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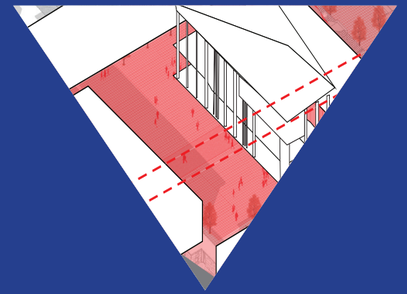
Syllabus

January 2022

Architecture Research Agenda



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Syllabus
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Syllabus presents experiences and research made inside formative courses at different levels: bachelor, master, doctorate.
The goal is to offer these results, provisional and incomplete as they can be, to the scientific community, enhancing dialogues and exchanges.

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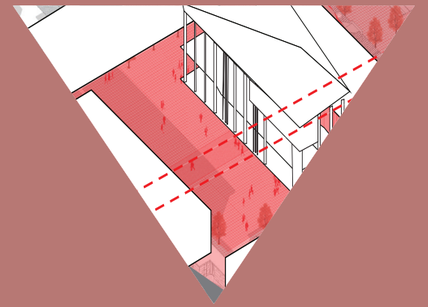

02

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Jiaxi Li
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PUBLICATIONS: Book chapter: Undergraduate dissertation published in "Between The Rails and Ties - Six School Joint Graduation Project of Urban Planning & Design", 2017, ISBN: 9787112212095, pp. 76-105. Journal article: Zhao Yachen, Li Jiaxi, "Green Ecological Design Strategy of Yulin Fuzhou Ancient City", published in Urbanism and Architecture, ISSN: 1673-0232, pp. 78-82.
Li Jiaxi, Zhao Yachen,Tang Mengying, "Research on the rationality of courtyards' spatial design of commercial complex based on structure perspective", published in Research on Urban Construction Theory, 2019, ISSN: 2095-2104, pp. 61-62.

Climate change and rising sea levels present immediate threats to humanity. The aim of this research is to design solutions that slow down the pace of land subsidence, absorb the impact brought by rising sea level, especially those exposed to risk of coastal hazards. Incorporating a research through design approach while developing vegetative and water-based systems, and flexible/dynamic infrastructure that intervene in ecological corridor to respond to slowly occurring sea-level rise hazards and abrupt coastal hazards; improving the overall microclimate of selected area. This research topic relates exclusively to water-related ecological corridor design which will be applied to coastal wetlands, ecological network to mitigate the threats both from land subsidence and slowly rising sea level.

Jiaxi Li

Synthetic landscapes, capable to deal with coastal issues

Position Project

Adaptation through design - Coupling of the Green City master plan and sponge city facilities.

TOPIC

This project is located in Nanwang Town, Shandong Province, which is the highest point on the Beijing-Hangzhou Grand Canal. Here, the water diversion channel that represents the highest construction technology on the Grand Canal is located (Li 2006, 96-104). In recent years, heavy rainfall exceeding 50mm has been frequent, causing frequent flooding in 17 counties including Nanwang City. Many cities are now suffering from flooding ("Shandong's Economic Losses From Flooding Disasters Are Reduced By 90%, And Provincial Emergency Command Center Is Built" 2020). This is not only the problem of poor drainage and unreasonable underground pipe network, but also the city has neglected the ecology in the development process, making it lose its flexibility (Wu 2019, 12).

AIM

To protect the water diversion channel and improve citizens' living comfort, the purpose of this project is to respond to the frequently occurring waterlogging and other environmental problems in Nanwang Town through ecological design, based and at the same time drive the urban renewal of Nanwang Town.

METHOD

Learning from the Chinese method of gardening landscapes, this project uses ecological technology to respond to the problem of flooding, under the guidance of Sponge City Theory. This project is articulated in three phases and more precisely in:

1. The Green City Master Plan, establishing an urban green space system relying on the blue system.
Urban parks and green spaces are natural sponges in cities, and they have a certain ability to collect and absorb rainwater. The existing green land along the river is fragmented, and a large amount of green land is occupied by construction.

