A Multi-level Perspective on Transition to a Green Oriented, Low Carbon Based City Life: Experience from China

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Overview

Introduction

- Global warming, extreme rainfall events, and rising sea levels.

Takes actions and
work together!

Introduction

- Transitions to low carbon-economy and green infrastructure planning are underway to achieve sustainability goals, which set up since the Paris conference.
- Different countries have their own development goals and challenges.
- Yet, their efforts build a sustainable world.

SUSTAINABLE DEVELOPMENT GOALS

Introduction

- According to *Brown to Green: the G20 transition to a low-carbon economy*, the frequency and severity of floods is highest in China due to climate change.
- The Sponge City Programme (SCP) initiated in 2014, 16 pilot cities.
- Goals:

1. 2020, 20% covered urban built-up area;
2. 2030, 80% covered urban built-up area.

- Research question:
- **How the SCP facilitate urban planning transitioning towards green-oriented, low-carbon based city life?**

Grey infrastructure

- Traditional underground sewer and pipe system to divert stormwater.

Green infrastructure

1. Rain gardens and eco-roofs at household scales,
2. bio-retention and detention facilities at neighborhood scales,
3. increasing the urban tree canopy at regional scales (United States Environmental Protection Agency 2007).

Introduction

- The objective of the SCP was to introduce green infrastructure into original grey-dominated urban stormwater system, to prepare regional water systems for the increasing frequency and intensity of urban flooding.

Literature review

- The GI concept offers innovative solutions to deal with stormwater problems (Padoa-Schioppa et al.,2009; Hansen and Pauleit,2014).
- The US Environmental Protection Agency (EPA) offers technical guidance, design manuals and tools (see: https://www.epa.gov/green-infrastructure).
- The European Union (EU) project 'GREEN SURGE' (FP7-ENV.2013.6.2-5-603567), urban green infrastructure planning and implementation in 20 European cities.
- Shandas's (2015) study in the US, provides local residents' perceptions to green infrastructure, to present the role of citizens in contributing to climate-proofing neighborhoods.
- Li and Bergen (2018), five forerunner cities, top-down approach, required cognitive, normative, and regulative conditions prepared.

