水弹性城市:理论与实践 Design for A Water Resilient City

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Kongjian Yu College of Architecture and Landscape Architecture, Peking University Turenscape, www.turenscape.com kjyu@urban.pku.edu.cn 1. What does climate change mean?

Floods



Flood: in China, annual flood damage cost 100 billion US \$, 10 million people live in flood plain

Draught





Draught: 400 of 662 cities in shortage of water, 20 million people are in shortage of drinking water, In Beijing, underground drops 1.0 meter each year.

Rising sea levels "Landscape of Fear " (Yi-fu Tuan)







- Strategy 1. Fix it:
- Reduce emission of GHG, by ecological land use planning and wise selections, reduce and reuse and recycle of materials, etc.
- Strategy 2 To live with it:
- Adaptation, create adaptive landscapes, which is, BTW, is nothing new to human beings. Planning to live with water was the king's art

2. To Live with it: Memories

water adaptive landscape and the art of survival





(1)Live with water and build water system as sacred landscape (the Dragons and Qi Vein)



The water adaptive city: Chinese cities built along with water system











Water system as infrastructure: Dujiang Yan Dyke, solve multiple problems of flood, drought and navigation

(2)Siting: *art of Wind and Water* taking place in the mother land





(3) Strategies of minimum defense



The Yellow river basin : The change of water course of Yellow river



Raise the building base



wall and dyke







商丘Shang Qiu



聊城Liao cheng



虞城Yu cheng



(4)Strategies of Making friends with floods: Retaining water





Water-within-city

city-in-water



Retaining water. Field making, rice paddies in Yunnan, China, and water uses system in South China



3 The losing of water adaptive capacity

The destruction of water system as infrastructure







The destruction of water system in the city

maximum defense







Control water as enemy





Cars in the water, Boats on the land

4. Rebuilding water adaptive capacity The reconstruction of water based ecological infrastructure to

sustain ecosystems services

 4.1 Planning Strategy: Ecological Infrastructure Across Scales As Integral Solution To Solve Water Problems



历史时期洪水分析

• 国土尺度洪水调蓄安全格局

- 低水平洪水调蓄安全格局,占国土总面积的0.8%;
- 中安全水平洪水调蓄安全格局,占国土总面积的2.2%
- 高水平洪水调蓄安全格局,占国土总面积的6.2%

L---Regional ecological infrastructure for a water resilient city: The Beijing Case

Beijing1984

Beijing2001

What Is the Future of Beijing?

Beijing, the capital of China, is situated in the North China Plain, with a total area of 16,410 square kilometers. During the last 30 years, its population has doubled from 8.7 million in 1978 to about 17 millions in 2008, and its built-up area has expanded almost 7 folds from 180 square kilometers in 1978 to 1254 square kilometers in 2008, and is still expanding 32 square kilometers per year. The notorious "scrambled egg" pattern is the evidence of the speed and magnitude of the urban spread.

01 The site of the project and the main issues

-22 The ground water drops one meter each year

Cars and buses in the water

A river without water

Flood risks

Areas most suitable for retaining raining water and recharging the aquifer

The security pattern for water processes: avoiding flood and retaining water

Regional Ecological Infrastructure

Integrated Ecological infrastructure



Landscape Security Patterns (SPs) that safeguard the individual processes are integrated into the overall comprehensive Ecological Infrastructure (EI). Using overlaying technique to integrate the SPs for individual processes, alternatives of regional EI are developed at various quality levels: low (minimum), medium(satisfactory) and high(ideal). They will be used to guide and frame regional urban growth.

Level of El

Minimum(lower)

ideal(higher)

Satisfying (medium)

Area of El (km²)

7729

11508

13902

Pan

47.

70.

85.

Regional Ecological Infrastructure



Scenario-1 Sprawl as usual

<complex-block>

Landscape leads the way: Urban growth based on El

Scenario-3

Scenario-4

Scenario-5



M: Design for water Resiliency Wulijie Eco-city



The subtle elevation change on the rolling terrain gives character to the existing water system, which is made of a series of ponds that catch stormwater in the rainy season and provide water for irrigation and daily use in the dry season. The new town will respect his unique hydrological feature, and it will become the basis for the watercentered ecological infrastructure.