2. The design of a reserve park, rendering the park absorbent.
The existing urban parks and green spaces lack rainwater collection and reuse systems. As a result, when heavy rain comes, the park's green space cannot effectively absorb rainwater from surrounding buildings and roads, which increases the possibility of urban waterlogging. At the same

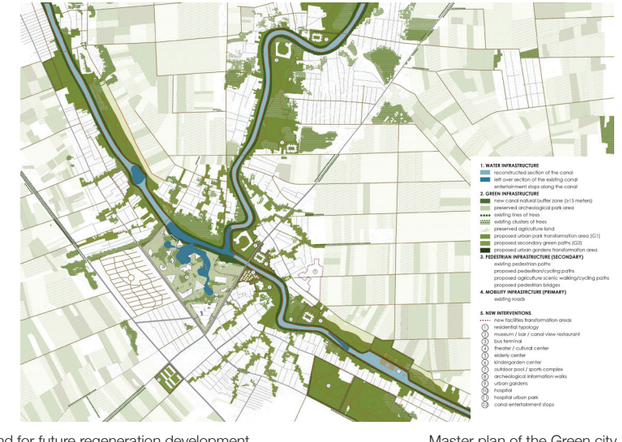
Phase 1: Establish the "green city": the green area along the river + the "green fingers" inside the town.

Step 1: Recover and create the green space along the river, improve green space's continuity.

Step 2: Extend green fingers SYS inside the built-up area to form the future green city.

Step 3: Introduce new public services to the future green city.

Mapping and demolish buildings in the green canal zone, green finger SYS and for future regeneration development.



Master plan of the Green city.

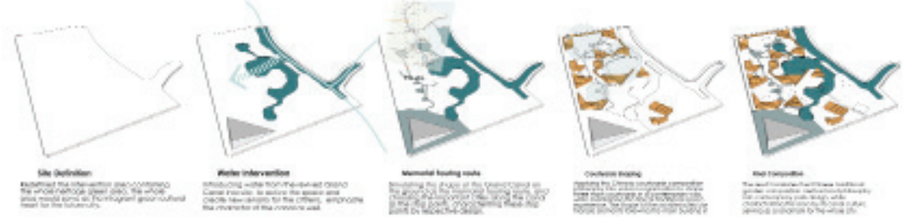
time, it wasted the function of the giant sponge in the urban park green space. The plants in the park's green space need water for irrigation every day, and the waste of drainage and rainwater has a massive impact on the park's sustainability.

3. The design of details in sponge facilities (Sponge City Design Diagram 2017, 28-72), such as the following:
a. Rain garden: The rain garden can effectively collect the surrounding rainwater runoff and avoid rainwater and waterlogging disasters. At the same time, the landscape effect of the rainwater garden can meet the viewing effect of the citizens.
b. Sunken green land: The sunken green land can collect surface runoff from the buildings, roads and squares around the park, and reduce the loss caused by regional waterlogging during the rain and flood period. At the same time, the underground water tank can store rainwater and reuse it.
c. Permeable pavement.

Design
Phase 1: Establising an urban green space system relying on the blue system.
1. Recover and create the green space along the river, improve green space's continuity (Increase urban green area);
2. Extend green fingers SYS inside the built-up area to form future green city (Separate motor vehicles from non-motor vehicles, green finger, only non-motor vehicles can pass on the greenway);
3. Map and demolish poor-quality buildings to restore the green system and develop existing green area to secondary green system which we called green fingers, and forbid to touch any unconstructed land to construction;
4. Introduce new public services to the future green city for urban renewal, e.g. kindergarten, caring center for the elderly, etc.

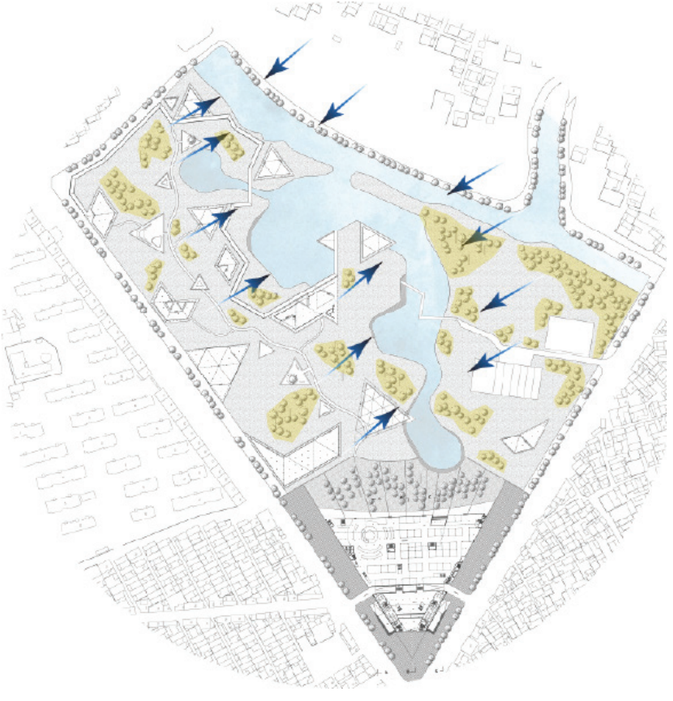
Q: How to determine the appropriate ratio of water and green land area and total land area in the town? (Reflection on research)

