

Sponge City and Sponge Planet

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Challenges

Climate Change



Flood

annual flood damage costs US \$100 billion



Drought

400 of 662 cities have water shortages



Pollution

75% of surface water, 64% of underground water



Habitat loss

50% of wetlands lost in 50 years



Conventional solutions: Grey infrastructure

Stronger and increasingly
more sophisticated:



Damming



Channelizing



Flood walls fighting
against water



Sewage plants
cleansing water



Grey infrastructure can be necessary to solve urgent individual problems, but

Consumes huge amounts of concrete and energy

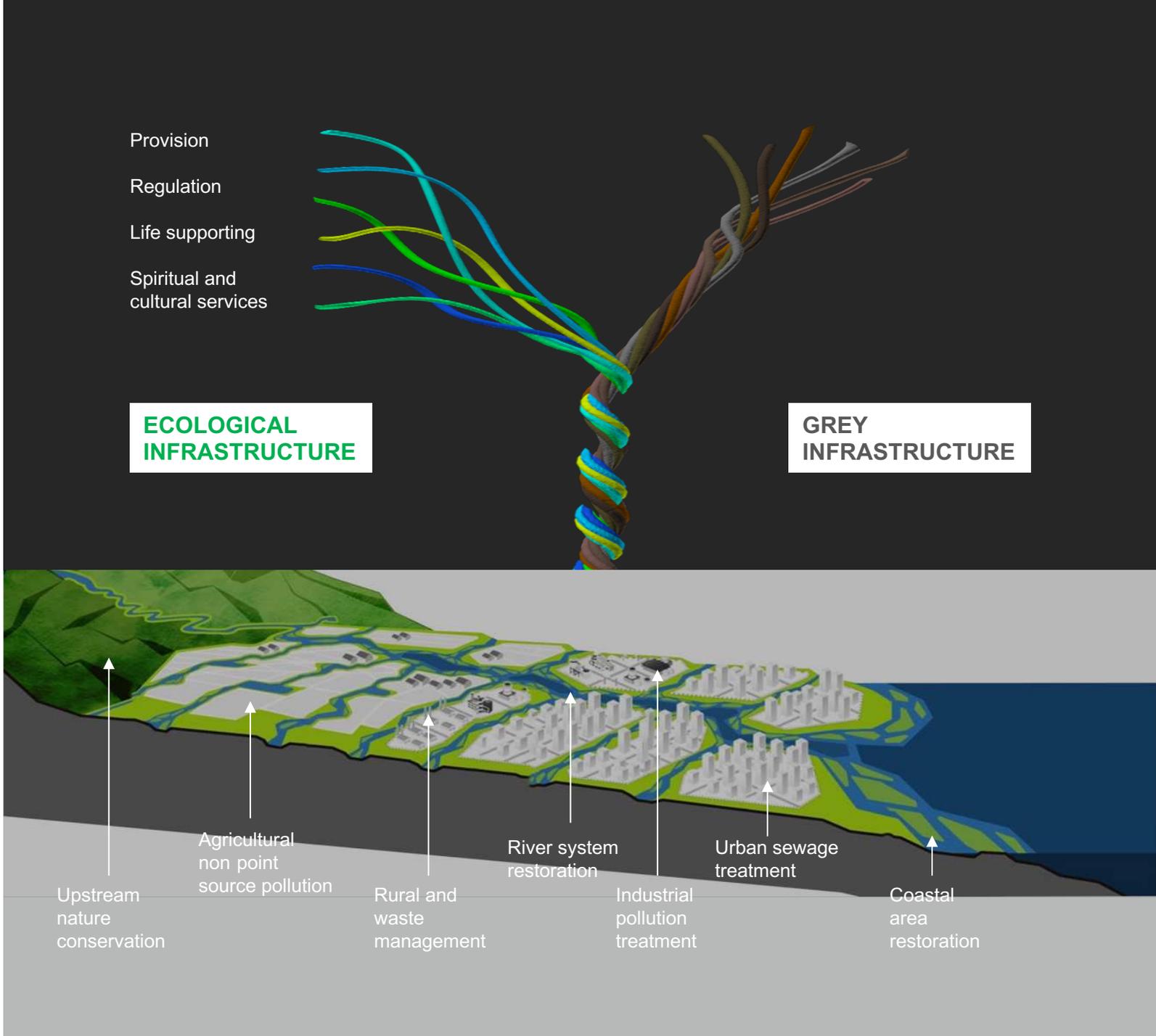
Lacks resilience and often accumulates a higher risk of disaster

Destroys nature and its resiliency

Breaks the connection between man and nature...

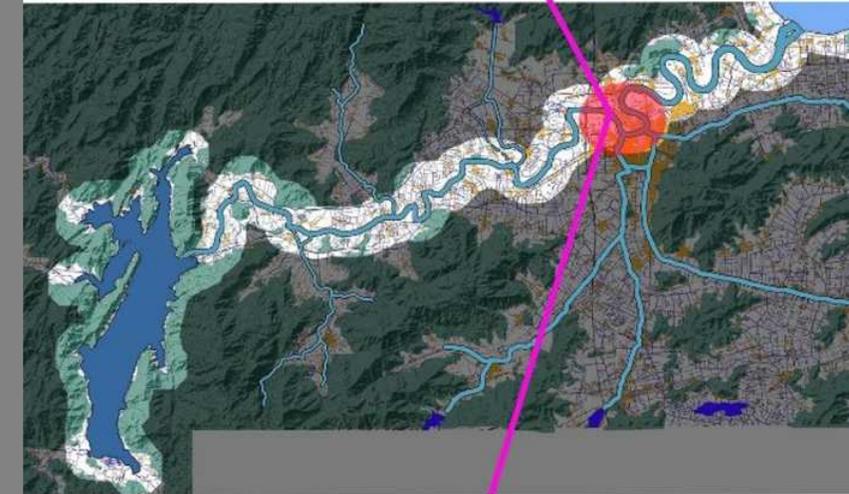
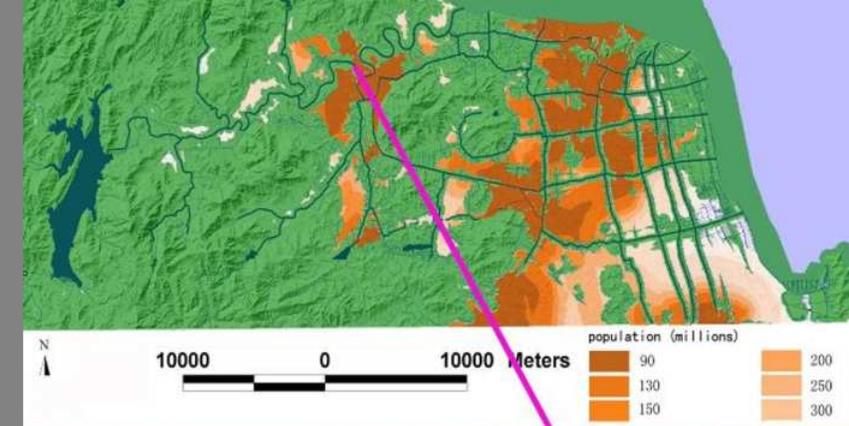
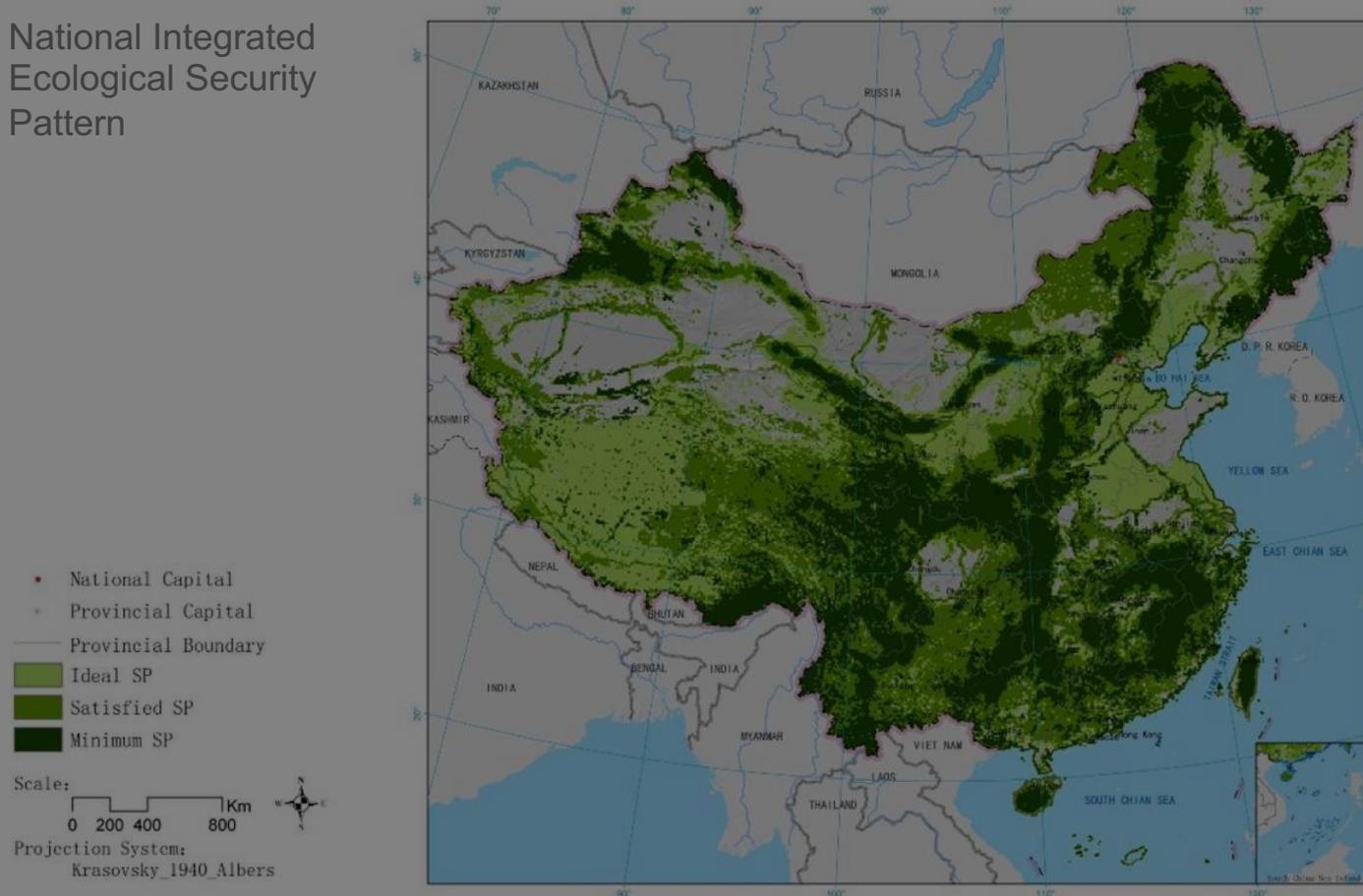


The alternative:
**Nature-based
ecological infrastructure**
which is critical for securing
ecosystem services
**woven together with
grey infrastructure**



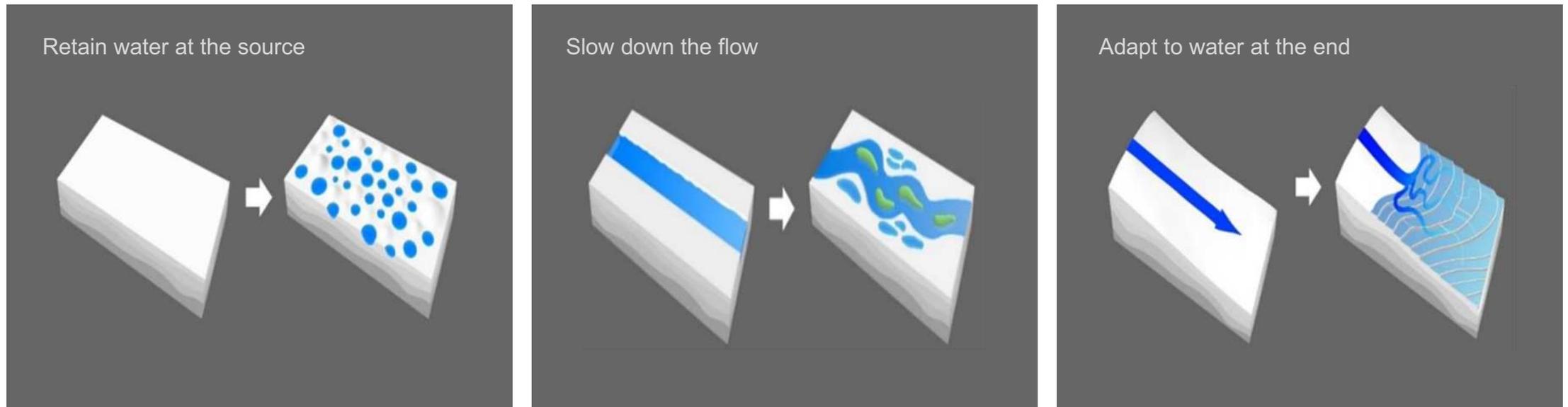
Ecological infrastructure must be planned and built across scales

National Integrated Ecological Security Pattern



Water is the key to such ecological infrastructure

A city built on water-centered eco-infrastructure is called a **Sponge City**. Its philosophy is to retain water, slow down water flow, and be adaptive to water – totally opposite to the conventional solution of grey infrastructure.