City based on El







The landscape security patterns for stormwater management are developed using three levels of stormwater retention capacity, calculated using GIS (geographic information systems), 50 mm, 100mm, and 150mm per day. This map will become one of the bases for the development of ecological infrastructure.



Other elements, including vegetation, cultural heritage sites, recreational resources, and habitats for native species, are integrated with the hydrological pattern to develop the overall landscape security pattern.



The stormwater collecting and filtrating system is the core for the ecological infrastructure of the new town. Three levels of green corridors were developed based that make up an interconnected ecological infrastructure for stormwater management, biological production using wetland plants and fish, birds, and wildlife species, plus recreational uses.



Pedestrian paths are integrated with the three levels of green corridors to create an overall network.



Bicycle paths are integrated with the three levels of green corridors to form a commuter and recreational network.









The city is under construction and well be built in 5-10 years

4.2 Design and Built Key principles and built demonstrations of big feet solutions

VS.



citified small feet

The unhealthy, and deprived of productivity, low performance but considered to be "beautiful"



rural big foot

Healthy, productive, high performance but considered to be "rustic"

#1 Make friends with Floods

The Floating Gardens of Yongning Park, Zhejiang, China

This project demonstrates an ecological approach to flood control and storm water management, while also educating people about other solutions to flood control beyond engineering.







Flooded ervery 10 years Flooded ervery 20 years Flooded ervery 50 years / Existing water courses

Location of the park

The ecological approach for storm water management was proposed by the landscape architect as an alternative to the commonly used concrete embankment and channelization. This proposal was finally been accepted. As a result, the former engineering approach was stopped, and the concrete lined river was to be ecologically recovered. The Yongning River Park was, therefore, set up an example for ecological recovering of the whole river.

Flood Analysis

The Floating Gardens: Yangning River Park





The park under development: Concrete was removed, diverse terrain on the river bed and along the riparian plane were laid to create various habitats for native plants, and the river bank was graded, allowing people to access the water. 解放大脚







#2 Green Sponge for a Water Resilient City

Qunli Stormwater Park Ha'erbin, 33 ha.







Qunli New Town











Before: 2009, the pre-existing site



After 2013, 3 years after the stormwater park was built



Year 2011 one year after the stormwater park was built



Year 2014, 4 years after the wetland park was built; residential development was catlized by the stormwater park



2013, early Summer, toward north east







#3 Slow Down: An Integration of ecological solutions to rejuvenate a whole City

Liu Panshui City, Guizhou






























People enjoy the clean water that has been filtered through the series of bio-swales and terraces. Visitors are excited at the intimate contact with the massive drifts of self-seeding flowers.







#5 Start with My Home

40 billion square meters of building, 2 billions increase every year, 99% of them are energy inefficient, how can we help?





01 The site plan, sections and illustrations: solar energy and rain water are harvested for a balcony garden and indoor living wall to transform two apartments into productive ecosystems





03 The year round planting design of the balcony vegetable garden



05 The vegetable garden: the owner has access to a mix of fruits, herbs, and vegetables available just a few steps away from the kitchen



08 The vegetable garden: productive ecosystems that provide fresh fruits and vegetables for the kitchen















Community education: Small solution to big problem





小改变解决大问题

Small solution to big problem Collect 52 Tons of rain water Save 2000 KW of electricity Produce 18 kg of vegetable 2000 kilowatts of electricity. If every apartments in China like that, we can save 3 three Gorges Dams

So right now, we are turning this living wall a replicable product and will be available at a minimum cost



5. Conclusion

- Climate change is nothing new to the Globe and human beings. We survived because we learnt to adapt, and we evolved physically and culturally
- The industrialization and urbanization in the past century had cut the process of adaptation and our survival memories are fading.
- It is time now to recover the memory, and to continue the process of adaptation and evolution.
- The key is to build an ecological infrastructure based on water process across scales, from the national and continental to the local and site specific.