EuroHub4Sino

European Hub
for Contemporary China

September 2024

The Sponge City Approach in China: Empty Metaphor or Promising Climate Change Adaptation Strategy?

by Fabienne Wallenwein

Funded by
the European Union

https://doi.org/10.31175/eh4s.2014.11

KEY TAKEAWAYS

- Since 2013, sponge city construction is promoted as a national climate adaptation strategy in China. Implementation started with the designation of 30 national-level pilot cities in 2015 and 2016. It was then expanded to cities and urban areas across the country and at the provincial level.
- The sponge city is not a single storm water management instrument. Rather, it is intended to draw from a portfolio of measures and strategies that are often characterised as environment-oriented, multi-functional and low-tech. This shall reduce costs as compared to former approaches merely relying on grey infrastructure.
- The sponge city combines individual adaptation measures and technologies developed and promoted internationally under designations such as low-impact development (United States), sustainable urban drainage systems (United Kingdom), blue-green infrastructure (other European countries) and water sensitive urban design (Australia).
- While sponge city measures such as the construction of wetland parks greatly increase liveability in densely populated urban areas, such interventions may raise real estate prices in surrounding residential districts and spur gentrification.
- The main challenges in implementation are administrative and political, e.g. lack of consultation and cooperation across departmental and (sometimes) municipal boundaries.
- In cities with completed sponge city facilities where flooding occurred nonetheless, problems were often traced back to deficiencies in construction and spot-level rather than comprehensive development.

Keywords

Sponge City

Climate Change

Adaptation

Water Cycle

Water Management

EU-China Cooperation

Introduction

In July 2021, extreme precipitation caused catastrophic flooding in Zhengzhou, the capital of China's Henan Province, which aspires to become a so-called "sponge city" (haimian chengshi 海绵城市). According to *official figures*, 380 people lost their lives within the city area, and the overall economic loss of the disaster reached RMB 40,9 billion (approx. EUR 5,2 billion). Although extreme weather events are not uncommon in China, especially during the summer months, the Zhengzhou floods received high domestic and international attention. In addition to the question of how local authorities dealt with the disaster, discussions arose about the effectiveness of China's sponge cities. This urban development approach is ecosystem-based and aims at responding to extreme weather – a threat that has been projected to occur more frequently worldwide in the future.

The transformation of cities towards climate-resilience is a global challenge that requires EU-China cooperation. While sponge city construction in China (nationwide initiative) and urban climate adaptation in many EU countries (more decentralised measures) differ in their overall approach, both strive to foster nature-based and low-tech solutions. Wider exchange of knowledge and implementation experiences will allow for a stronger consideration of distinctive local conditions (hydrological, climatic, socioeconomic) rather than "one-size-fits-all" modelling. Moreover, exchange has been and is expected to be beneficial with regard to setting up financing and evaluation schemes for climate adaptation measures. Besides the mitigation of disaster risks, sponge cities strive to conserve urban biodiversity and improve city dwellers' well-being and health. These factors are becoming more important to gain public support for climate adaptation in both China and Europe.

What does "sponge city" mean in a Chinese context?

Sponge cities are mostly known for addressing two seemingly contradictory urban threats amplified by global climatic changes: flooding and water shortages. The basic urban planning concept behind this ostensive metaphor, which is said to have originated in China, is to render the city "absorbent as a sponge". By use of flooding areas, wetlands, and nature-based technologies such as bioretention swales (vegetated and landscaped depressions with gently sloping sides designed to filter pollutants and temporarily capture rainwater), storm water shall be stored where it falls instead of being drained directly via networks of pipes and sewers. In turn, during hotter weather, water evaporating from these areas is expected to reduce heat effects. Moreover, well thought-out interventions are multifunctional, making full use of their potential to improve liveability in the city, e.g. by increasing green spaces that enhance air and aesthetic qualities. Their mostly nature-based and low-tech strategies often require a lower budget than conventional grey infrastructure solutions.