A photograph of a farmer in a grey jacket and a light-colored bucket hat, seen from the back, carrying a wooden hoe over their shoulder. They are standing on a dirt path overlooking a vast landscape of terraced rice fields. The sun is low on the horizon, creating a golden glow and reflecting off the water in the terraces. The background shows rolling hills and some trees under a hazy sky.

Sponge Cities are inspired by the ancient wisdom of farming and water management that use simple tools to transform the global surface at a vast scale in a sustainable way



Terracing



Ponding



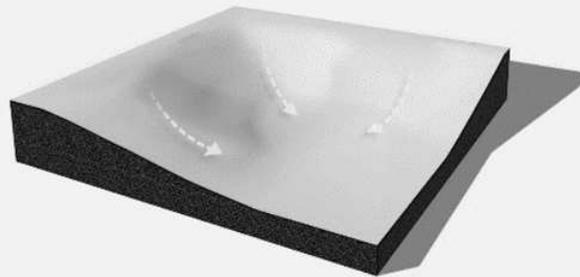
Dyking & ponding



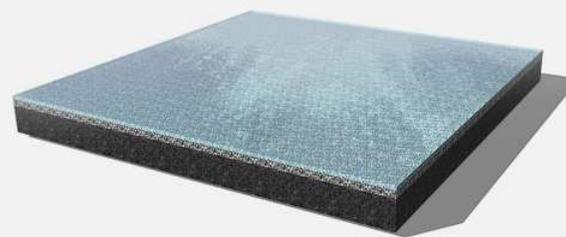
Islanding



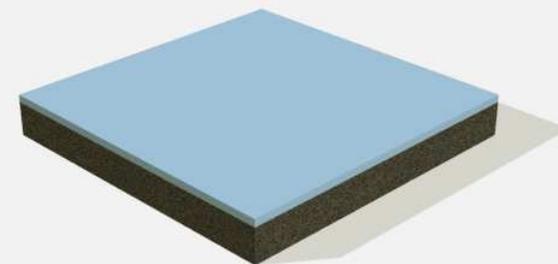
Source



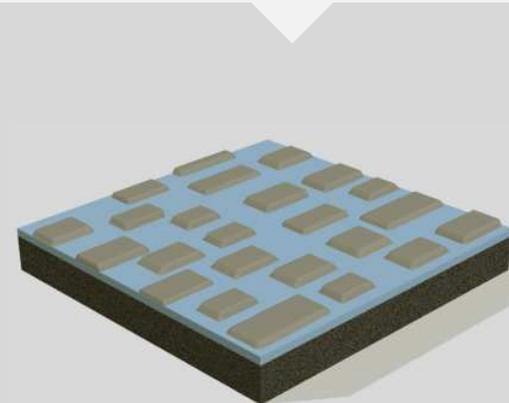
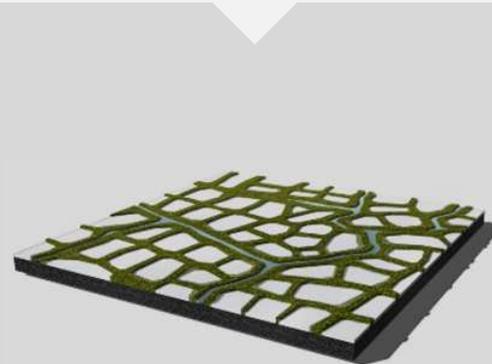
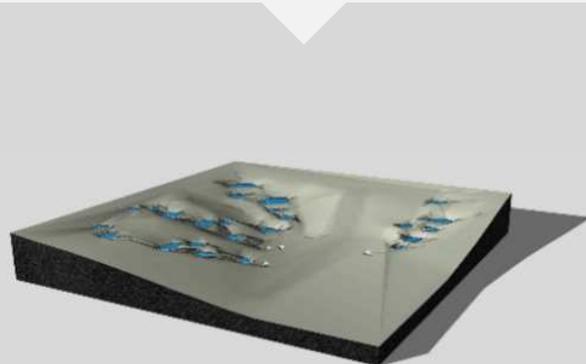
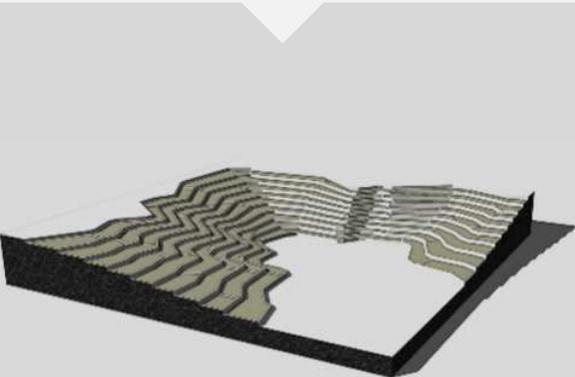
Flow



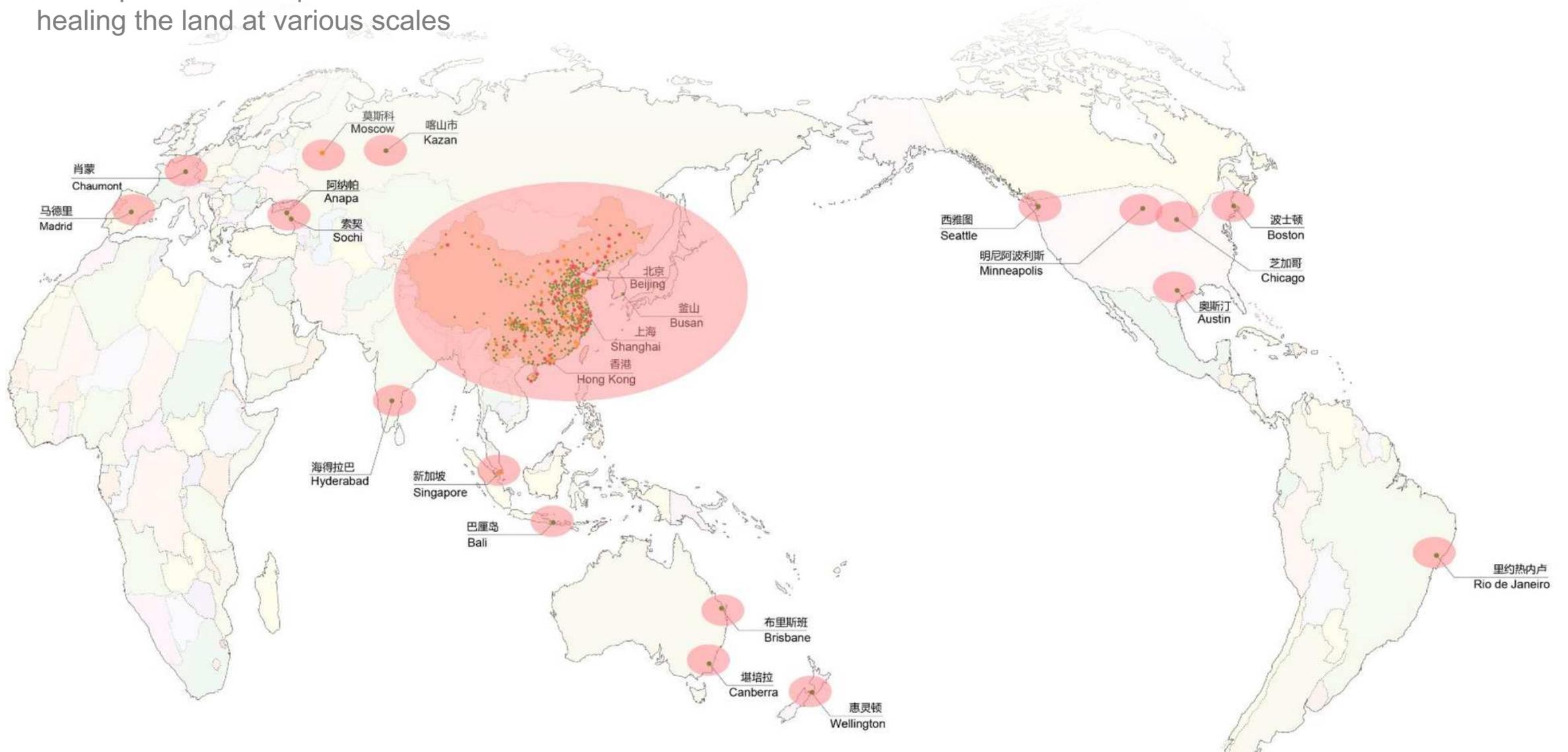
Sink

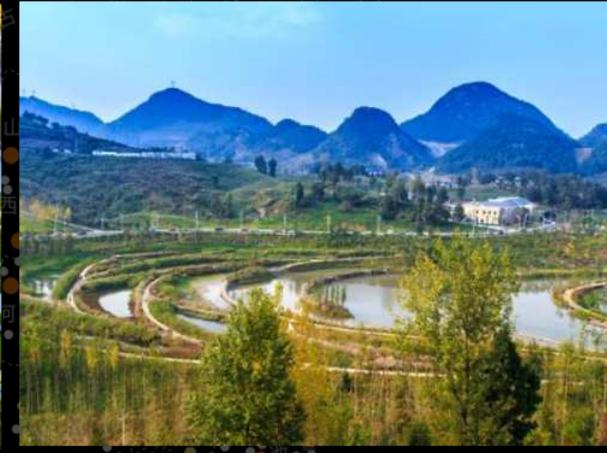


Sink



For over 20 years, we have tested and built over 500 projects in 200+ cities and developed several replicable models for healing the land at various scales





While focusing on some **major targets**, such as

1

Flood adaptation

2

Stormwater regulation

3

Water cleansing

4

Climate resiliency

5

Soil remediation

6

...