Theoretical Framework

- Gap: nature system----------social system

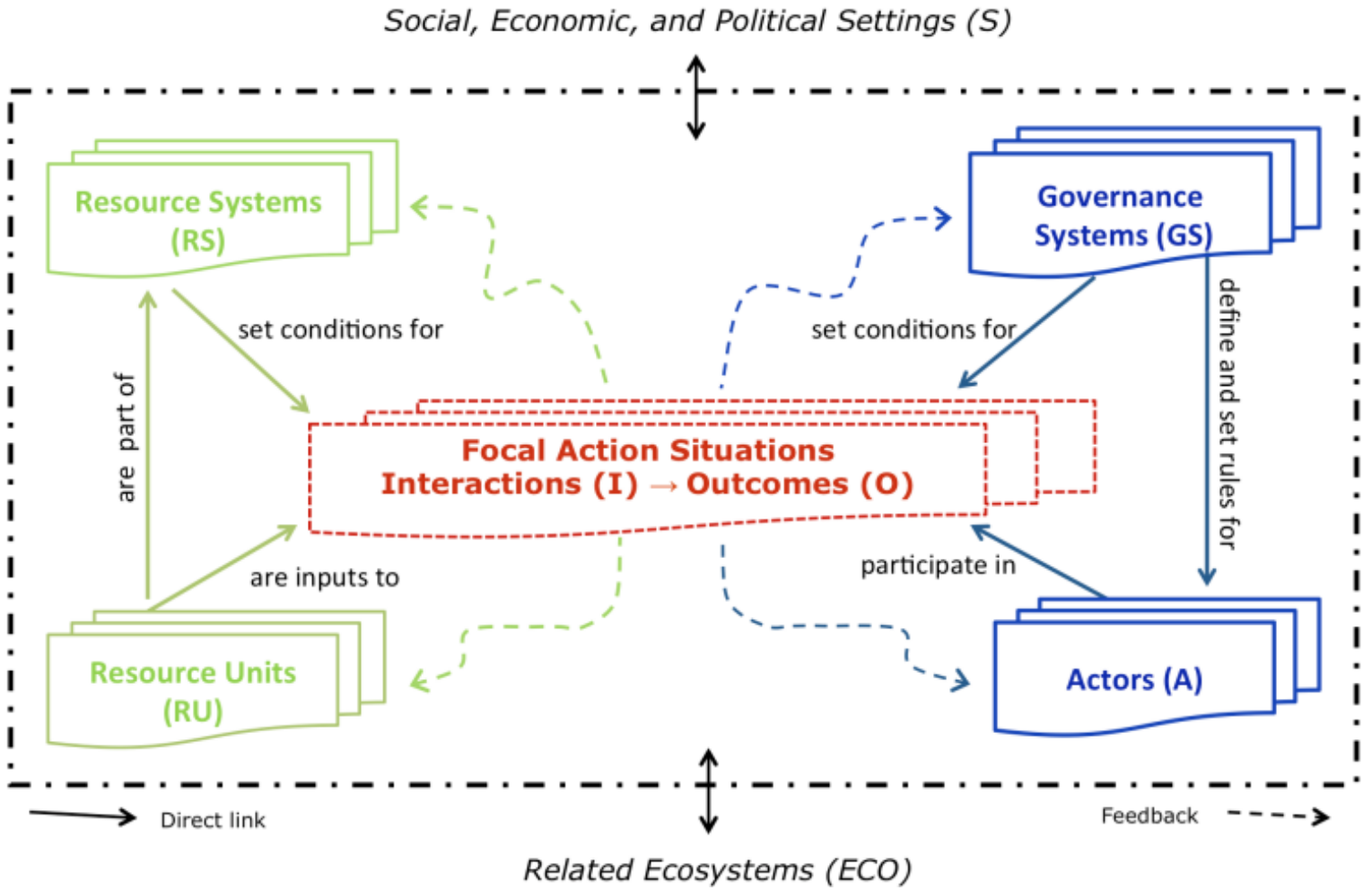


Table 1. Second-tier variables in framework for analyzing an SES

Social, Economic, and Political Settings (S)

S1- Economic development. S2- Demographic trends. S3- Political stability.
S4- Government settlement policies. S5- Market incentives. S6- Media organization.

Resource System (RS)

RS1- Sector (e.g., water, forests, pasture, fish)
RS2- Clarity of system boundaries
RS3- Size of resource system
RS4- Human-constructed facilities
RS5- Productivity of system
RS6- Equilibrium properties
RS7- Predictability of system dynamics
RS8- Storage characteristics
RS9- Location

Governance System (GS)

GS1- Government organizations
GS2- Non-government organizations
GS3- Network structure
GS4- Property-rights systems
GS5- Operational rules
GS6- Collective-choice rules
GS7- Constitutional rules
GS8- Monitoring & sanctioning processes

Resource Units (RU)

RU1- Resource unit mobility
RU2- Growth or replacement rate
RU3- Interaction among resource units
RU4- Economic value
RU5- Size
RU6- Distinctive markings
RU7- Spatial & temporal distribution

Users (U)

U1- Number of users
U2- Socioeconomic attributes of users
U3- History of use
U4- Location
U5- Leadership/entrepreneurship
U6- Norms/social capital
U7- Knowledge of SES/mental models
U8- Dependence on resource
U9- Technology used

Interactions (I) → Outcomes (O)

I1- Harvesting levels of diverse users
I2- Information sharing among users
I3- Deliberation processes
I4- Conflicts among users
I5- Investment activities
I6- Lobbying activities

O1- Social performance measures
(e.g., efficiency, equity, accountability)
O2- Ecological performance measures
(e.g., overharvested, resilience, diversity)
O3- Externalities to other SESs

