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Fighting pollution and restoring water quality with a nature-based filtration system in Finland

Stormwater management meets ecosystem restoration and preservation at Maunulanpuisto Park

In Maunulanpuisto Park in Helsinki, sustainable stormwater management with a biofiltration system treats rain- and meltwater and improves local water quality.

Key Learnings

- **First biofiltration system in Helsinki:** The biofiltration system is the first of its kind in the city, offering a groundbreaking approach to stormwater management.
- **Low maintenance, high efficiency:** The system requires relatively little maintenance while effectively managing runoff and supporting environmental health.
- **Benefits of Nature-based Solutions:** This biofiltration system helps clean stormwater, reduce flood risks, and support biodiversity, showcasing the value of nature-based solutions in urban stormwater management.

About the region

Helsinki, the capital of Finland, spans approximately 213.8 km² and is home to about 658,864 residents ([2023](#)). The city is characterised by a coastal landscape along the Gulf of Finland, with numerous islands and extensive green spaces. Nearly 34% of Helsinki's area is designated as city-managed green space. Climate-related challenges in Helsinki include increased flooding due to rising sea levels, heavy rain, and extreme winter conditions. These hazards pose risks to infrastructure, public health, and biodiversity. The city is actively implementing adaptation measures to enhance resilience against these climate threats.

Climate Hazards

Flooding, Storms

Sector

Urban, Water Management, Coastal Areas

Key system

Ecosystems and Nature Based Solutions, Water Management



Climate Threats

Polluted storm water, human activity and wastewater reduce water quality, especially in the Helsinki area. Climate change, with a rising frequency and intensity of extreme weather such as heavy rain and snow, adds pressure to the problem of already polluted waters. The high percentage of sealed surfaces prevents water from soaking into the soil, causing rapid runoff that leads to flash floods. These sudden, intense floods overwhelm drainage systems, which, when overloaded, can carry high levels of pollutants – like solids, nutrients, and oils – from heavily trafficked and paved areas into water bodies. For example, rainwater and meltwater entering the Haaganpuro brook are often contaminated, harming aquatic life such as fish stocks. This pollution exacerbates the challenges posed by flooding and erosion. Rising sea levels also significantly increase the risk of flooding and landslides by reducing the stability of slopes.

As large parts of the Helsinki area are subject to significant industrial activity and intense agricultural use, water and soil pollution have become a challenge for the local environment. The Baltic Sea is one of the most polluted brackish water bodies in the world. High nutrient loading from municipal wastewater, fertilisers in agriculture, scattered settlements, heavy traffic, and industry and energy production are among the most serious threats which severely threaten aquatic biodiversity. They disrupt habitats, reduce species diversity, and endanger vulnerable marine and coastal organisms. Protecting biodiversity in this region requires addressing these pollution sources to maintain ecosystem health and resilience.

Heavy rain and uncontrolled stormwater runoff occasionally overwhelm the drainage system in Helsinki. Asphalt covers most of the drainage area, so drainage system overflows lead to blockages and allow rain and meltwater with high levels of nutrients and oil to seep into local aquifers. The pollution from water runoff can contaminate the environment and harm the local fish stocks (e.g. trout) and other organisms in the brook ecosystem.

A biofiltration system for climate adaptation and a clean drainage system

To tackle this problem, the city of Helsinki adapted its stormwater strategy. The strategy aims to manage stormwater more sustainably through Nature-based Solutions that mimic natural water cycles, because these solutions address the problem while supporting ecosystem health. The [CITYWATER](#) project (2012-2015) implemented such a sustainable water management solution at Maunulanpuisto Park in Helsinki, where pollution affected water runoff entering the Haaganpuro Brook. The project team installed a biofiltration system (see Figures 1 and 2). This artificial water management system uses plants and the soil's natural ability to bind pollutants, thereby filtering the excess water entering the local ecosystem.

This biofiltration at Maunulanpuisto Park is the first of its kind in Helsinki and covers approximately 700 m². The system maintains urban nature and biodiversity in the district and neighbourhood, purifying rainwater and meltwater, protecting the citizens from river flooding, as well as helping them adapt to the climate impacts. The project was supported by informing citizens about the climate threats affecting the Baltic Sea on a local level and raising awareness.