These projects are always holistically and systematically designed to provide all kinds of ecosystem services – for native species, people and the planet as whole

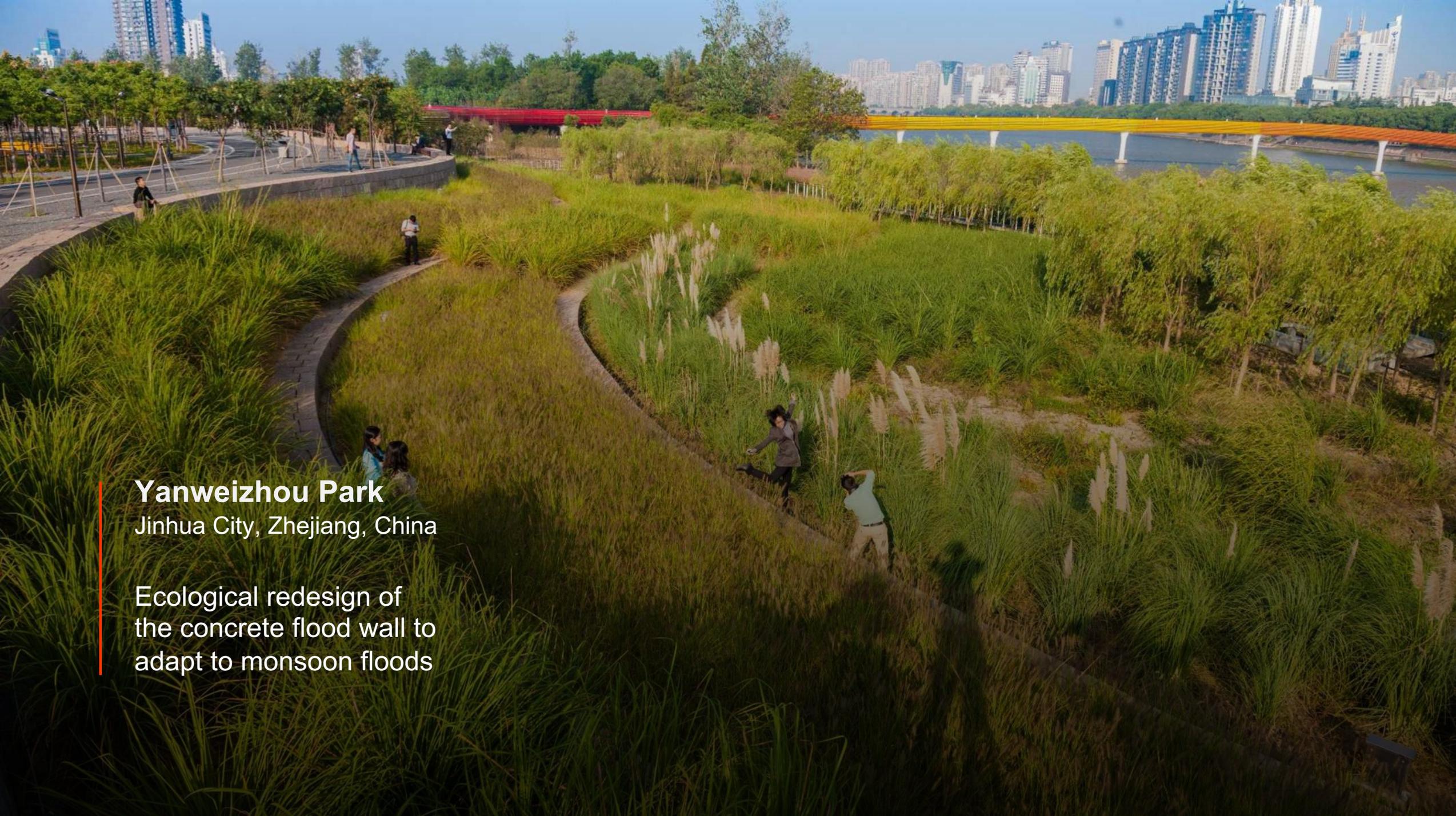
Flood adaptation: embracing flooding as a natural phenomenon

In China, all urban rivers have
been dammed and channelized
with concrete flood walls

More than US \$20 billion
is invested to control flooding,
but US \$100 billion is lost every year

We have to end
this never-ending war



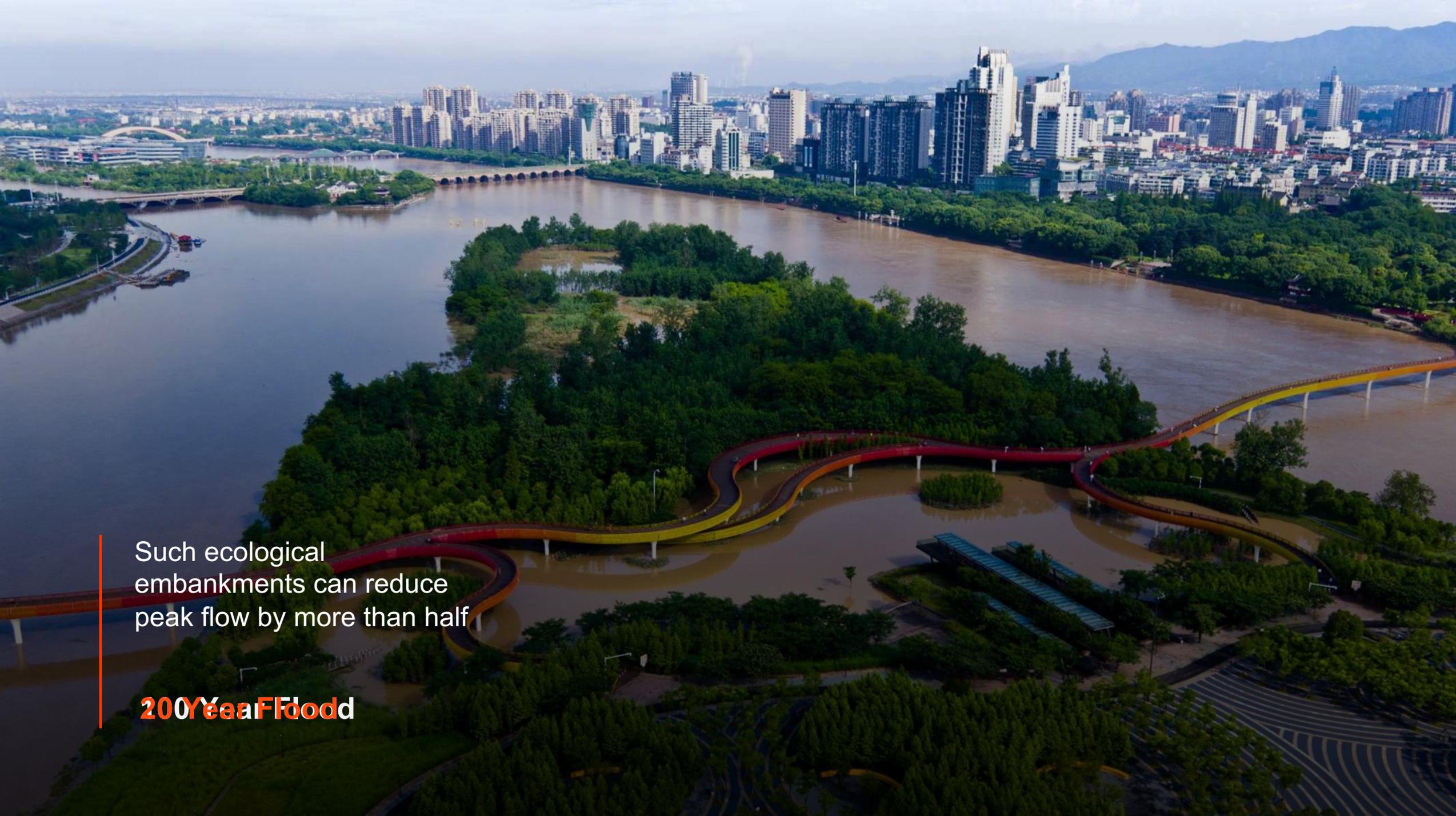


Yanweizhou Park

Jinhua City, Zhejiang, China

Ecological redesign of
the concrete flood wall to
adapt to monsoon floods





Such ecological
embankments can reduce
peak flow by more than half

200 Year Flood

**Yongning
River, Taizhou City,
Zhejiang, China, 2003**





Stormwater regulation: absorbing excess water

Over 65%

of Chinese cities suffer from
urban inundation



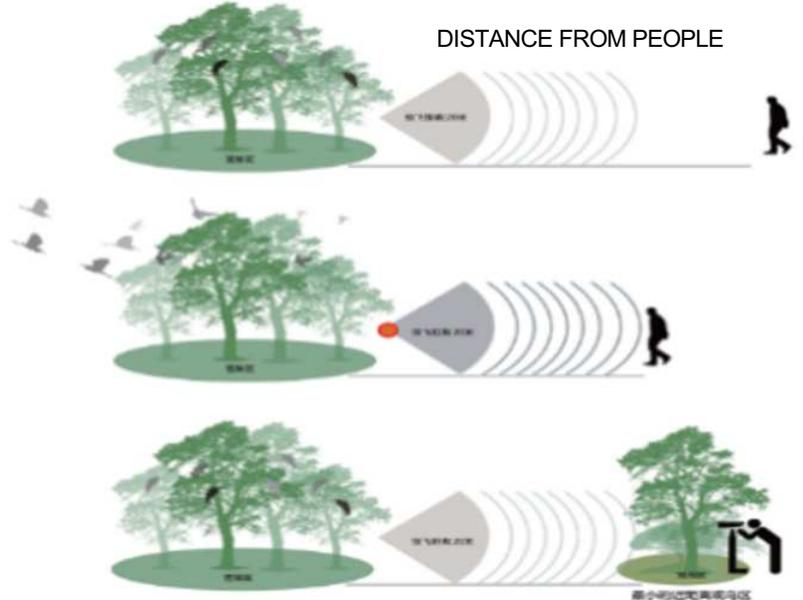
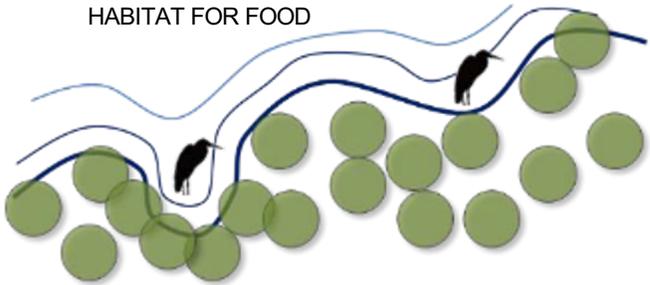
Sanya City