Phase 2: Make reserve park the heart of green city
1. Apart from the new-built museum and water diversion channel, demolish the existing buildins on site.
2. Create a pond to improve the capacity for water storage and improve citizens' psychological perception.
3. Bring the concept of grand canal and express it as the route and using the principle of Chinese traditional garden to organize the corridor and buildings.



Phase 2: Make the reserve park the heart of the green city.

Master plan of Reserve Park.



Collection of rainwater
Rain garden
Sunken green land

Distribution of sponge facilities in Reserve Park.

4. Introduce rain garden, sunken green land, and permeable pavement to enhance resilience.
Q: How to transform existing green space instead of demolishing and reconstructing? (Reflection on research)

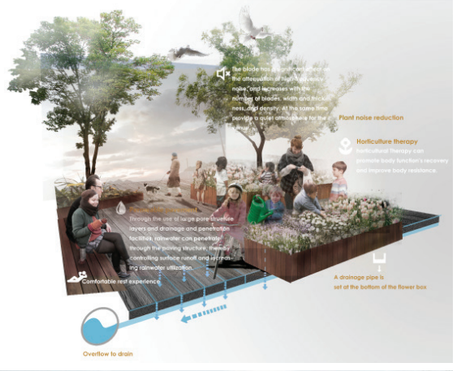
Phase 3: Detail design in sponge city construction
1. Rain garden: put plants with drought-tolerant, barren-tolerant, and waterlogging-tolerant properties into the rain garden and set a pebble area in the middle to prevent rain washing;
2. Sunken green land: make it into a basin with the lowest point about 0.8m below the ground level, and put the underground water tank under the sunken green land;
3. Permeable pavement.

Q: If rain garden and sunken green land are inside an ecological design tool kit, how can we localize these components in a specific design? (Reflection on research).

From infrastructure to landscape

Coastal communities are experiencing the effects of climate change, including sea level rise, more intense storms,flooding, and erosion. Coastal flooding has more than doubled in the past 30 years (Climate Science Special Report 2017, 6).

Additionally, due to sea level rise, high tides are becoming higher and higher, and the highest tides—king tides, which usually occur seasonally—are projected to become daily high tides, leading to even further flooding (Siddall and Pollard 2012, 1-7). On top of this, gray infrastructure built to "control" flooding, especially in the face of extreme weather, is increasingly failing to do its job (Schueler 2017, 2-5). Climate change impacts require a re-evaluation of infrastructure solutions. Nature itself it is never in equilibrium and what has to do is not try to compensate or balance but catalyze different nested equilibrium cycles that allow the system to evolve what nature does (Miriam García 2015, 2). Therefore, how we have designed our cities' infrastructure to respond to disturbance both internal and external is important.
Infrastructures along coasts is a way of closed systems that were capable of producing and conceiving, and those closed systems have paralyzed the very capacity of systems to adapt later. We need to inject changes to activate that resilience process (Schueler 2017, 4). Studies suggest coastal nature-based solutions can mitigate flood and storm damage more effectively than gray infrastructure alone, and are more resilient (Maza 2020, 1). However, resilience design has to do with modularity with working from the small work and modular, allows this connection of the components and its



Rain garden scenario.

Sunken green land scenario.

adaptation, of the condition that is on the periphery of those systems that is, the makes much more flexible elements of the system capable of adapting. Therefore, the knowledge acquired from this project has involved breaking down the projects submitted after hurricanes Katrina, and from there extracting some pieces.

Q1: How to fix America's crumbling infrastructure?
Q2: How to make communities more resilient to climate impacts?

Reasons for choosing the Living breakwater project
The Anthropocene condition signifies a different mode of change and a different mode of existence that calls for a design revolution. (Timothy Morton 2017, 14-30). There is a revolution from structure to the synthetic metamorphosis of landscapes where metamorphosis is about generating and implementing resiliency in the age of climate change (Miriam García 2015). The focus should be on what is now emerging future structures, norms, and new beginnings (Ulrich Beck 2014). He said that it is the moments of great anthropological clashes when allowing civilizations to emerge new orders where innovation arises from a global crisis because the powers are tempered at that moment, and only innovation can respond. There is need, and risk feels global. Therefore, I looked at two scenarios, catastrophic hurricanes Katrina and Sanders in the United States: not only design response that occurred after these hurricanes. I focused there also because the country's economy and a whole country can be rethinking its design agenda from other budges.

