support of the projects. Green filters are the primary focus of the “Clean Water for the World” campaign, initiated by GNF in collaboration with Kärcher. Of particular importance is the support and enthusiasm of every local partner as well as the involvement and participation of the local community.

About the Author

Julia Pérez Sillero is an environmental scientist with master expertise in natural resources, global change and sustainability by the Universities of Barcelona, Córdoba (Spain) and Grenoble (France) and working in Global Nature Fund as a project assistant. She is the manager in different wastewater treatment projects in Latino America as well as in a protection of biodiversity, traditional cultures, rural development and local sustainable production project.

Global Nature Fund is a German non-profit, private, independent international foundation for the protection of environment and nature. The headquarters are located in Radolfzell at Lake Constance, Germany with offices also in Bonn and Berlin. GNF was founded in spring in 1998 with the objective to foster the protection of nature and environment as well as animals.

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