Ecological measures to manage storm water, purify precipitation runoff and reduce heat and flooding risks of cemented and asphalted surfaces in urban centres have been developed worldwide since around the 1980s. These include best management practices (BMPs) and low-impact development (LID) in the United States, sustainable urban drainage systems (SuDS) in the United Kingdom, water sensitive urban design (WSUD) in Australia and blue- green infrastructure in many countries of continental Europe. The Chinese sponge city draws on individual technologies and measures from these schemes, but is conceptualised as holistic approach. Chinese landscape architect Yu Kongjian, Dean of the College of Architecture and Landscape Architecture at Peking University, is credited as founder of the sponge city concept and, most importantly, for having achieved buy-in from the central government. In the long term, he and his architectural firm "Turenscape" envision the establishment of a *nationwide ecological security system* based on spatial analysis of hydrological processes at the macro scale (regional and national).

How effective are sponge cities for climate change adaptation?

In contrast to Europe where green transformations of urban centres are usually done at the initiative of pioneering municipalities, sponge city construction is promoted on a nationwide scale in China since the mid-2010s. A key event that catapulted stormwater management onto the national agenda was a disaster in 2012, the Beijing floods, in which 79 people lost their lives. Only three years later, the State Council issued its *Guidelines for the Promotion of Sponge City Construction* that define a very ambitious goal: 70% of precipitation shall be collected, stored and utilised where it falls, a target which is to be achieved for more than 80% of built-up areas in Chinese cities by 2030. Practical implementation started with the designation of 16 pilot cities and areas in 2015 and another 14 cities in a *second batch* one year later. Systematic nationwide rollout began in 2021 and by now encompasses 60 so-called

"model cities" that were selected in three rounds. The budget these model cities receive varies according to administrative level and geographical location. In the second batch, prefecture-level cities and above received RMB 900 million (approx. EUR 115 million) of subsidies in the eastern region, RMB 1 billion (approx. EUR 128 million) in the central region and RMB 1.1 billion (approx. EUR 140 million) in the less developed western region of the country. County-level cities were provided RMB 700 million (approx. EUR 90 million) in the eastern, RMB 800 million (approx. EUR 102 million) in the central and RMB 900 million (approx. EUR 115 million) in the western regions. The subsidies are allocated over a three-year period in accordance with the progress of implementation.

In China, the effectiveness of sponge cities was first questioned in 2016, shortly after the usual annual flooding period. By then, ten pilot cities from the first, and nine from the second batch had again been affected by flooding or waterlogging. Authorities defended the approach by pointing to the short period of time since the programme's implementation and to its still ongoing construction. In this context, the aspect of disaster severity came into focus, leading cities to adapt their drainage designs to larger return period events (*from 1-in-1 and 1-in-5-year events to 1-in-30-year events*).

Record-breaking disasters such as the Zhengzhou floods in 2021 further fuelled criticism against the sponge city approach, given that the municipality had invested *more than US$ 80 million* (approx. EUR 73 million) over the previous five years in green areas and infrastructure supposed to mitigate flooding in Henan's provincial capital of 12 million inhabitants. Yu Kongjian defended the concept in an *interview* by the American Society of Landscape Architects, saying that Zhengzhou could not yet be considered a sponge city at the time of the disaster as the proportion of grey infrastructure in the city was still far too high. He further pointed out the problem that municipalities in China would sometimes simply use the term "sponge city" for other types of interventions to obtain central government funding.

Another point of criticism has been the centralised character and universal application of guidelines, standards, and evaluation criteria for sponge cities defined by national and regional governments which do not always take full account of *local problems caused by distinctive climatic, hydrological and socioeconomic conditions*. The regulation of sponge city transformation is within the responsibility of three state authorities, the Ministry of Housing and Urban-Rural Development (MOHURD), the Ministry of Water Resources and the Ministry of Finance. Sponge city measures as defined by the State Council encompass six categories:

- "infiltration" (e.g. construction of green roofs and permeable pavements),
- "retention" (e.g. through sunken green spaces),
- "storage" (e.g. preservation and restoration of water bodies and wetlands),

- "purification" (e.g. construction of water treatment plants),
- "utilisation" (e.g. through water regeneration), and
- "drainage" (e.g. upgrade of sewer systems)

Although an adaptation to local conditions is explicitly stated as a basic principle in the *Technical Guidelines issued by MOHURD* in 2014, this principle reaches its limits in practical implementation.

