Bring Nature to Cities
Deep Forms: Nature Based Solutions

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How can we survive?

Flood: annual flood damage cost 100 billion US $

Draught: 400 of 662 cities in shortage of water

Pollution: 75% of the nation’s surface water is polluted, 64% of cities’ underground water is polluted

Habitat loss: 50% wetland disappeared in the past 50 years

Over 80% of the Chinese cities suffer air pollution, kills 1.2 million people each year
Conventional solutions of single-minded engineering are not sustainable
Alternative---
Nature based solutions: by planning and designing landscape as ecological infrastructures (Green Infrastructure) to provide multiple eco-services:

- Provision
- Regulation
- Life supporting
- Cultural and spiritual services
- Inspirations and beauty
• Such solutions result in deep forms that stands in contrast to shallow form, “which has only the surface perceptual order and lacks the solidity of coherent process beneath the surface” (Lyle, 1985).
Two strategies to create the ecological infrastructure, thus deep forms

1. Planning to create configurative deep forms

2. Design and engineering to create transformative deep forms
For about 20 years, my team have been testing such solutions in over 200 cities and showcased numerous replicable models for transforming our environment at various scales.
1. Planning to create configurative deep forms
Ecological Infrastructure across scales
National water security pattern

- 1-year flood, 0.8% of the national land;
- 10-year flood, 2.2% of the national land;
- 50-year-flood, 6.2% of the national land;
洪水淹没区内GDP分布
the national Ecological Infrastructure
The Foothills Strategy: where to build another 500 cities for 0.5 billion new immigrants (Kongjian Yu, Capitalizing on foothills: restoring the relationship between people and land. Harvard International Review; Summer 2012, Vol. 34 (1); 40-45)
Regional 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.
Landscape leads the way: Urban growth based on EI

Scenario-1 Sprawl as usual

Scenario-3

Scenario-4

Scenario-5
The subtle elevation change on the rolling terrain gives character to the existing water system,

Conventional way of city building
Landscape as infrastructure leading urban development
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
The city is under construction and will be built in 5-10 years.
2. Design and engineering to create transformative deep forms
Inspired by the ancient farming wisdom, based on sciences of ecology, replicable terrace module is developed to solve the problem in an inexpensive way.
• #1 Make Friends with Flooding

• Annual flood damage cost 100 billion US $, 10 million people live in flood plain.
• All Rivers in China are dammed and channelized with concrete flood walls, What can you do?

Number of dams (height>15m)
World total: 49,697
China: 25,800
USA: 8,724
#1 Make Friends with Floods

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All Rivers in China are dammed and channelized with concrete flood walls, What can you do?
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: Yongning River Park*
Jinhua YAnweizhou: 浙江金华，燕尾洲公园
100年一遇的洪水淹没的实景
20年一遇
An aerial view of the park during the dry season, note the lush tall grasses covering the terraces on the embankment. The terraces are enriched by silt deposited during the flood season (view is toward the west, photo: September, 2016).
浙江金华，与洪水为友：燕尾洲公园
100 Year Flood
An aerial view of the park during the dry season, note the lush tall grasses covering the terraces on the embankment. The terraces are enriched by silt deposited during the flood season (view is toward the west, photo: September, 2016).
#2 Creating Water Resilient City by Restoring Native Habitats
The Mangrove park and wetland Park in the city of Sanya

三亚的系列生态修复工程,由住建部召开现场会,向全国推广（之一）
海南三亚红树林公园

通过弹性适应、界面增强和仿生修复等技术,快速修复红树林栖息地

修复之前，2016

修复之后，2018
The preexisting conditions:

- The site is at the upper limit the ocean tide can reach.
- The former natural mangroves had been destroyed by careless urban development and concrete embankment.
- Piled with construction debris and garbage.

Dividing line of salt water vs. fresh water.

Salt water from the sea.

The site.
To induct ocean tides and avoid destructive freshwater storm

To avoid tropical destructive storm from the sea

01 Site plan: form follow processes. The designed ecotones of inter-locked fingers help to induct ocean tides, avoid the freshwater flush and destructive tropical storm.
Ecotones with diverse aquatic settings

Bio swales and vegetated terraces to filtrate polluted urban runoffs

The designed ecotone of inter-locked fingers dramatically enhances the edge effects (water edge length increases from 700 to over 4000 meters, and water depth varies from 0 to 1.5 meters), and creates a dynamic aquatic environment following the rise and fall of tides.

Low tide

High tide

Eco tones with diverse aquatic settings
The preexisting site, April, 2016 (Google Earth)

The process of construction, April 2017

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The former land fill of construction debris and concrete materials from the demolition of the flood wall are recycled on site, and by means of cut-and-fill, ecotones of inter-locked fingers are created for diverse fauna and flora, particularly different species of mangroves;
2004.2
The interlocked fingers at the right side of this aerial image is inaccessible for the public and reserved for natural fauna including many species of birds, while the left part is accessible for public to enjoy the nature including bird watching.
The ecologically restored mangrove park become an oasis right in the middle of the city, surrounded by skyscrapers of residential buildings. Residents take leisure in the pavilions watching white egrets feeding fishes just feet's away.
At the backdrop of the skyscrapers, the interconnected waterways breathe with the rise and fall of the ocean tides. The pavilions are just like pairs of feeding Egrets resting quietly in the morning light.
The pavilion is designed in such a way so that the harsh sunlight in the middle day can be effectively blocked, and the morning and afternoon sunlight can penetrate through.
East bank wetland
[Diagram showing various sections of a park or urban area with labels in Chinese.]}
Billions of dollars have been spent to turn nature into expensive urban landscapes. What could be the alternatives?

Under the name of safety and “beauty,” we created shallow form or fake forms
The Red Ribbon park, Qinghuangdoa City, Hebei Province
Board walk

Light

Fiber steel

Planter connected to the ground