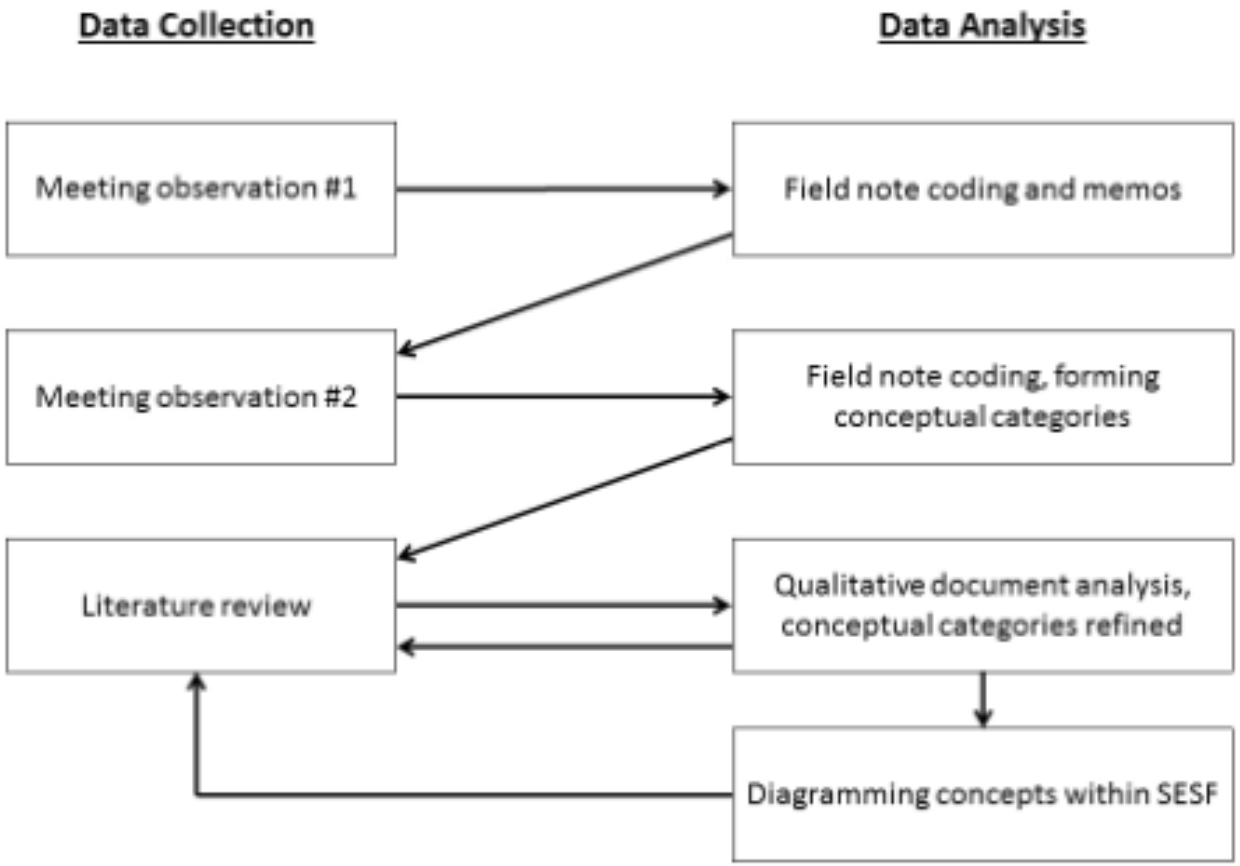
Related Ecosystems (ECO)

ECO1- Climate patterns. ECO2- Pollution patterns. ECO3- Flows into and out of focal SES.