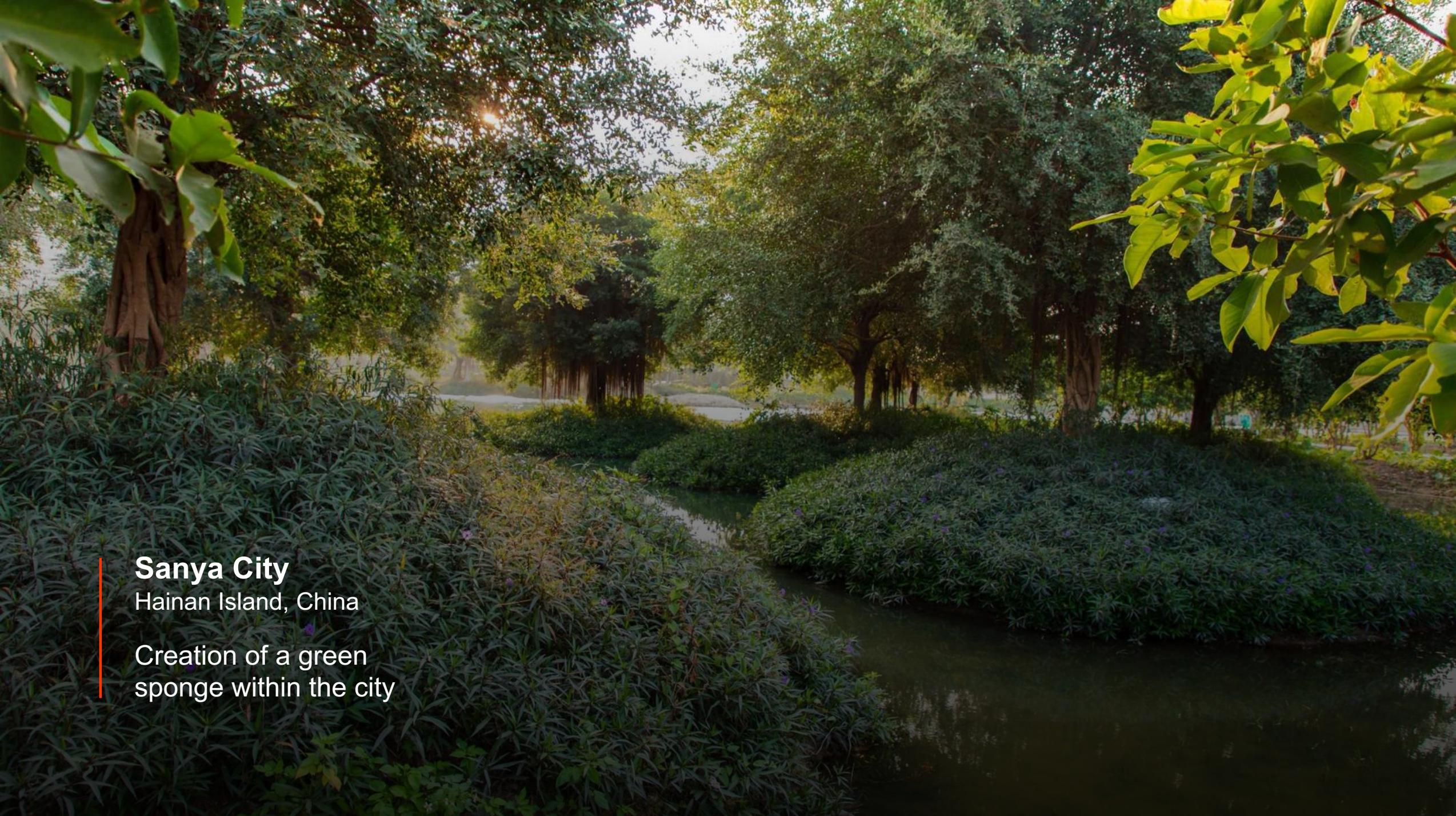
Hainan Island, China

Creation of a green
sponge within the city



Create habitat and public space





Sanya City

Hainan Island, China

Creation of a green
sponge within the city







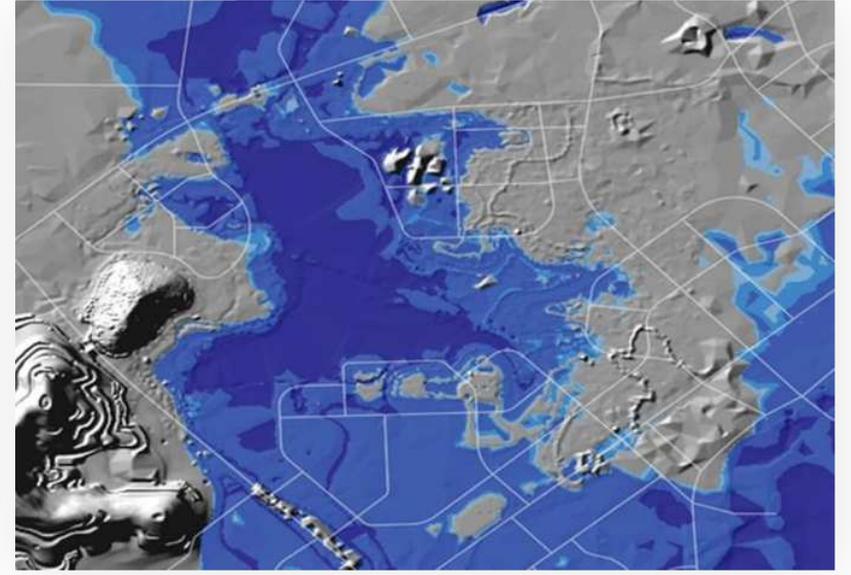
2015

2021



Before

2015



After

2020

Qunli Sponge Park
Ha'erbin, 33 ha.







**Benjakitti Forestry,
Thailand , Bangkok.
We are creating huge
green sponge in the
city center**



Water cleansing: creating living systems to clean water

75%

of surface water
is contaminated
in China

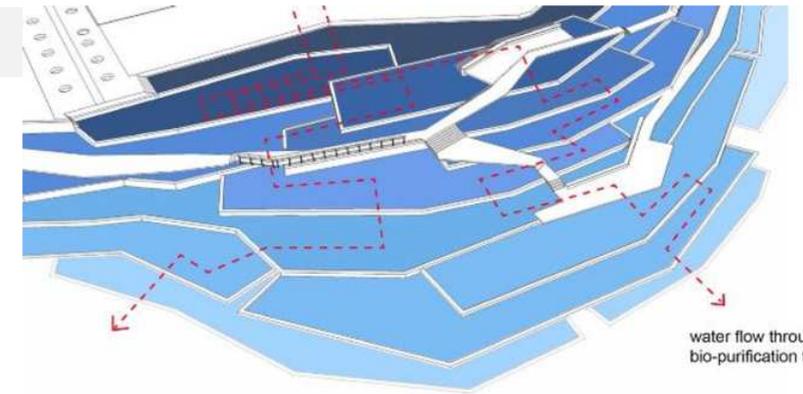
85%

of sewage globally
goes into rivers and
seas untreated

We need alternative
affordable and fast
solutions



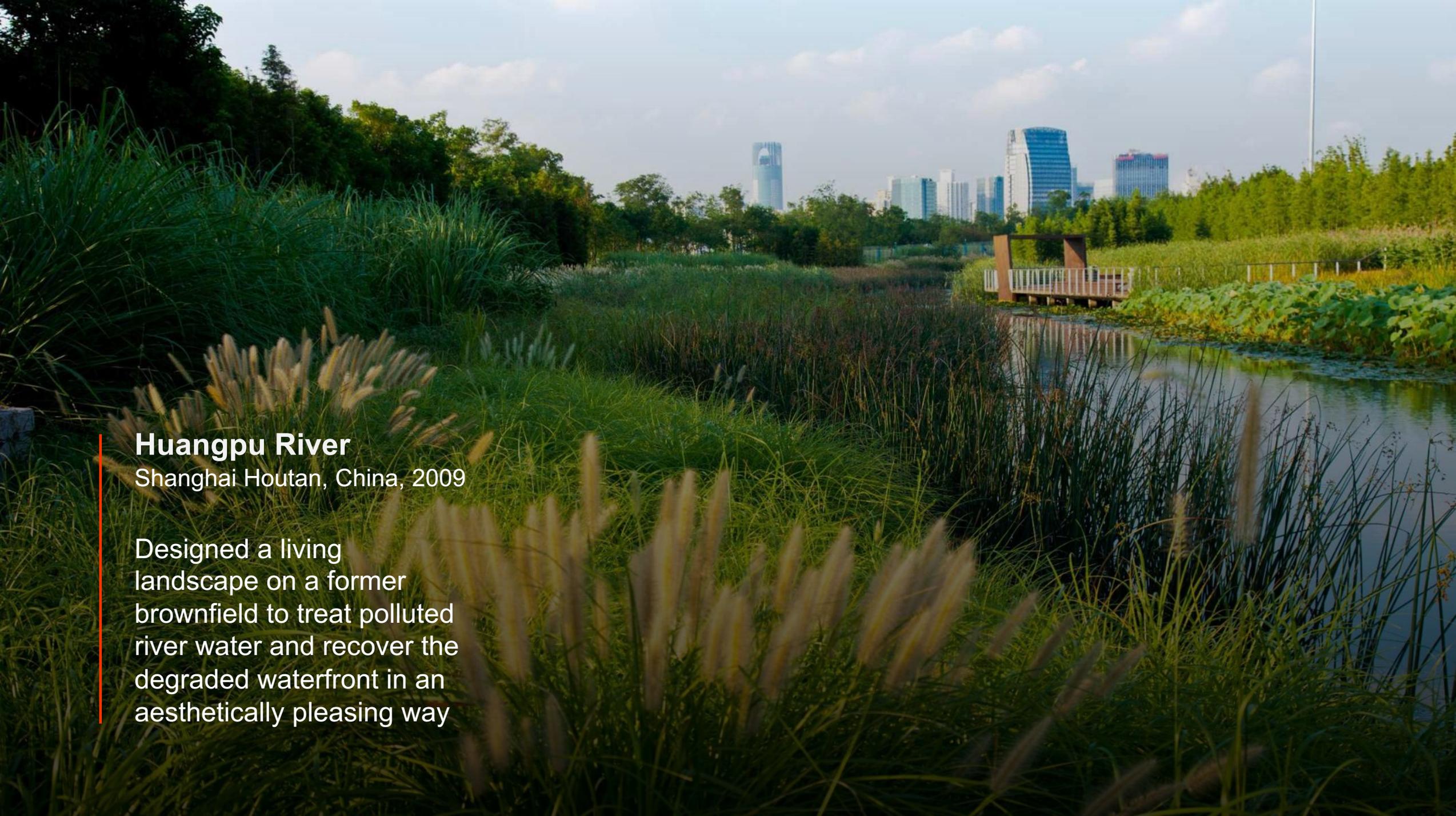
Constructed wetlands can remove nutrients through biological processes



water flow through bio-purification terraces



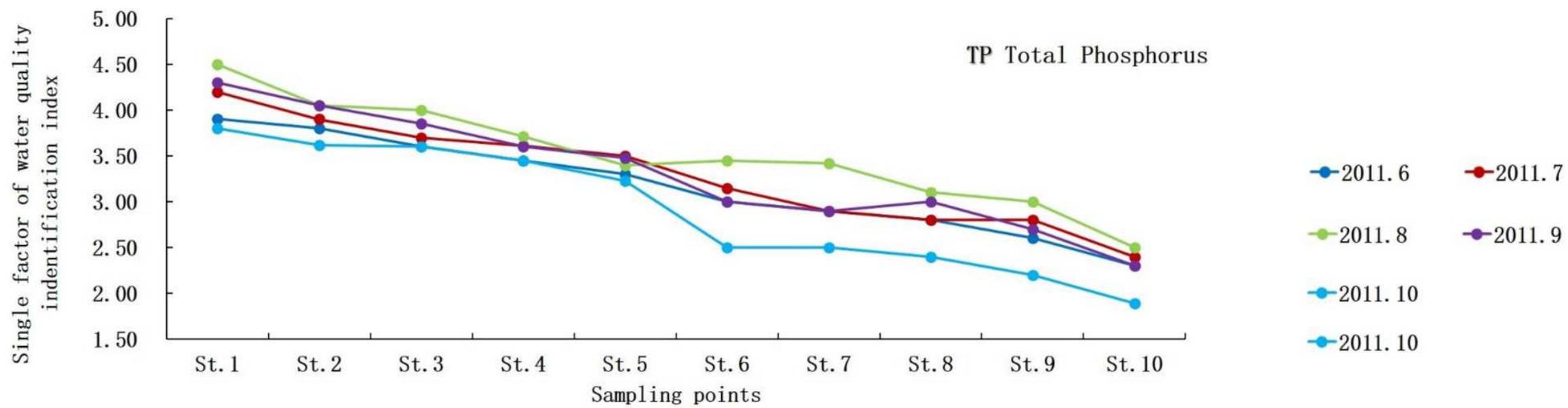
rain garden	wooded hills	polluted water	sub-surface filtration	waterfront promenade	constructed wetland
rainwater collection ditch		aeration wall	pavilion	bio-purification terraces (pathogens/heavy metals/bod/cod/p/n)	aquatic plants (reeds/water lilies/typhae/lotus)
urban realm	noise barrier/green lung	aeration/transition zone	phytoremediation	constructed wetland	



