

**University of Lisbon**  
**Institute of Social Sciences**



UNIVERSIDADE  
DE LISBOA



***Transforming Urban Green Space Governance in China  
under Ecological Civilisation - An Institutional Analysis***

**Jieling Liu**

Supervised by:

Prof. Dr. Franz Gatzweiler, Institute of Urban Environment, Chinese Academy of Sciences

Prof. Dr. Olivia Bina, Institute of Social Sciences, University of Lisbon

This thesis is specifically developed for obtaining the doctoral degree in *Climate Change and Sustainable Development Policies*, specialty in *Geography and Planning*

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## Abstract

Facing expeditious urbanisation and climate change impacts, how has China governed urban green spaces? This thesis establishes urban green spaces as an essential part of urban social-ecological systems critical for overall stability, including climate resilience, health and wellbeing. This thesis turns to the *common-pool resource theory* to understand urban green space governance. The theoretical framework convenes that *non-excludable* but highly *subtractable* goods can be governed more sustainably in small scales and through collectively designed rules by actors that contain well-defined *property rights*, *monitoring*, and *sanctions* appropriate to respective *levels* and *scales*. The thesis selects three empirical cases and uses the Institutional Analysis Development framework to structure a case study-based qualitative content analysis and a Multi-Criteria Assessment informed by in-depth interviews and urban green space policies and plans.

This research finds that land property rights are critical factors for participation in urban green space governance, and urban green spaces in China are still governed primarily as land resources. Conceptualising urban green spaces as *common-pool resources* reveals that they should contain property rights different from urban land resources for more sustainable governance. Besides, China's urban green space governance has gradually formalised ecological functions, including the potential to cope with climate change, into institutional arrangements in the past two decades and is mostly in line with the common characteristics of successful *common-pool resource* governance regimes. China's urban green space governance can be improved by striking a better *equivalence between benefits and costs* for all actors and broaden the extent of *collective-choice arrangements*. Furthermore, Guangzhou's urban green space governance attunes with the national environmental governance framework *Ecological Civilisation* through conducting both the *means* and *ends* of institutional change. Finally, despite substantial progress under *Ecological Civilisation*, three main institutional barriers remained in Guangzhou's urban green space governance: the lack of legal foundations for regular ecological status assessments, low awareness of local state actors on climate change impacts and the ecological potential of urban green spaces, and the lack of long-term commitment for a more *ecosystem-based* approach to urban green space governance.

The findings indicate that urban green spaces as essential part of the complex urban social-ecological system should not be governed simply as land resources. To attach importance to

the ecosystem services and ecological values, it is necessary to define an exclusive and clear set of property rights for urban green spaces. The *common-pool resource theory* also tells us that institutional arrangements for long-term sustainable resource governance should enable individual and collective actors to participate in the *process* thoroughly and achieve the *end* goals, such as good health, wellbeing, and climate resilience. This research helps policymakers in Chinese cities understand why some urban green space governance in the past failed even with great technical planning expertise. Besides, it provides policymakers with practical suggestions on institutional arrangements helpful to promote urban green space governance and to achieve *Ecological Civilisation*. Finally, the researcher presents several recommendations for policymakers for better practices in the future and future research directions.

**Keywords**

Urban green spaces, climate adaptation, urban health and wellbeing, governance, institutional change, common-pool resource, property rights, transaction costs, sustainable urban development, *Ecological Civilisation*

**Resumo (em português)**

Enfrentado pela urbanização acelerada e pelos impactos das alterações climáticas, como a China governou os espaços verdes urbanos? Os espaços verdes urbanos são um ponto de entrada em que as ações e os resultados são importantes para a saúde e o bem-estar de todos os cidadãos urbanos e a resiliência climática independentemente dos contextos sociais, econômicos e políticos. A China tem uma enorme responsabilidade e potencial devido às escalas da sua economia, a população e a pegada de carbono total e tem visto uma forte determinação política para agir nos desafios climáticos e ambientais enquanto as constantes necessidades de urbanização e desenvolvimento econômico. Então, como é que as cidades chinesas abordaram o planeamento e a governança dos espaços verdes urbanos? Que facilitações ou desafios institucionais enfrentaram ao planear espaços verdes urbanos? Como é que os governos locais conseguiram melhorar os espaços verdes urbanos e implementar mais *Nature-based solutions*? Quais são as boas práticas a serem partilhadas? Além disso, por quê alguns desafios persistiram, apesar do sistema de governo centralizado e a forte determinação política? Esta tese propõe-se a estudar três casos sobre o planeamento e a governança dos espaços verdes urbanos em Guangzhou, uma cidade costeira altamente populosa, compacta e vulnerável no sudeste da China. Os objetivos eram compreender as dinâmicas institucionais, os facilitadores e as barreiras subjacentes que podem infetar o planeamento e a governança dos espaços verdes urbanos, examinar a extensão e as abordagens para melhorar os espaços verdes urbanos, analisar os custos e benefícios levados em consideração e, compreender as *barreiras institucionais* relacionadas ao valores intrínsecos, o que é essencial para desenhar soluções mais genuinamente baseadas na Natureza e do ecossistema.