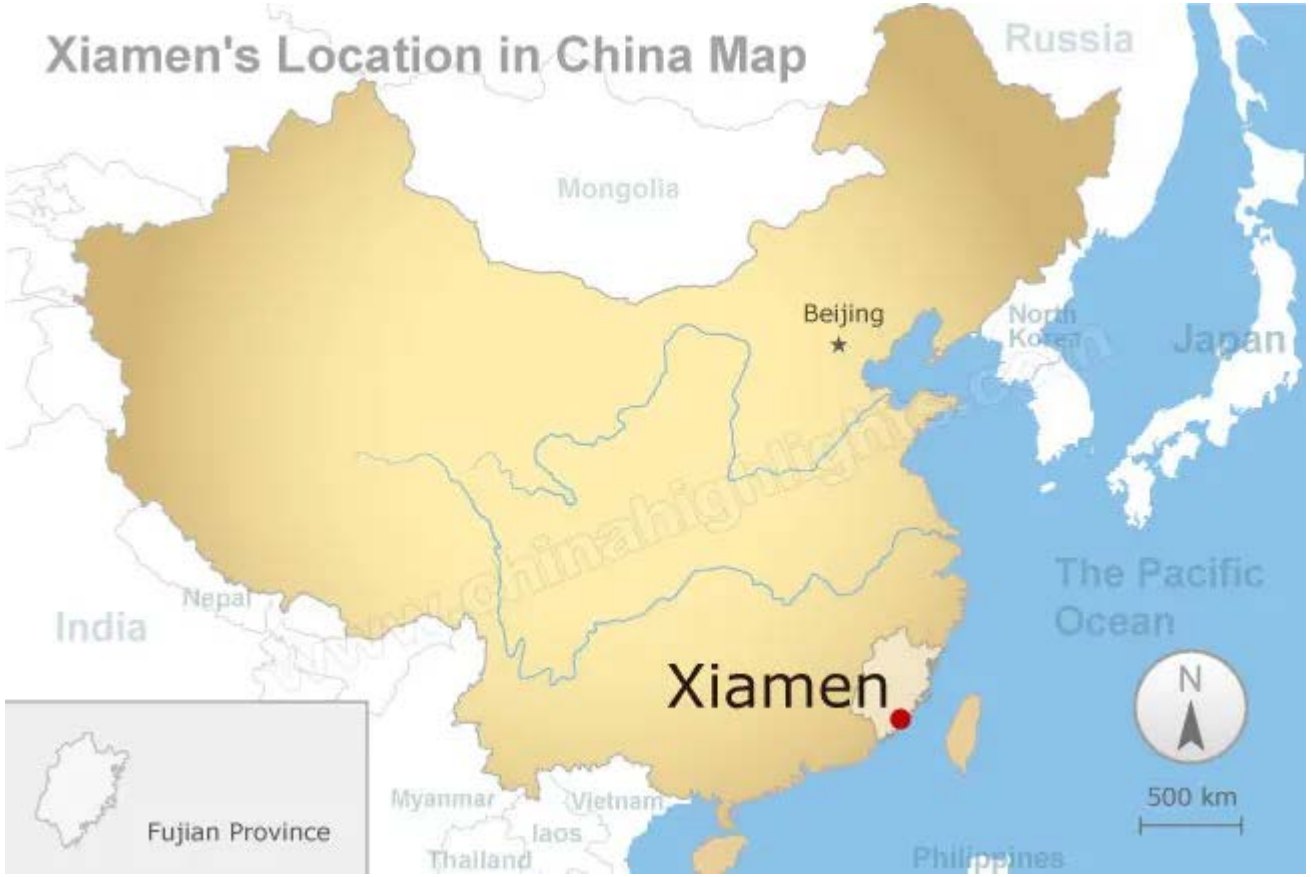
Methods

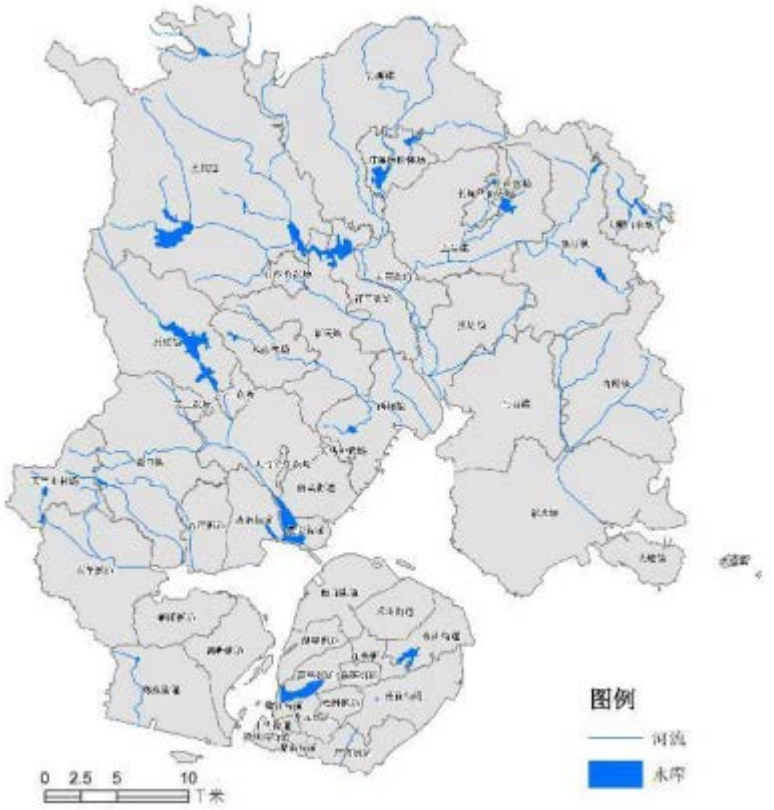
- Data were collected from open sources, including political speeches, public policies and regulations, published plans, documents, and articles, and the case city's official websites, through the four modules and relevant variables.

- Some interviews were conducted with people of diverse roles, such as government officials, policy makers, designers, academics, people from third parties and a project manager.