Huangpu River

Shanghai Houtan, China, 2009

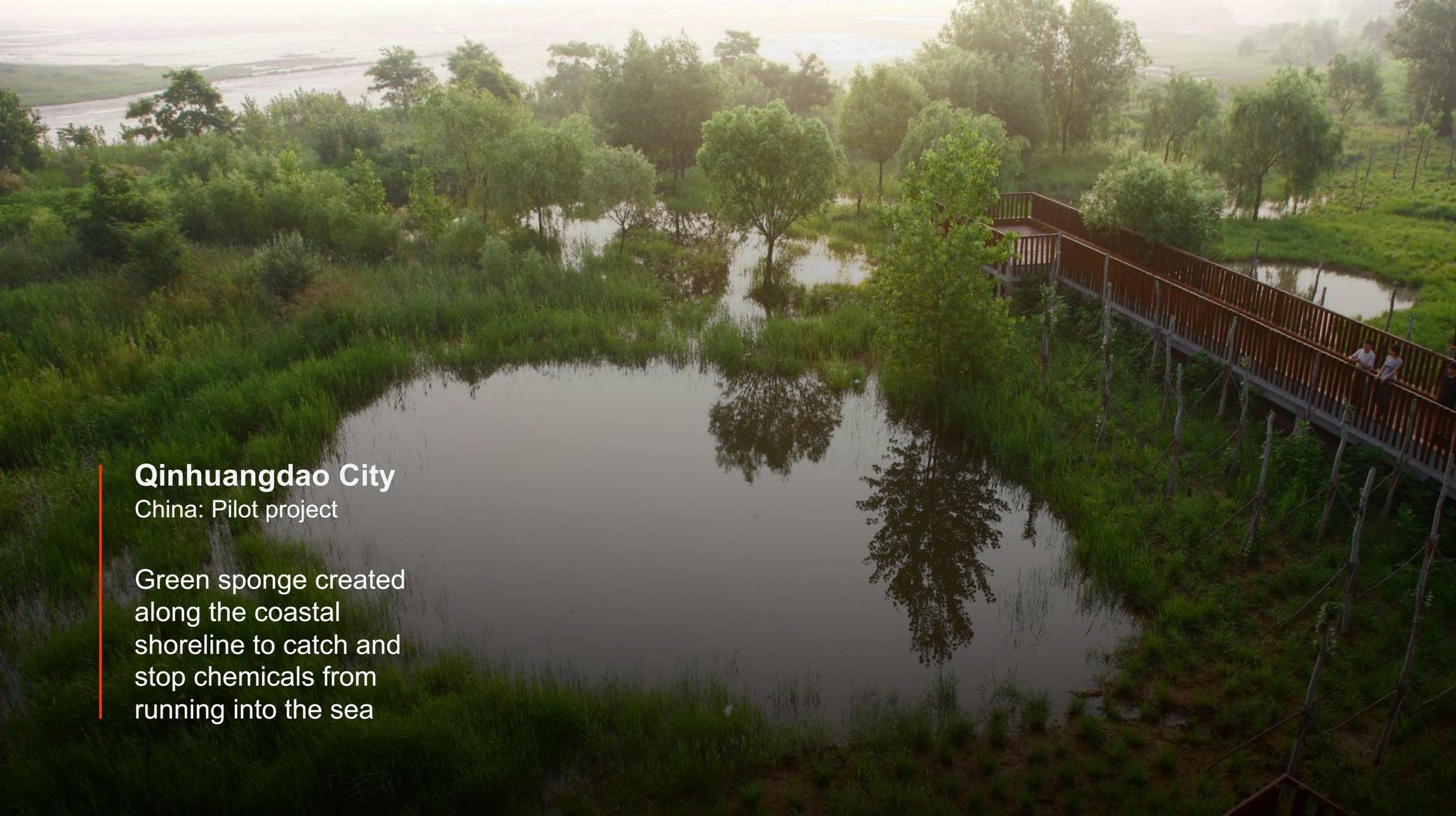
Designed a living landscape on a former brownfield to treat polluted river water and recover the degraded waterfront in an aesthetically pleasing way







**Effective solution for
larger-scale water issues?**
The Bohai Sea (770,000 km²)
is seriously contaminated and
becoming a dead sea

An aerial photograph of a coastal wetland area. A wooden boardwalk with a railing runs along the right side of a body of water. The water is calm and reflects the surrounding greenery. The landscape is lush with various trees and grasses. In the background, a large body of water, likely the sea, is visible under a hazy sky. A few people can be seen walking on the boardwalk.

Qinhuangdao City

China: Pilot project

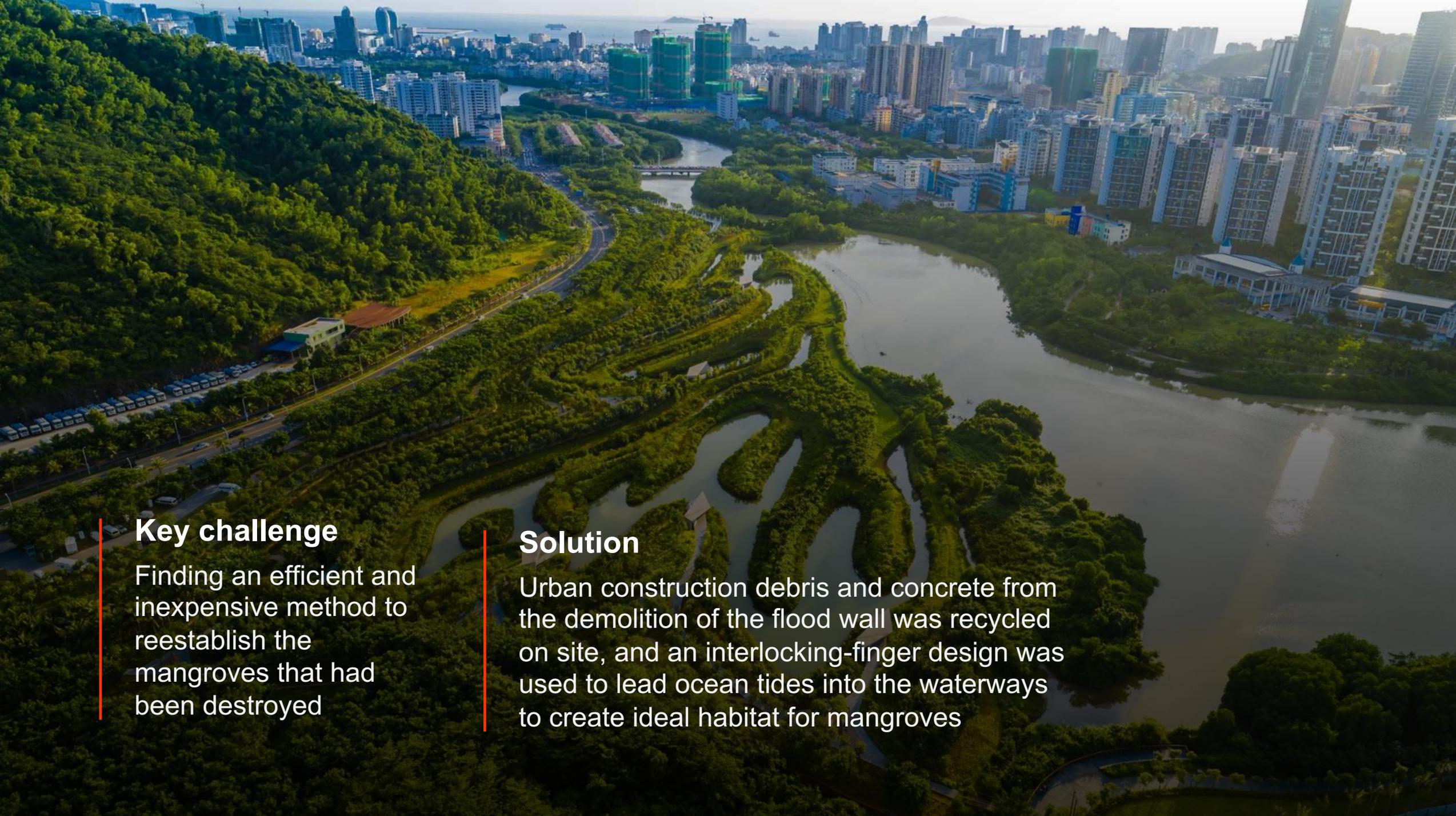
Green sponge created
along the coastal
shoreline to catch and
stop chemicals from
running into the sea

Climate resiliency: mitigating storm risk

Sanya City
Hainan, China

Restored mangroves
instead of building
concrete walls



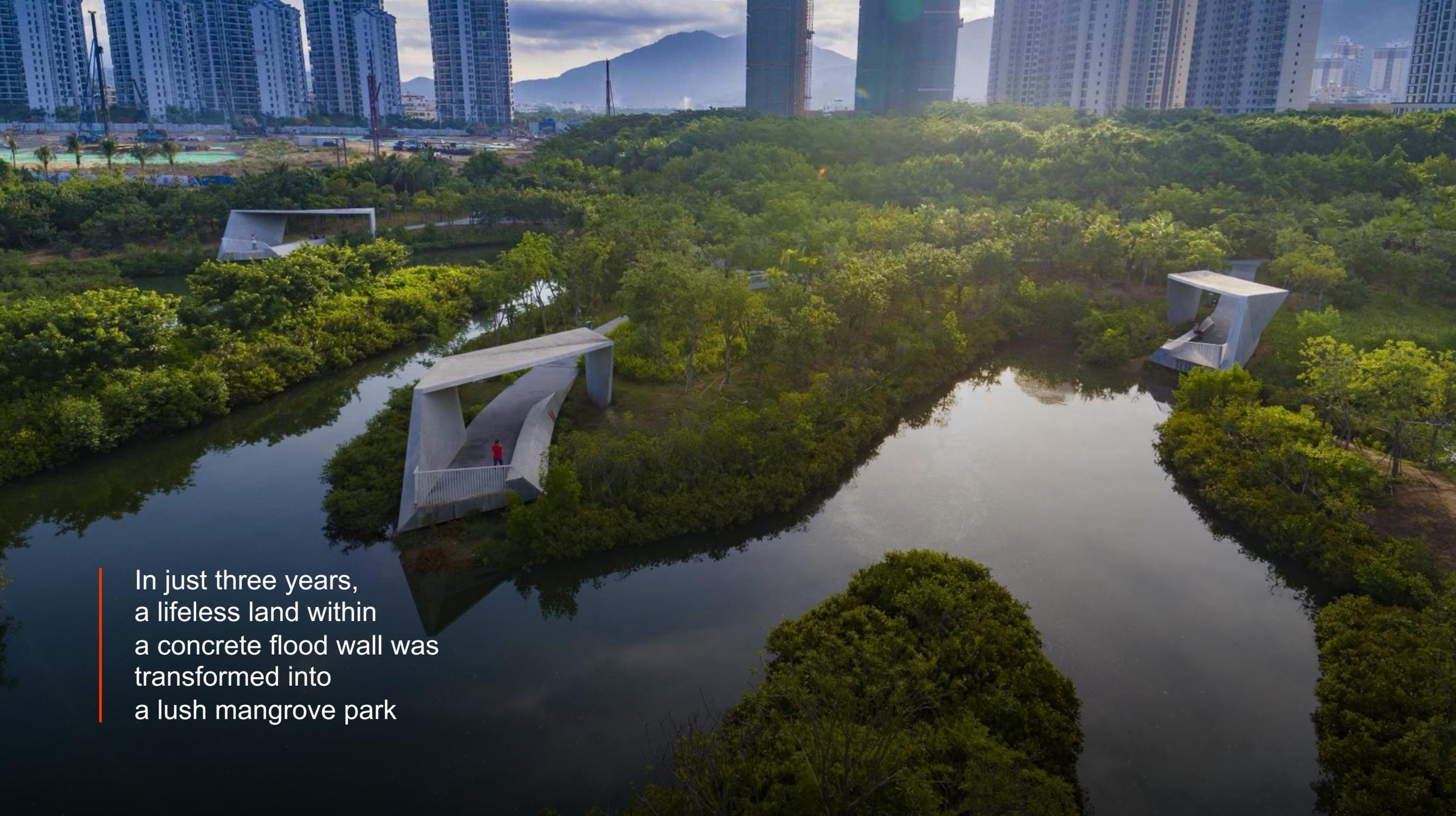


Key challenge

Finding an efficient and inexpensive method to reestablish the mangroves that had been destroyed

Solution

Urban construction debris and concrete from the demolition of the flood wall was recycled on site, and an interlocking-finger design was used to lead ocean tides into the waterways to create ideal habitat for mangroves



In just three years,
a lifeless land within
a concrete flood wall was
transformed into
a lush mangrove park

Soil remediation: letting nature do the work

60%

of urban soil is
contaminated in China

Conventional
remediation is usually
very expensive



A group of people is sitting on a wooden walkway in a restored wetland area. The walkway is made of light-colored wood and has a simple railing. The area is filled with tall, green grasses and some purple flowers in the foreground. In the background, there is a white railing and a line of trees. The scene is lit with warm, golden light, suggesting late afternoon or early morning.

