

NATURE BASED SOLUTIONS – Resolving Climate Induced Urban Challenges

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Vuores, a new greenfield district in Tampere, is comprised of existing and developing residential blocks located around multifunctional parks.

Studies have shown
that half of the world's
population already lives
in areas with water scarcity.

IN 2017, natural disasters affected the lives of 96 million people (Burek et al., 2016; Centre for Research on the Epidemiology of Disasters (CRED), 2018). By 2050, nearly 20% of the population will be at risk of floods and up to 5,7 billion people will be living in water-scarce areas (United Nations World Water Assessment Program (WWAP), 2018). An estimated US\$6.7 trillion is required by 2030 to finance water supply infrastructure needs alone, a value that increases to an estimated \$22.6 trillion by 2050 and significantly outpaces financial flows to this sector (OECD, 2018). Communities around the globe are struggling to build reliable, safe and resilient infrastructure. A potential solution lies in the integration of nature into mainstream infrastructure systems to achieve lower cost and more resilient services (Browder, Ozment, Rehberger Bescos, Gartner, & Glenn-Marie, 2019).

The latest report by the World Bank states that in the face of the changing global climate, urban populations in particular can no longer afford to be completely reliant upon traditional infrastructure (Browder et al., 2019). In certain situations, combining 'green infrastructure' such as wetlands, forests and floodplains with traditional 'grey infrastructure' such as dams and reservoirs may enhance system performance and better protect communities from impacts of extreme weather events. This type of hybrid infrastructure approach may also be beneficial for water utilities, flood management agencies, and hydropower companies as these service providers may be able to effectively combine cost-effective decentralised water management approaches with existing infrastructure solutions to enhance the respective system's capacity to respond to extreme weather events (Browder et al., 2019).

Nature based solutions (NBS) have gained popularity in addressing issues related to urban storm water management. Nature-based solutions represent natural "green" solutions to societal challenges such as flooding, environmental pollution, biodiversity decline, and human well-being. NBS are co-created systems that use natural features and ecosystem-based processes. In other words, NBS are able to protect, manage or restore ecosystems and their services, thereby addressing a multitude of urban challenges posed by the world's changing climate.

The EU Research and Innovation policy agenda on Nature-Based Solutions and Re-Naturing Cities aims to place the EU as a world leader in the growing market of nature-based solutions (NBS) to create more sustainable and resilient societies (European Commission, 2015). The EU identified four principal goals that can be addressed by nature-based solutions:

- Enhancing sustainable urbanisation through nature-based solutions to boost economic growth and improve the environment to make cities more liveable and improve human well-being.

- Restoring degraded ecosystems using nature-based solutions to improve system resilience and ability to deliver vital ecosystem services.
- Mitigating and adapting to climate change by providing more resilient responses to extreme events, such as floods or drought while having the possibility to preserve the environment such as through protection of coastal areas, improving biodiversity and carbon sequestration.
- Improving risk management and decreasing vulnerability to extreme events yielding greater benefit compared with conventional methods via synergies in reducing multiple risks (European Commission, 2015).

NATURE BASED SOLUTIONS TO MITIGATE URBAN FLOOD RISK

The increased frequency of intense rainfall and extreme weather events has led to a multitude of adaptation efforts by cities worldwide. Studies indicate that parts of Eastern Europe and Scandinavia are prone to the greatest flood risk in the future (EEA, 2017). Coverage of urban surfaces such as roads, sidewalks, and parking areas by impenetrable materials increases the vulnerability of urban areas to flooding as the water cannot infiltrate the soil beneath. The volumes of surface water runoff generated during heavy rainfall events can overwhelm the capacity of the drainage and sewer networks, which may lead to overflow of stormwater and untreated wastewater. Innovative solutions that complement existing grey infrastructure (drainage channels, embankments and sewers etc.) are needed to adapt to changing climatic conditions, in particular to resolve flood risks in urban areas. Many different types of NBS can help urban areas to adapt to climate change and to manage stormwater resulting from heavy rain events, such as:

- Multifunctional green spaces;
- Urban forests – conservation of forests during land use plan-



The heart of Vuores' nature-based stormwater management system is Central Park, where retention ponds (above), swales, and wetlands retain and purify waters before discharge to Lake Koijärvi.

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- ning, planting of new forest areas or reforestation of cleared land;
- Establishment or restoration of riparian areas along waterways and near waterbodies;
 - Conservation, restoration or construction of wetlands;
 - (Re)connection of rivers to floodplains;
 - Green infrastructure, such as green roofs and façades;
 - Rain gardens, infiltration basins, bioretention basins, and biofilters;
 - Stormwater retention ponds and detention areas; and,
 - Vegetated filter strips, vegetated swales, and infiltration trenches.

The coming decades will see a rise in urban densification and demand of services, placing a further burden on the ecosystems and human well-being. Implementation of NBS could resolve the major challenges for the cities, such as flood risks as discussed here, but they may also deliver many co-benefits such as biodiversity, new recreational opportunities, improved air quality, reduction of the urban heat island effect, and improved human health and well-being (Fig. 2). There is no one good solution for all cities, thus policy makers may use a combination of NBS and grey solutions to address the respective urban challenges and improve their city's resilience for the future.



URBAN NATURE LABS – THE UNALAB PROJECT

The Urban Nature Lab (UNaLab) project, led by VTT, responds to the need for a robust European evidence base of NBS performance and impact. A strong network of ten partner cities facing the common challenges of climate change and growing urbanisation form the core of the UNaLab project. This network of UNaLab cities is sharing knowledge and experiences whilst working in parallel to co-create and demonstrate locally attuned, innovative nature-based solutions to climate- and water-related challenges in the context of an integrated urban ecological approach: the Urban Nature Lab. The project's three large-scale demonstration cities are working to co-create and co-implement (with stakeholders) NBS to address local issues: Eindhoven (Netherlands), Genova (Italy), and Tampere (Finland). A further five European cities with balanced geographical spread, and diversity in size and climate conditions, are working with local stakeholders to co-create common visions of future city development, and will pilot UNaLab's NBS replication framework: Başakşehir (Turkey), Cannes (France), Castellón (Spain), Prague (Czech Republic), and Stavanger (Norway). UNaLab will provide quantitative evidence of NBS efficacy, applicability, and cost-effectiveness, including several comprehensive, user-friendly handbooks for end-users to guide the development and implementation of scientifically-validated NBS schemes and related support systems/frameworks in urban areas beyond the scope of the UNaLab project. Together, UNaLab and related projects funded under the same call topic aim to provide the requisite evidence and theoretical and practical

framework to mainstream NBS and facilitate integration of NBS with conventional urban infrastructure. UNaLab's upscaling and replication efforts are supported by a clearly defined replication strategy and extensive stakeholder network.

For more information: vtt.fi/sites/naturebasedsolutions/unalab.

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