Synthetic Landscapes Practice: Living breakwater
The project combines coastal resiliency infrastructure with habitant enhancement techniques and community engagement models, deploying a layered strategy that links in-water protective forms to on-shore interventions.

AIM
Advance ideas that help protect us from periodic weather extremes while improving the quality of our everyday lives.

METHOD
Rather than cut off communities from the water with a levee or a wall, living breakwater embraces the water and its economic and recreational opportunities, using shallow water landscapes to stabilize the shore. Ecosystems can be restored to step down risk faced by coastal communities and to rebuild diverse habitats. The LAYERED APPROACH extends across

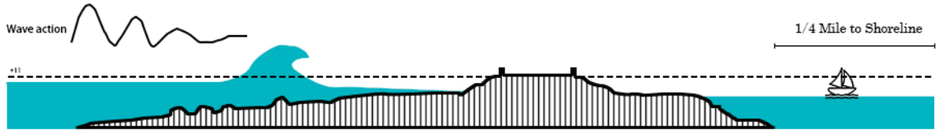


Fig. 1. Exposed breakwater.

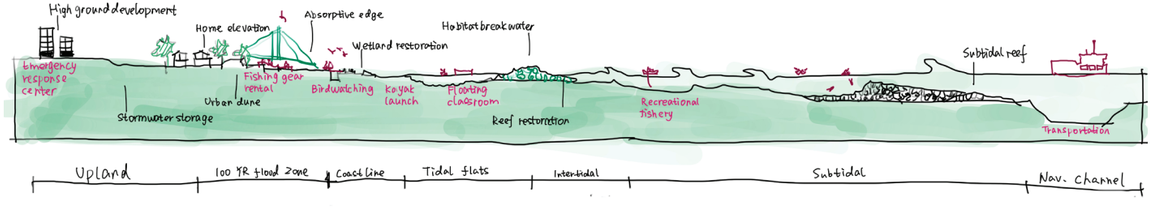


Fig. 2. A set of scattered breakwaters with various programs.

a thick section, creating multiple lines of defense that will not fail singularly and catastrophically. People are a critical component of any ecosystem.

They have thus developed a framework to link people with the shoreline and with the water through education, engagement, and the expansion of a water-based recreational economy. Shallow, slow, and safe water opens up a variety of in-water programming opportunities, from sport diving to charter fishing to kayaking to citizen stewardship, all enabled by the layered approach.

This project can be summarized as following four aspects:

1. Using a set of scattered breakwaters instead of a solid wall. Similar to reefs and submerged reefs, they can slow down waves breaking, reduce wave height, prevent coastline erosion, and expand beach areas for human activities (Fig. 1).
2. In order to restore the ecology of the waterfront, they designed a special “ecological breakwater”. The underwater “reef ” is composed of “ecological concrete blocks”, which can be isolated from the outside world, and fish, shrimp and oysters can live and multiply here. The water part can accommodate seagulls and birds to build nests and provide habitat for carnivores (Fig. 2).
3. While protecting the ecology, the designer did not prohibit human activities in a “one size fits all” manner. They designed a three-dimensional aquatic center that can be matched with surrounding facilities (Fig. 3).
4. In addition to reducing waves and developing economic and leisure potential, Living Breakwaters also introduced a new partner-a program called Billion Oyster. The latter plans to restore the ecology of New York Harbor in the next 20 years, with the number of live oysters reaching 1 billion. (Fig. 4).

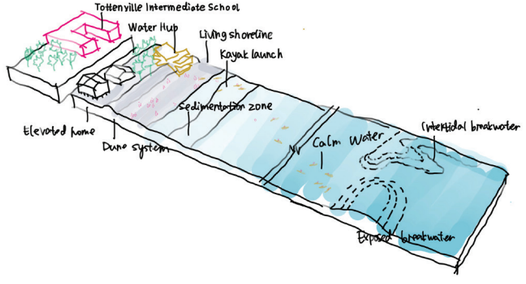


Fig. 3. Revive recreational economics.

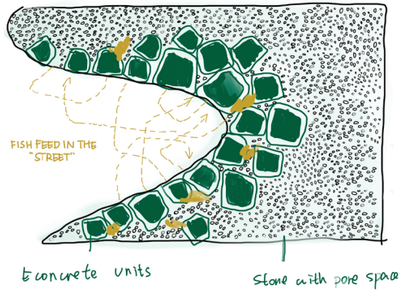


Fig. 4. The reef “Street”.