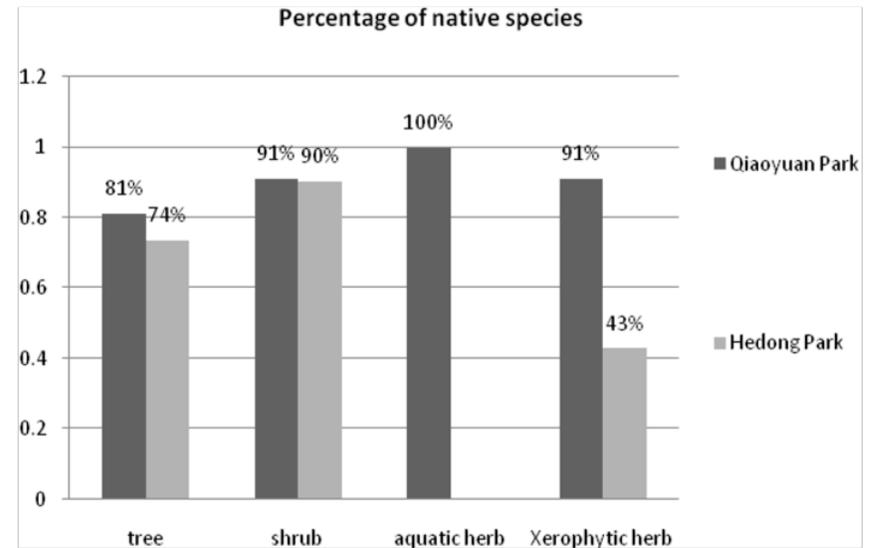
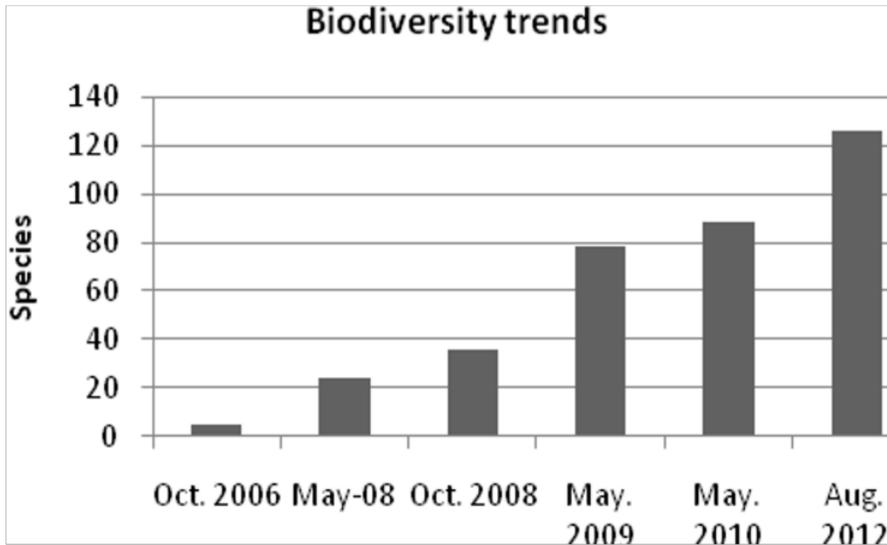
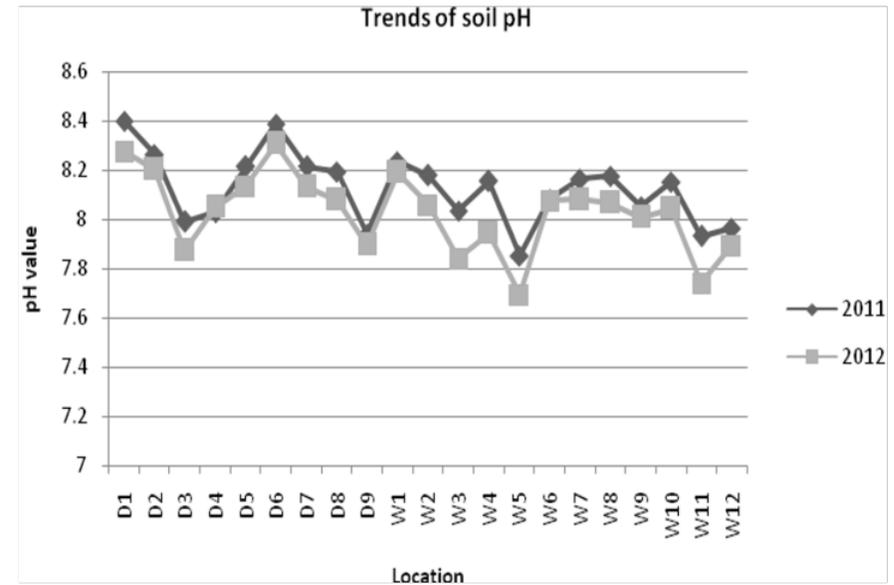
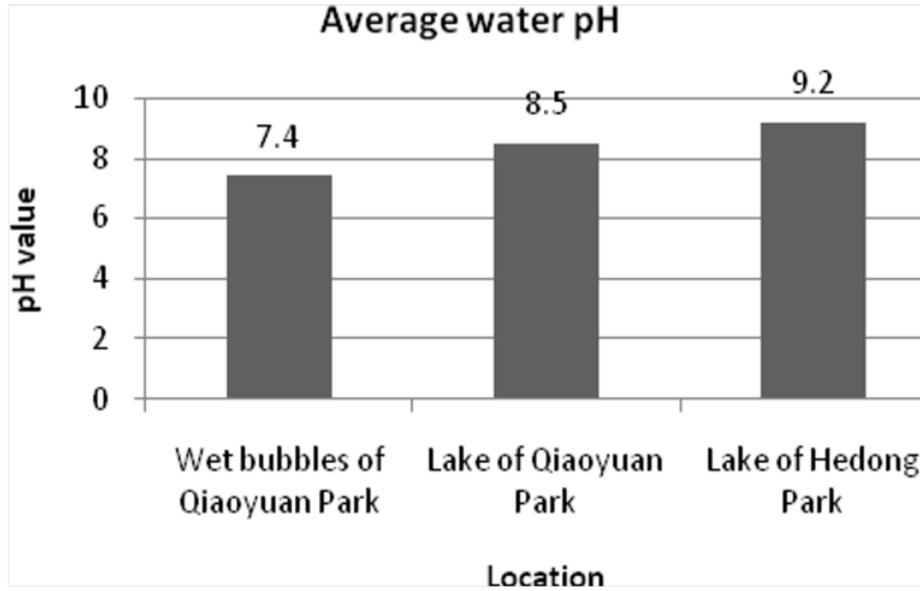
Tianjin city

China

Restored wetlands
on an abandoned
shooting range used
as a garbage dump



Water and Soil remediation service in Qiaoyuan Park



Healing the city through greening the infrastructure

Meishe River
Haikou City, China





Meishe River
Haikou City, China



Removal effect and cumulative removal rate of **nutrients**

90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
-10.00%
-20.00%

Habitat recovered in
the dense city center



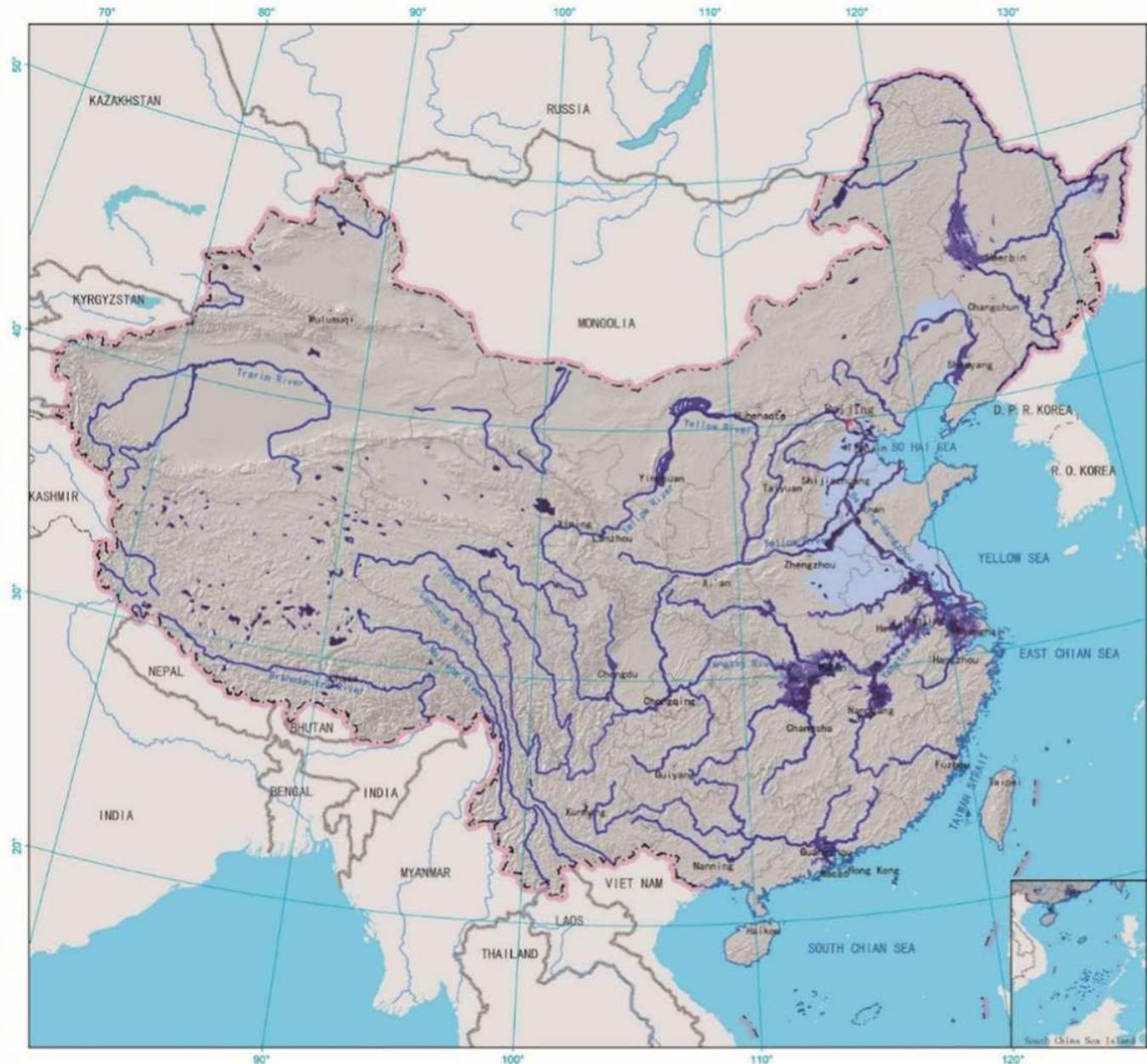
XL,L,M,S

Sponge System Across Scales, A Sponge Planet

I am talking not just about a river, I am talking about transforming the whole infrastructure



National



National Flood Regulation and Storage Security Patterns

- ★ National Capital
 - ⊙ Provincial Capital
 - Provincial Boundary
- Flood Regulation and Storage SP
- Higher level
 - Moderate level
 - Lower level

