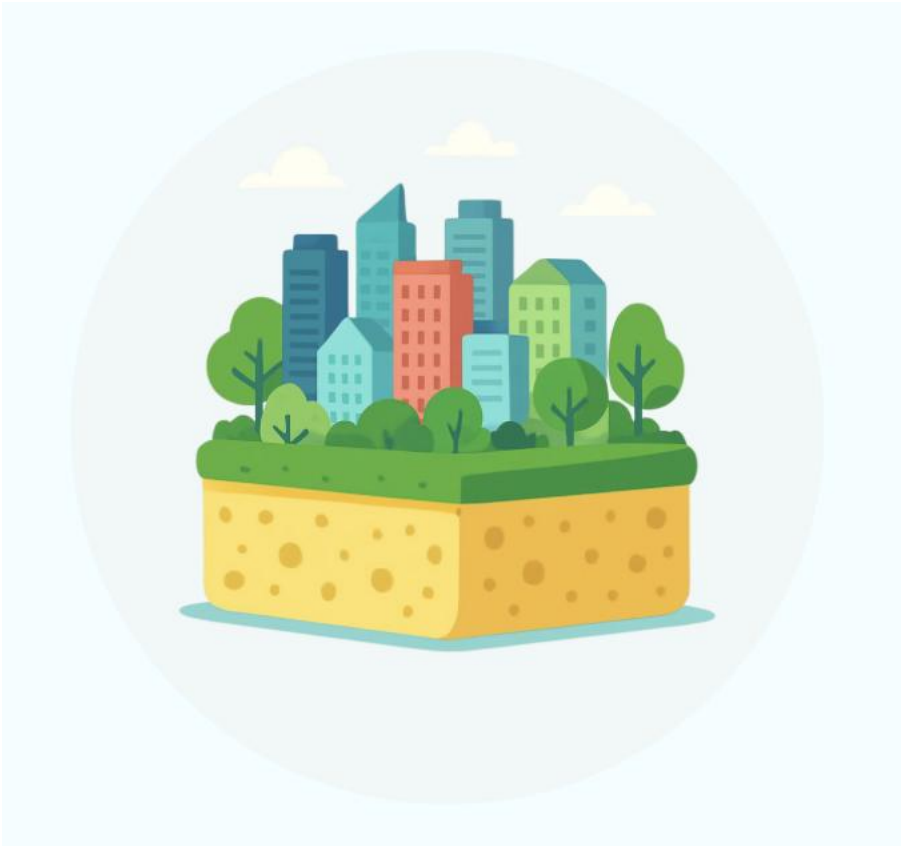
Sponge cities in Finland: Why and How?

Matilda Ojanpää, Kare Visuri, Minka Paavola, Noah Clarkeburn & Pihla Markkanen

Hello reader!

In the early 2010's researchers in China developed a new concept to combat the weather extremes in cities, dubbing it 'the Sponge City Concept'. The idea is just as simple as it sounds. When it rains, the urban environment will act as a sponge, absorbing and retaining stormwater, which helps to prevent flooding and providing moisture in the soil during dry periods. Sounds promising, but how does it work, and how should we apply it here in our Nordic climate? This is what we sought to find out during our project course! We found challenges, mainly cold weather and its impacts, but also came up with a way to promote the concept. Improving data availability and pitching the full benefits of sponge city to municipality decisionmakers could be a steppingstone in normalizing the concept in Finnish cityscapes. Read on for more details!



Picture: Canva

This spring our group got the task of looking into how the concept of sponge cities could be implemented in Finland. We got to work with a mentor from AFRY, Maija Ahonen, who helped us shape our project and was there to answer all our questions. We wanted to find some recommendations for how AFRY could promote the implementation of sponge cities in Finland. By recommending it to municipalities who come to them for consulting, helping them with gathering needed data, and planning suitable and feasible sponge city solutions for every unique case, AFRY could help with creating sustainable, long-term urban stormwater management solutions for our Finnish cities.

What is a sponge city?

Now more specifically, what is a sponge city? Sponge cities are cities based on low-impact development (LID) and nature-based solutions (NBS), meaning that e.g. typical stormwater drainage systems are replaced with soil and vegetation (=NBS). The used elements can vary from parks to porous pavements, but the common thing is that they absorb stormwater close to the source (=LID) by mimicking natural water cycles. There are other ways to "construct" a sponge city as well, but our focus was on nature-based solutions.

On top of better stormwater management, NBS provide a multitude of benefits for urban citizens, backed up by scientific literature. Vegetation, for example, mitigates harmful effects of heat and traffic, and provides space for social engagement and physical activity. On a system wide level, high amounts of green spaces and elements decrease the dependency on centralized systems which, in the event where these centralized systems break down, provide redundancy and security. In general, implementation of nature-based solutions improves urban resilience against both acute shocks and long-term stresses, holistically bettering the city. To receive the most benefits, larger green areas, such as parks are preferred over smaller elements. Transition of squares to parks and streets to boulevards are examples of NBS applications on a larger scale.

Challenges in the Finnish conditions

Our findings point to the fact that sponge cities are possible in Finland. There are already elements such as wetlands and green roofs that have been implemented, but sparsely located individual elements are not enough. However, especially the cold climate of Finland creates a significant challenge. Winter in Finland entails cold weather and snow. This means that the environment becomes dormant for half a year, reducing the effectiveness of

NBS. The frozen ground makes even naturally permeable surfaces impermeable. Snow creates large amounts of snow melting run-off in the spring to increase the peak run-off that NBS have to deal with. These, in addition to the salting and sanding of roads, are new problems that come with our climate (excessive infiltration of road salt could spoil groundwater, while sand blocks draining solutions). Finnish soils are also widely unsuitable for sponge cities, since they are impermeable in the case of clay and shallow bedrock, sand freezes quickly, and gravel is largely unsuitable for vegetation.

Proper usage of NBS will require a selection of suitable locations and tolerable species, as well as good understanding of the maintenance requirements and space constraints considering snow storage in the winter. Cooperation with municipal gardeners could be helpful to make sure that increased maintenance needs, snow challenges, and sufficient budgeting are also considered.

However, there are several opportunities as well. In many cities, there are eskers and other areas where the soil type of the ground allows excellent stormwater infiltration in soil. Green roofs are still seldomly used in Finland but provide water retention capacity with minimal downsides. Pavements in e.g. parking lots could be transformed into a combination of grass and paving slabs to form a semi-permeable pavement. Evergreen trees are another great option, making the urban areas more visually pleasing during all four seasons. The existing Finnish drainage systems are ageing, and NBS could be implemented in the process of renewing them.

Looking forward

Currently, there's very little research on Sponge City feasibility during snowy and cold periods. Nevertheless, during our project we noticed that data needed for further studies exists in a large part. The problem is that this data is scattered over many different providers, creating a high technical threshold. By examining this issue, our proposed solution includes a centralized municipal open-data platform that can be easily accessed and contains all necessary data sets. On top of that, there's a need for mapping microclimates and co-benefits of sponge cities, like traffic noise and biodiversity, to really assess the full potential. In the current situation, many of the good perks of NBS could be totally missed out because they are simply never made visible to decision makers.

Centralized data could be offered as commercial data packages for city planning purposes, combining information about both NBS' potential and constraints. Wide availability of data would support e.g. pilot projects where the performance of a Sponge City would be researched to make implementation successful also

in the north. As the functionality of nature-based solutions decreases during colder periods of the year, it could be worth looking at what kinds of other uses green elements could have specifically in the winter, something that we didn’t include in our analysis yet.