Do common global challenges provide opportunities for cooperation?

In recent years, Europe also experienced *increasing weather extremes*. In 2023, precipitation reached a value of 7% above the annual average. Across almost the whole region, above-average temperatures generated an increase of days with "strong" up to "extreme heat stress". Around 1.6 million people suffered from flooding and related consequences, including 44 deaths. Moreover, weather and climate-related events caused 81% of the total financial losses of EUR 13.4 billion.

In Europe, pioneering cities, such as Vienna, Copenhagen, Amsterdam, Berlin, Hamburg and Leipzig play an important role for developing and implementing climate adaptation measures. Copenhagen, for example, builds on a *dual approach* where water is retained in basins underground and green spaces above ground. Sealed surfaces are rendered permeable and green roofs are constructed on new buildings in order to store precipitation. In Groningen in the Netherlands, the nature-based *transformation of Damsterplein Square* has been a first initiative to increase the city's overall climate-adaptation capacity. The project further aims to involve residents, allowing them to plant and maintain green spaces. Such strategies to increase public participation and stakeholder involvement still constitute a deficiency in the sponge city planning process and may therefore be a suitable starting point for cooperation.

By continuously testing and improving its sponge city strategies, China strives to become a global pioneer and *export domestic climate adaptation solutions*, for example to developing partner countries in the Belt and Road Initiative. This may prospectively position China in a competitive relationship with the United States and EU member states that engage in green transformation. At the same time, the different political approaches and practical experiences in Chinese and European cities offer far-reaching opportunities for joint initiatives in the transformation towards climate-resilient cities. Great potential lies in exchanges with regard to methods, tools, financing mechanisms and evaluation models, as well as co-creation strategies.

A hurdle faced in Chinese and European cities alike is political and public support. Successful implementation of climate adaptation measures requires close cooperation, negotiation and approval of different municipal departments. Denmark has a long tradition of close

collaboration between public and private partners as well as across authorities and organisations, which has proven effective in other sectors such as *cycling*, for example, and may provide inspiration for both European and Chinese cities. At the same time, implementation of sponge city measures in Chinese cities has shown the significance of enhancing liveability and health to *gain public approval*, e.g. by means of green spaces construction and air quality improvement. As a large part of such transformations usually relies on public resources, the support of local citizens is crucial.

Financing climate adaptation strategies is another common issue. In Chinese cities, a major problem is to raise enough funds to implement sponge city measures. *Chan et al*. estimated the cost for a three-year sponge city pilot project at RMB 1.2 to 1.8 billion (approx. EUR 153 to 230 million). Especially in cities of the interior where municipal budgets are low, public goods such as water management infrastructure lack prioritisation, despite their smaller cost compared with development schemes. The Chinese approach therefore puts great emphasis on public private partnerships (PPP). However, such partnerships are again realised much easier in developed coastal cities such as Shenzhen which partly relied on *private investment* from its tech and manufacturing corporations. Smaller urban municipalities in Europe with limited resources are facing similar problems and obstacles in attracting investment. Here, it has been suggested to cluster activities for climate adaptation into larger portfolios. Other alternative financing mechanisms include municipal-issued green bonds, a measure still rarely applied, and grants to property owners willing to install green infrastructure. A *promising subsidy scheme* to mitigate flooding and extreme weather events through decentralised measures of residents and private businesses was introduced in the city of Bratislava, Slovakia, in 2016.

Networks such as *Local Governments for Sustainability* (ICLEI), *C40 Cities* and *United Cities and Local Governments* (UCLG) have long been important platforms for international exchange on such climate change adaptation strategies. Furthermore, there have been efforts to integrate nature-based solutions in Chinese and European city development as part of joint programmes such as *UrbanByNature* or the *Sino-German Urbanisation Partnership Project*. Building on these experiences, it is desirable that a regular exchange on urban climate adaptation strategies in Europe and China is maintained to sound out potential for future interest-orientated cooperation, in particular, at the subnational level.

The project "European Hub for Contemporary China (EuroHub4Sino)" has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement number 101131737.

Funded by the European Union. Views and opinions expressed are however those of the authors) only and do not necessarily reflect those of the European Union or European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.