Scale:
0 200 400 800Km

Projection System:
Krasovsky_1940_Albers

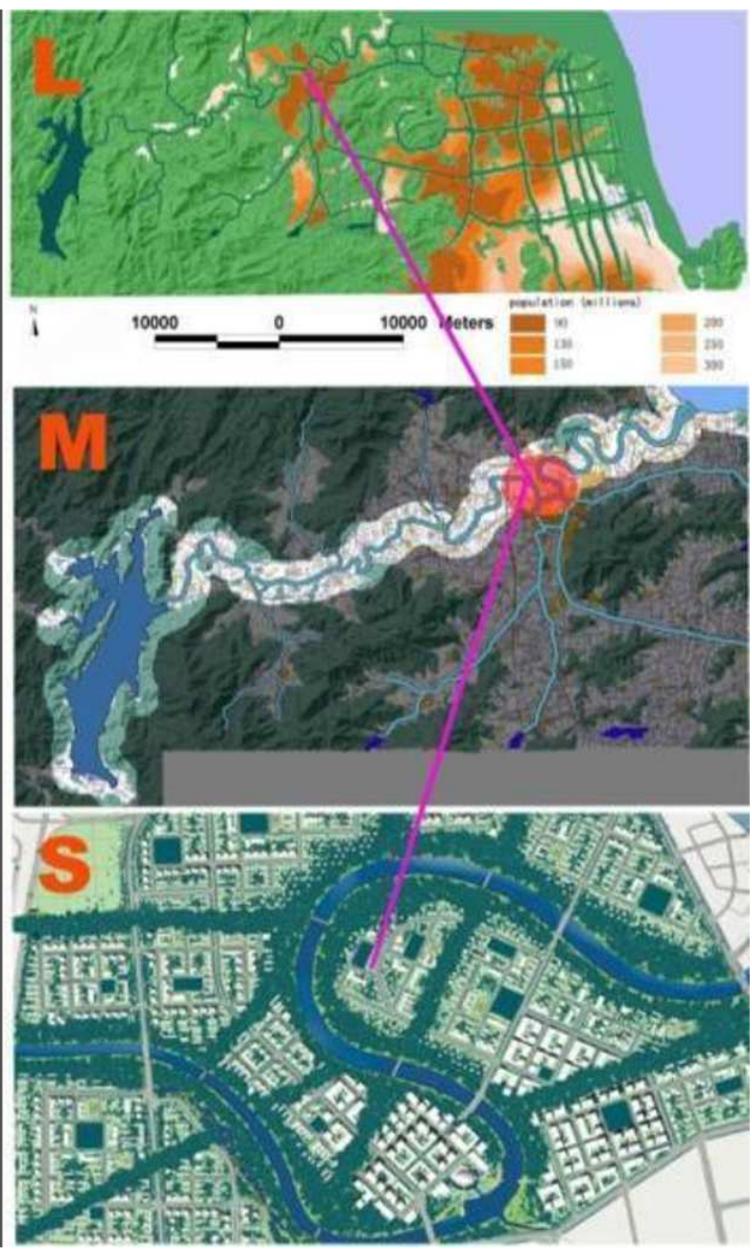


National Integrated Ecological Security Pattern

- ★ National Capital
- ⊙ Provincial Capital
- Provincial Boundary
- Ideal SP
- Satisfied SP
- Minimum

Scale:

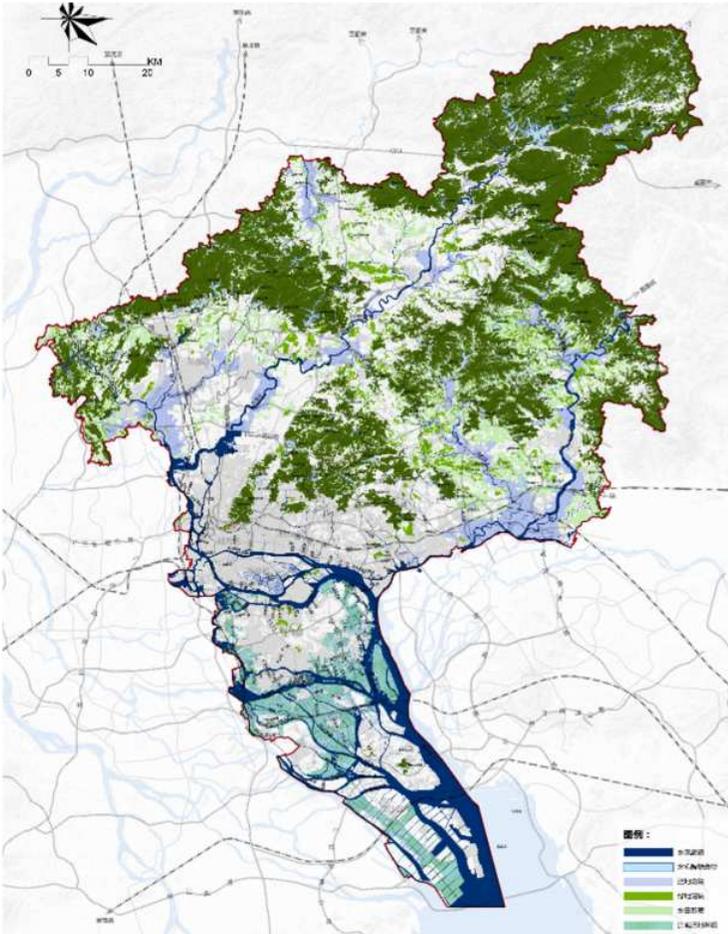
Projection System:
 Krasovsky_1940_Albers



Regional

Guangzhou Sponge City Planning and Implementation

7434 Square Kilometer



Retaining water at the source
(Distributed Terraces and ponds)

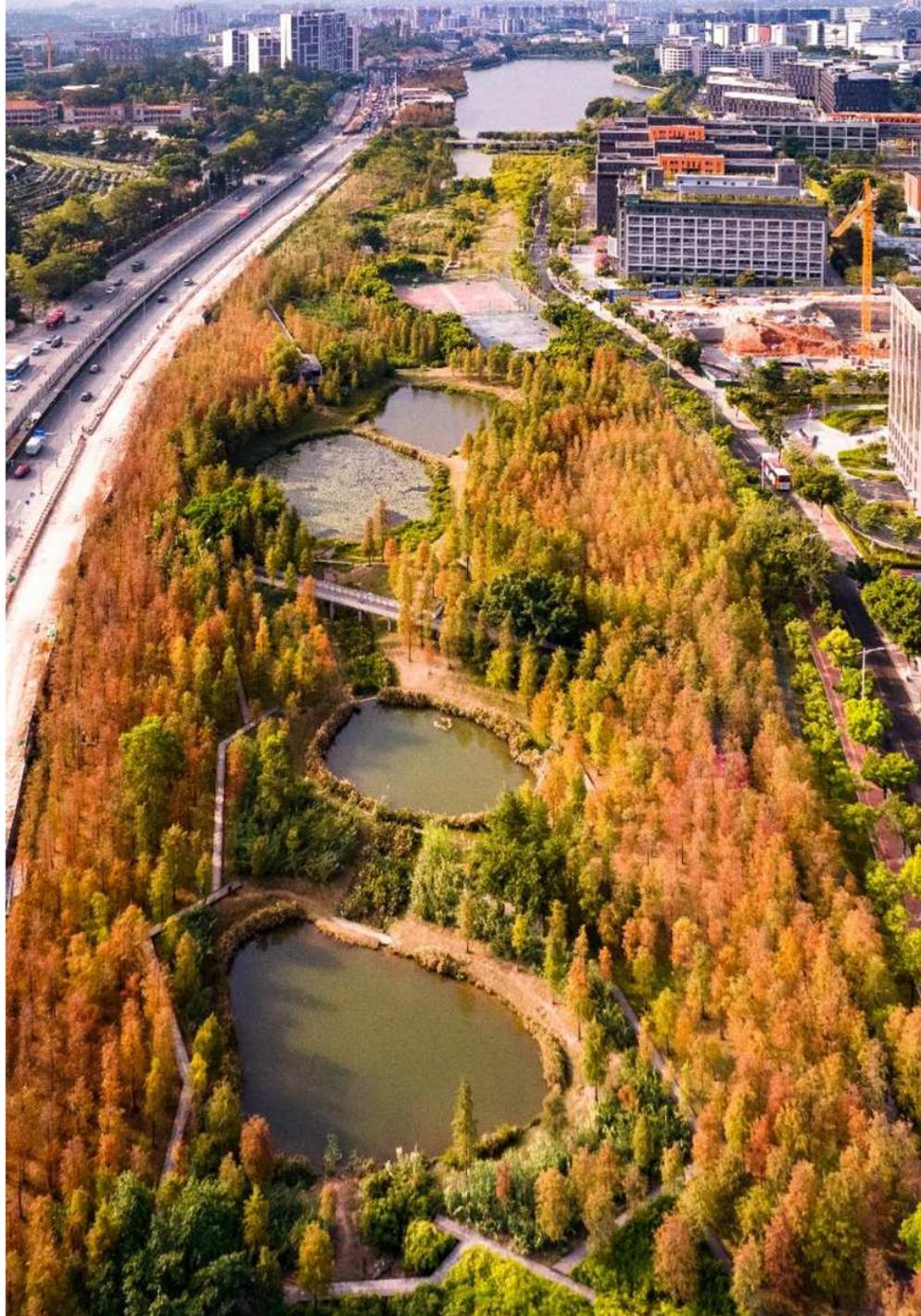


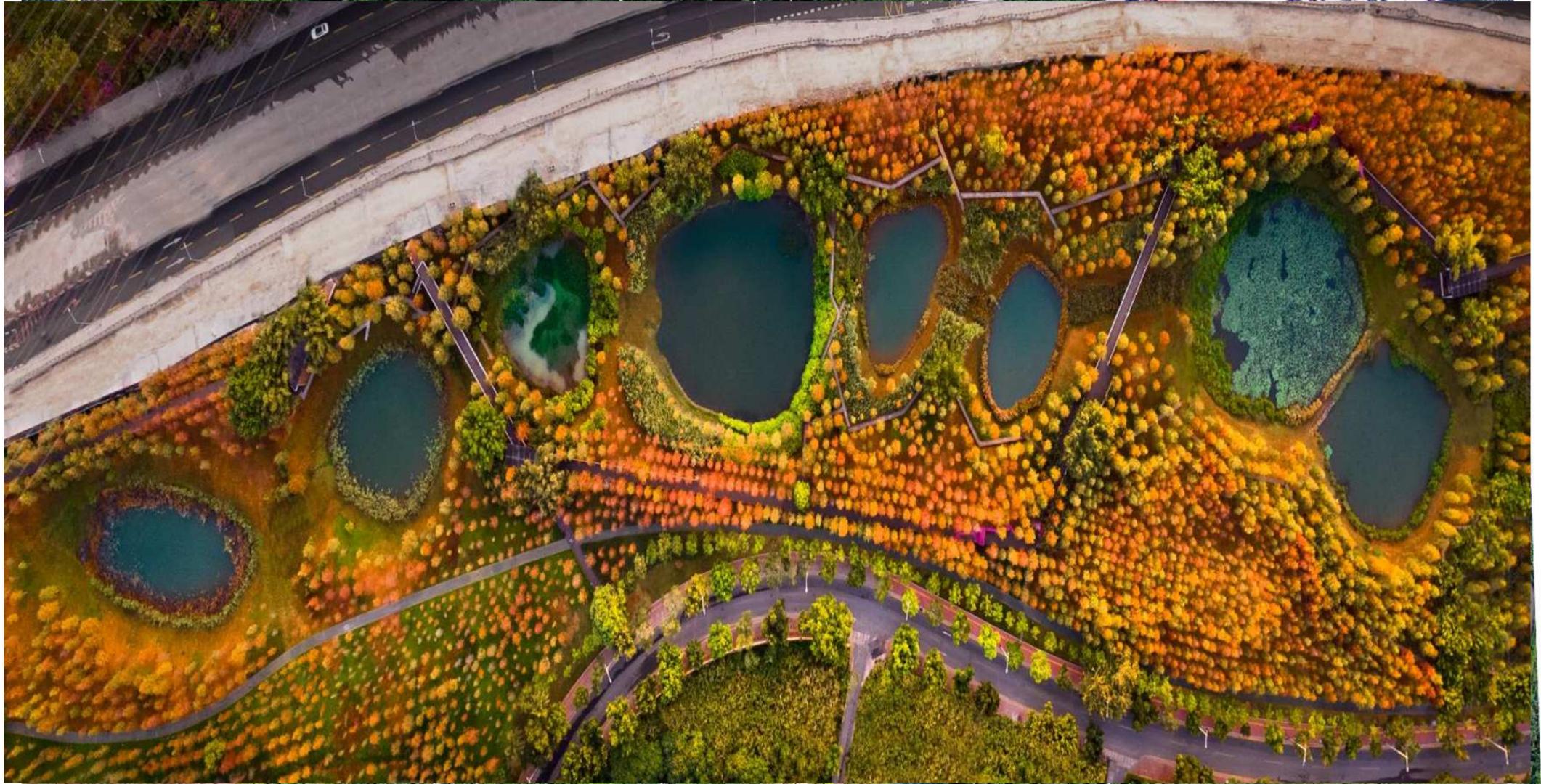
Be adaptive at the sink (pond-and-dyke system)

