



# China's Sponge City concept: Restoring the urban water cycle through nature-based solutions

ICLEI Briefing Sheet - China's Sponge City Concept

**By turning cities into “sponges” China aims to restore urban water cycles and improve urban resilience to flood and drought events. The city-wide deployment of nature-based solutions such as green roofs, pervious pavements and bioremediation along with the restoration of urban and peri-urban wetlands and rivers lie at the heart of the national initiative.**

## Key messages

- The Sponge City concept requires re-designing cities in an ecological, water-sensitive way: In line with low-impact development principles, nature-based solutions<sup>1</sup> are deployed and integrated with grey infrastructure solutions throughout the entire urban and peri-urban fabric to absorb excess stormwater runoff, filter out pollutants and store up to 70% of it for reuse during periods of drought.
- To fully implement China's ambitious Sponge City program which foresees 80% of China's urban built up areas to meet Sponge City building requirements by 2030, the concept needs to be integrated in local policies and urban planning and additional funding needs to be secured.

**“Low-impact development (LID)** is a stormwater management strategy that [...] comprises a set of site design strategies that minimize runoff and distributed, small scale structural practices that mimic natural or predevelopment hydrology through the processes of infiltration, evapotranspiration, harvesting, filtration and detention of stormwater.” (*US Environmental Protection Agency, 2007*)

**“Nature-based solutions** are defined as actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.” (*International Union for Conservation of Nature, 2016*)

## China's urban water challenge

China's urban areas face a myriad of water-related issues ranging from urban flooding, reduced water quality, water scarcity and land subsidence induced by groundwater extraction. Over the last few decades rapid urbanization has replaced large areas of natural ecosystems with impervious surfaces and left many urban areas with outdated drainage systems. As a result, 300 of China's 657 cities fail to meet

national flood prevention standards. In 2013 alone, more than 230 cities were subject to urban water-logging. In addition, more than half of China's cities are considered water scarce or severely water scarce. This is in large part due to the over-extraction of groundwater and high levels of water pollution caused by agricultural intensification, industrial and urban expansion as well as the large-scale disappearance of different wetland types. Rising global temperatures are predicted to further exacerbate the intensity and frequency of extreme weather events. Coupled with a projected urban population increase from 54% in 2014 to 70% by 2025, these challenges require an integrated and adaptive approach that enhances the resilience of China's urban areas.

## China's response: Creating Sponge Cities

In an effort to improve cities' capacity to address their water-related challenges, China's national government promotes the transformation of urban areas into so-called Sponge Cities. In fact, the ambitious program envisions 80% of China's urban built-up area to be sponge-like by 2030. To accelerate this process, 30 pilot cities including Beijing, Shenzhen, Wuhan and Jinan have been selected to receive financial and technical assistance to redesign their urban areas in a water-sensitive way. This is to be accomplished through the adoption of low-impact development principles and the large-scale deployment of nature-based solutions that preserve, mimic and support the natural water cycle. Concrete measures include the replacement of impervious infrastructure with green roofs, walls and permeable pavement and the revitalization of degraded lakes and wetlands to allow for the absorption of excess rainwater during downpours. In turn, raingardens and bioretention swales are used to collect the runoff and filter out pollutants. Some of the purified water is then sent back to the natural system to recharge aquifers and some of it is stored to ensure availability of water for irrigation and cleaning purposes during periods of drought. The aim is for cities to be able to absorb and reuse nearly 70% of their excess rainwater.

<sup>1</sup>Please refer to ICLEI's Nature-based Solutions Briefing Sheet for more information.

## Cost-effectiveness and co-benefits

Nature-based solutions often prove to be cost-effective, particularly in terms of implementation. In a comparison of different nature-based solutions conducted by the Chinese Ministry of Housing and Urban-Rural Development, installation costs were as little as RMB30/m<sup>2</sup> (4 Euro/m<sup>2</sup>) for vegetated filter strips and RMB200/m<sup>2</sup> (27 Euro/m<sup>2</sup>) for permeable pavement (MoHURD, 2014).

Next to future-proofing and enhancing the water resilience of China's cities, nature-based solutions come along with a suite of environmental, social and economic co-benefits. They can improve urban air quality, regulate the micro-climate, sequester carbon, foster biodiversity and offer opportunities for recreation. This is in stark contrast to grey infrastructure measures such as sewers, dikes and concrete walls which are often mono-functional.

## Making the Sponge City work

Achieving China's ambitious goal on a local level necessitates overcoming various challenges. Foremost, it requires re-thinking urban areas as complex systems that are embedded in their natural environments. Instead of deploying isolated solutions, the entire urban fabric needs to be re-designed in an ecological way and any future expansion needs to take the urban

water-cycle into account. Moreover, it is estimated that one square kilometer of Sponge City re-development will cost 100 million yuan to 150 million yuan (13.5 to 20 million Euro). Yet, given the current and future challenges China's cities face and factoring in the additional benefits that nature-based solutions provide, both inaction and conventional approaches will be more costly in the long-term. Key steps to spur the Sponge City transition at the local level include:

- **Strengthening inter- and transdisciplinary dialogue and collaboration** between local decision makers, natural and social scientists, urban planners and city departments to ensure administration-wide support;
- **Fostering the exchange of good practice examples** with practitioners and other cities to build internal capacity;
- **Adapting local policies and urban planning guidelines** according to Sponge City construction requirements to ensure their consideration in new infrastructure projects;
- **Developing a Sponge City action plan** tailored to the local context;
- **Leveraging private and public sector financing and identifying innovative finance tools** to operationalize the action plan.

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## References and Further Reading

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