Key Words — Key Projects
Adaptation through design
Capable synthetic landscapes to deal with coastal issues
Research Subject: Coastal ecological corridor as a nature-based defense to tackle rising sea level.

AIM
The research topic relates exclusively to water-related ecological corridor design, which will be applied to coastal wetlands, ecological networks to mitigate the threats both from land subsidence and slowly rising sea level, especially coastal disaster's impact and improve the psychological perception of citizens.
Hypothesis: Coastal ecological corridor has good "resilience/flexibility" in adapting to environmental changes and responding to coastal issues.

METHOD
This research starting from understanding the current coastal environment situation, exploring why nature-based defense is effective in responding to sea level rise; secondly, integrate and collect innovative coastal ecological corridor applications as tool kits; thirdly, localize the applications of the model on real situations.

Phase 1: From risk to resilience
(Understanding the current coastal environment situation)
Keywords: Metamorphosis
Case study: Resist, delay, store, discharge (OMA 2014)

We are in a post-ecological era in which nature as a distinct archetype of humans no longer exists. An era is known as the Anthropocene, in which global warming is the most emblematic crisis. I became aware that, like many of us, the human being who inhabits the planet earth today is very different from the first human beings. What is important is that living in the current era means to inhabit and design differently because the condition in which we live is no longer generated by the forces of nature itself but by man's interaction with nature. In this context, Timothy Morton, in his book" Hyperobjects" tells us that we do not know how to relate within the Anthropocene with this crisis more critical which is precisely that of the climate change Nantes taking awareness of these two things and try to understand we live on a planet that is causing problems and this planet is over-designed(Morton 2017, 8-33). A moment, therefore, of personal and global responsibility, in which the action is necessary (Purdy, 2015). The German sociologist Ulrich Beck denominates the metamorphosis of the risk (Beck, 2015).

In her work "Toward the synthetic metamorphosis of the coast", Miriam García mentioned that there is a revolution from structure to the synthetic metamorphosis of landscapes where metamorphosis is about generating and implementing resiliency in the age of climate change. It is not only about contemplating the negative consequences brought by the new global economic and ecological conditions, to take advantage of the unexpected, but potentially positive and emancipatory consequences of the catastrophes.

Phase 2: From infrastructure to landscape (Integrate and collect innovative coastal ecological corridor applications as tool kits).
Keywords: Structural measures and natural-based measures
Case study: The Big U ("NYC: The BIG U | Rebuild By Design" 2021).
Natural-based: artificial reefs, constructed wetland, diversion infrastructures, rain garden, sunken garden, etc.
Structural measures: basic wall, bulkhead, dike ring, drainage inlets, groyne, levee, etc.

Though case studies and literature review, massive applications for water management and design, for example learning from tool kits, like "cool pills" in Miriam García's work. The landscape acquires its entire dimension since the landscape is a cultural construction representing the relationship of a man and a means and the construction. However, landscape design always starting from the small work. Modular allows this connection of the pieces and this adaptation. I will apply them to the coast as I have my pieces of generative design components that are structural measures and natural-based measures to this synthetic application.

Phase 3: From design to design thinking (Localize the applications of the model on real situations)
Keywords: localization.

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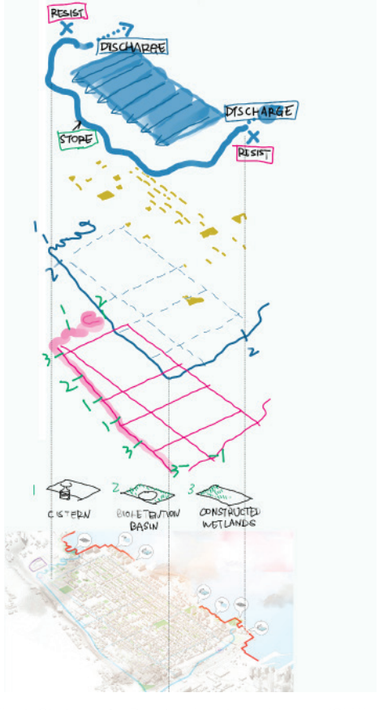

Scheme

Store

Discharge

Delay

Resist

Fig. 1. Strategies for Resist, delay, store, discharge (OMA).

Fig. 2 Co-design with community participation in project. The Big U.