City Scale









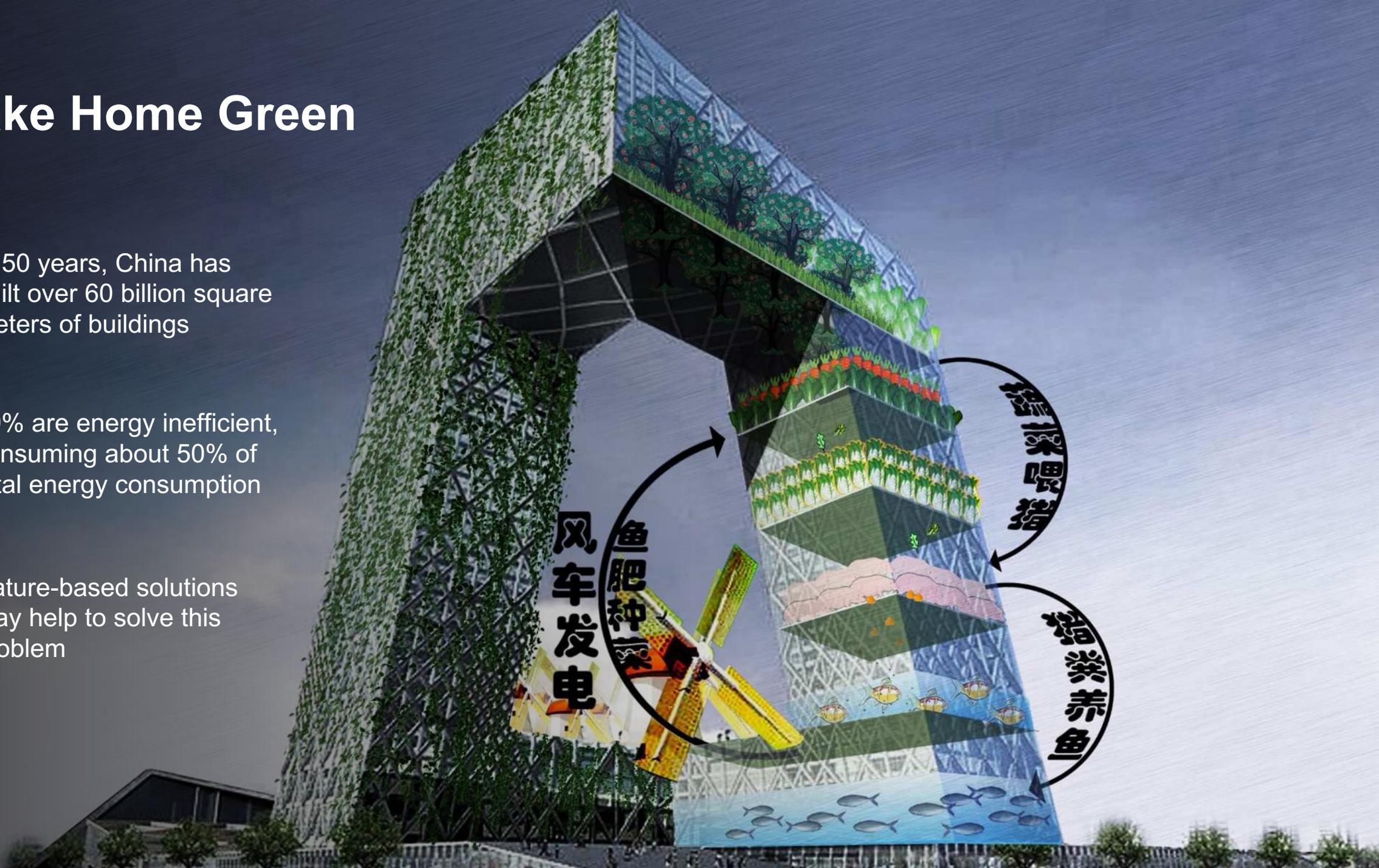


Make Home Green

In 50 years, China has built over 60 billion square meters of buildings

99% are energy inefficient, consuming about 50% of total energy consumption

Nature-based solutions may help to solve this problem



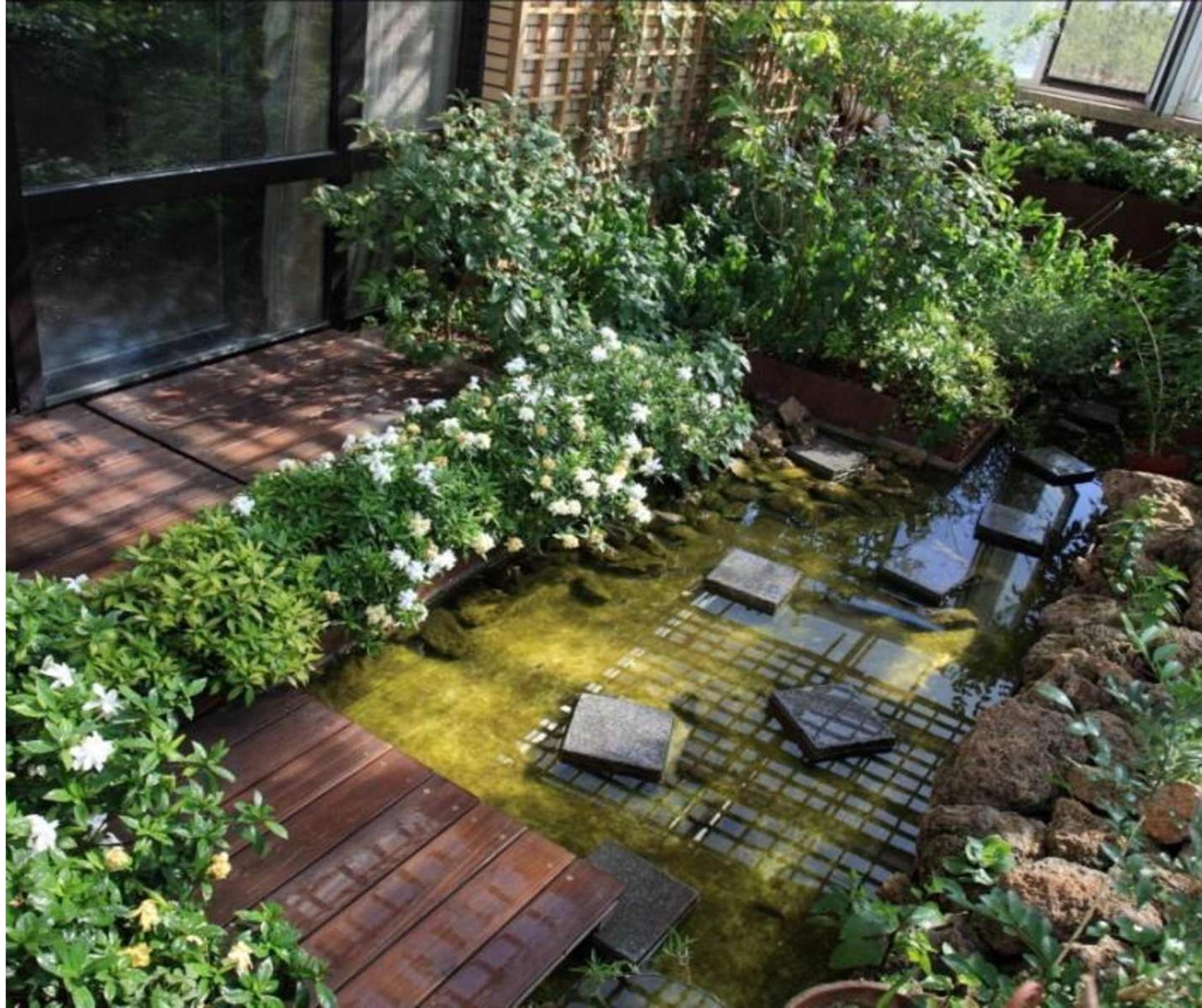
In my own home,
I collect storm
water and energy
from the roof and
grow vegetables
on the balcony



I produce
32kg of
vegetables
each year



I collect
52 tons of
rainwater



I recycle water
to create a living
wall to air-condition
the home and
save 2000 KW
of electricity



This helps show the community that **everyone can contribute to healing the planet** by practicing simple nature-based solutions at home



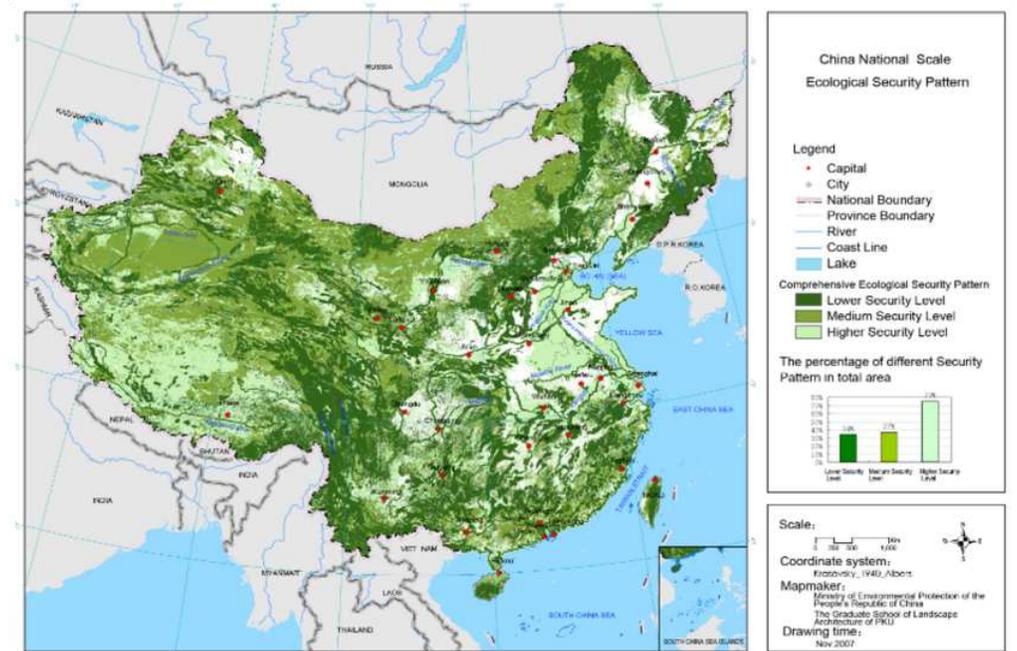
More than ever

we have to **rethink** the way we build our cities, the way we treat water and nature, and even the way we define civilization



Sponge City, or Sponge Planet

is a holistic and nature-based solution to protect and restore ecological infrastructure and make wise use of nature's services for the benefit of the planet and the welfare of people



Think like
a king,
but act like
peasants



King Yu the Great, who had the vision of healing the earth and living with nature



Peasants who transform the globe down to earth