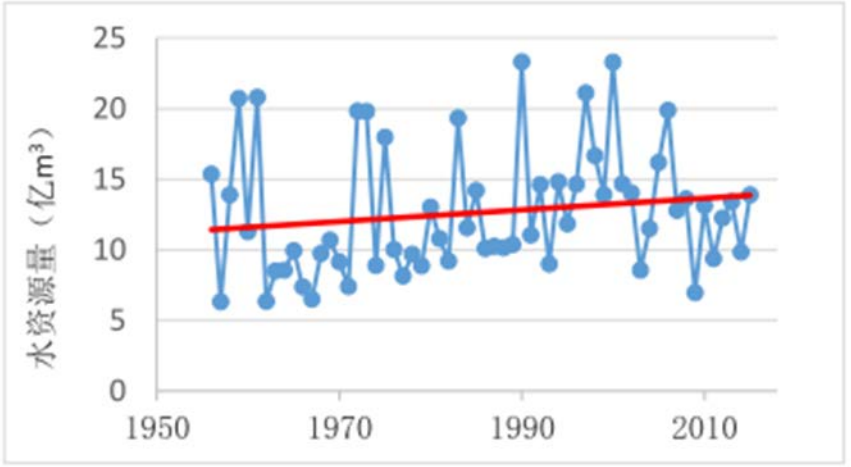

Data Collection
Data Analysis
Meeting observation #1
Field note coding and memos
Meeting observation #2
Field note coding, forming conceptual categories
Literature review
Qualitative document analysis, conceptual categories refined
Diagramming concepts within SESF

Xiamen


Xiamen's Location in China Map
Russia
Mongolia
Beijing
North Korea
Japan
The Pacific Ocean
India
Nepal
Xiamen
N
500 km
Fujian Province
Myanmar
Vietnam
Laos
Thailand
Philippines


图例
河流
水库
0 2.5 5 10
千米

Xiamen-RS



- Southeast China.
- Water resources: 1.23 billion m3, 290 m3 per capita, 14%.
- Water scarce city.
- 75% water resources come from outside.
- Vulnerable to typhoon, short-term heavy rainfall, city flooding, and water pollution problems.

Typhoon disaster

Mountain torrent

City flooding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Xiamen-RU

1. Haicang: area 20 km^2, water area 4.5 km^2, built-up area 9.1 km^2.
   - Goal: water pollution ,city flooding ,rain utilization.
2. Xiang’an: area 15.4 km^2.
   - Goal: water pollution

Xiamen-G system

- An office for SCP was organized, led by city manager, members include all related departments, including water resources, finance, forestry, environment, and district leaders.
- Division of work among departments.
- Documents: guidelines for SCP, rules for SCP.
- Process tracing: planning- construction- use and maintenance.
- Finance: 7.21 billion RMB; from central government, local governments, and social investments.

Xiamen-preliminary outcomes

- Before 2014, green land area 11172 ha, water area 6%, rainfall utilization 0.5%.
- In 2020, green land area 18648 ha, water area 7%, rainfall utilization 2%.
- Increase in green land, reduced carbon emission 6626.7 ton per year,;
- Increase in water area, reduced carbon emission 962.8 ton per year,
- Rain utilization, reduced carbon emission 2719.1 ton per year (Shao, Liu, et al, 2018).

First-tier variable	Second-tier variable	Contents
RS	RS1-location	Demand- supply
	RS2-weather	Rainfall, time, scale
	RS3-disaster	Time, scale
	RS4- water resources	Sources, water quality and quantity
RU	RU1-rain utilization	Pipe construction
	RU2-park renovation	Xiang’an, Haicang
	RU3-water pollution governance	River clean
GS	GS1-government	Management
	GS2-company	Construction
	GS3-local community	Old residence renovation
A	A1-population	Population, job occupation, gender
	A2-uses	Walk, reuse water, view
	A3-incentives	Awareness, perceptions
O	Environmental outcomes	Reduction in carbon emission; Increase in green infrastructure.
	Social outcomes	Local people’s engagement

Concluding remarks

1. The usability of the SES and certain variables to estimate the likelihood of success of SCP.

2. Taking a positive role engaging in Paris Agreement, Chinese government is contributing its unique experience to resolve global environmental issues.

3. Significantly, environmental issues and sustainable goals shall be accomplished based on a system perspective, including social and ecological both.

Future study

1. How do the SCP affects perceptions of local people?

2. What demographic factors contribute to the likelihood of residents engaging in sustaining the green stormwater infrastructure?

Thank you!