Figure 1: Biofiltration system at Maunulanpuisto Park. Source: [Urban Nature Atlas](#). Image Credit: Kajsa Rosqvist (City of Helsinki/CITYWATER project), retrieved 08/15/2018).

Combining water treatment with biodiversity preservation – an effective symbiosis

The biofiltration system consists of two filtration stages:

First, the polluted water runoff (from rain and snow) flows into a sedimentation basin. Here, the solid pollutants settle to the bottom. The water then moves into a bio-filtration area, where special plants successively bind nutrients and heavy metals contained in polluted water. The plants and their roots enable the water to gradually permeate the sandy filtering layers beneath the vegetation, capturing and absorbing harmful pollutants. The water then slowly percolates through the sandy layers beneath the vegetation, where microbes absorb pollutants. Finally, the purified water discharges into the ditch via a drainpipe and into the Haaganpuro stream.

By collecting and treating polluted water runoff, the biofiltration system reduces the pressure on the urban drainage system and mitigates the flood risk. The sedimentation process, the plants, and the microbes improve water quality and preserve the local water habitat and ecosystem, which benefits fauna and flora. Fish stocks, such as economically significant trout and other organisms, benefit from this water-purifying Nature-based Solution in the Haaganpuro brook, where trout and salmon stocks breed.

" In autumn 2018, the number of plant seedlings in the area of Kauppalanpuisto was estimated to have risen about ten times compared to estimations in 2015. The renovations in the lower parts of the brook seemed very successful."

"[...] the recovery of trout in Haaganpuro is already a significant economic and nature conservation success story."

The [Haaganpuro association](#) (translated from Finnish, Source: [Haaganpuro](#), 2022)

Nature-based Solution Maintenance

The sedimentation basin and the biofiltration area (Figure 2) require annual performance checks, which the responsible city authorities carry out. Vegetation maintenance comprises annual cuttings in August or September. Every five years, the sediment deposited in the riverbed requires removal from the dredges. Every ten years, the biofiltration layers need replacement.

Figure 2: Biofiltration system under construction at Maunulanpuisto Park. Source: [Urban Nature Atlas](#). Image Credit: Kajsa Rosqvist (City of Helsinki/CITYWATER project), retrieved 08/15/2018.



Success factors

Environmentally friendly and cost-effective water protection measures in the Baltic Sea region (Finland and Estonia) improve the quality of local water aquifers. Communication and knowledge exchange improved working procedures, enabling more effective adaptation measures. The Baltic Sea Challenge, a network connecting more than 170 actors from various backgrounds, principles supported the measures. Assessing the environmental impact and cost-benefit of water protection measures and synthesising the results in a handbook enables access to a collection of effective water protection measures for cities.

The project also raised awareness about the importance of protecting local flora and fauna. The Haaganpuro association, a voluntary association working to preserve trout stocks in the Haaganpuro stream, highlighted this impact.

Governance and funding

The project CITYWATER cost € 1.16 million in total, of which about half (€ 578,909) stems from the European Union's LIFE+ programme. The Finnish Ministry of the Environment contributed the rest of the budget, which also led the project management and collaboration process with local stakeholders and partners such as the Baltic Sea Challenge and the city authorities of Helsinki. The City of Helsinki contracted the Finnish Consulting Group to plan and implement the biofiltration system at Maunulanpuisto Park. The local costs of the biofiltration measures implemented here amounted € 220,000.

Summary

Sustainable stormwater management solutions, such as Nature-based filtration, tackle multiple climate challenges by capturing pollutants, filtering excess water, and lowering flood risks. They enhance water quality and protect local aquatic habitats. In Helsinki, runoff from heavily trafficked roads threatens these ecosystems, but bio-filtration naturally cleanses the water and helps preserve biodiversity. Fish stocks such as trout and other organisms benefit from a water-purifying Nature-based Solution in the Haaganpuro brook, where economically significant trout and salmon populations breed. Additionally, these measures have increased public awareness about climate change's local effects and dangers.

Further information

The work presented in this adaptation story is part of the [CITYWATER](#) project.

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