Com base nos insights da revisão da literatura das teorias e práticas chinesas e ocidentais de planeamento urbano, e da governança urbana da perspectiva institucional, esta tese estabelece os espaços verdes urbanos como uma parte essencial dos *sistemas socioecológicos urbanos* (*urban social-ecological systems*, ou *urban SES*) essenciais para a estabilidade geral, incluindo a resiliência climática, a saúde e o bem-estar, e vira-se para a *teoria de recursos comuns* (*common-pool resource*), o qual foi desenvolvida pela cientista política norte-americana Elinor Ostrom, para compreender a governança dos espaços verdes urbanos. A estrutura teórica convoca que, os bens não excludentes, mas altamente subtraíveis, podem ser governados de forma mais sustentável em pequenas *escalas* e por meio de regras projetadas coletivamente

com os *direitos de propriedade* bem definidos, os mecanismos de *monitorização* e *sanção* apropriados aos respectivos *níveis* e *escalas*. Foi selecionado três casos empíricos de estudo e utilizado a ferramenta de *Institutional Analysis Development (IAD) framework* para estruturar uma análise de conteúdo qualitativo e uma Avaliação Multi-Critérios informadas pelas entrevistas em profundidade e políticas e planos de espaços verdes urbanos.

Esta pesquisa mostra que os direitos de propriedade de solo são fatores críticos para a participação na governança dos espaços verdes urbanos na China, e os espaços verdes urbanos ainda são governados principalmente como recursos de solo urbano. A conceituação dos espaços verdes urbanos como *recursos comuns (common-pool resources)* revela que eles devem conter direitos de propriedade diferentes do que os recursos de solo urbano. Além disso, a governança dos espaços verdes urbanos da China formalizou gradualmente as funções ecológicas, incluindo o potencial para lidar com as alterações climáticas nas últimas duas décadas e está principalmente em linha com as características dos regimes de governança de *bens comuns* bem-sucedidos. A governança dos espaços verdes urbanos da China pode ser melhorada, alcançando uma melhor equivalência entre benefícios e custos para todos os atores e ampliando as práticas de escolha coletiva. Além disso, a governança dos espaços verdes urbanos de Guangzhou está em sintonia com a estrutura de governança ambiental nacional de *Civilização Ecológica (Ecological Civilisation)* por meio da condução ambos dos *meios* e dos *fins da mudança institucional*.

Finalmente, apesar do progresso substancial sob a *Civilização Ecológica*, este estudo encontrou três *barreiras institucionais* principais remanescentes na governança dos espaços verdes urbanos em Guangzhou: a falta de fundamentos legais para avaliações regulares do estado ecológico, a baixa consciência dos atores locais do estado sobre os impactos das alterações climáticas e o potencial ecológico dos espaços verdes urbanos, e, a falta de compromisso de longo prazo na abordagem mais baseada no ecossistema. A falta de fundamentos legais para avaliações regulares do estado ecológico é uma *barreira institucional* que impede a coordenação institucional multinível. A baixa consciência dos atores locais do estado sobre os impactos das mudanças climáticas e o potencial ecológico dos espaços verdes urbanos é uma *rigidez institucional* que limita a interação horizontal dentro dos governos locais que requer soluções institucionais. A falta de compromisso de longo prazo para governar os espaços verdes urbanos com base no reconhecimento dos valores e potenciais ecológicos é uma outra

*rigidez institucional* que implica objetivos conflitantes, tensões e compensações nas dimensões políticas.

Os resultados indicam que os espaços verdes urbanos como uma parte essencial do *sistema socioecológico urbano* complexo, não devem ser governados simplesmente como recursos de solo urbano. Para atribuir mais importância aos serviços ecossistêmicos e aos valores ecológicos, é necessário definir um conjunto exclusivo e claro de direitos de propriedade para os espaços verdes urbanos. A *teoria de recursos comuns* também indica que os arranjos institucionais para a governança de recursos sustentáveis de longo prazo devem permitir que os atores individuais e coletivos participem do *processo (means)* e atinjam os objetivos  *finais (ends)*, como a saúde, o bem-estar, e a resiliência climática.

Esta pesquisa tem potencial em ajudar os formuladores de políticas nas cidades chinesas a entender por que alguns casos de governança dos espaços verdes urbanos falharam no passado, mesmo com grande perícia técnica no planejamento. Além disso, tem fornecido aos formuladores de políticas sugestões práticas para melhorar a governança dos espaços verdes urbanos e para se aproximar mais aos ideais da *Civilização Ecológica*. Finalmente, foi apresentado várias direções para pesquisas futuras.

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## Dedication

To Nir Aviram, Hagibor:

אני בר מזל שיש לי את האהבה המסורה והחברה שלך במשך שנים רבות. תודה. כל יום אני חושב עליך  
ומרגיש מעודד ממך. אתה הגיבור שלי.

并致自己:

勿忘初心，为社会和环境作贡献。

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## List of Acronyms and Abbreviations

- CCICED: International Cooperation on Environment and Development
- CPR: Common-Pool Resources
- COP: Conference of the Parties*
- DACCS: Direct Air Carbon Capture and Storage
- EA: Ecological Asset
- EbA: Ecosystem-based Adaptation
- ECV: Ecological Culture Services Value
- EGCA: European Green Capital Award
- EPV: Ecosystem Provision Value
- ERV: Ecological Regulation Services Value
- FYP: Five-Year Plan (China's national social and economic development plan)
- GDP: Gross Domestic Product
- GEP: Gross Ecosystem Product
- GD-HK-MO GBA: Guangdong-Hong Kong-Macau Greater Bay Area
- GHG: Green House Gases
- GNH: Gross National Happiness
- GPCDCP: Guangdong Provincial Centre for Disease Control and Prevention
- HDI: Human Development Index
- HiAP: Health in All Policies
- HWP: Haizhu Wetland Park
- IAD: Institutional Analysis and Development
- IASS: Potsdam Institute of Advanced Sustainability Studies
- IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
- IUCN: The International Union for Conservation of Nature
- LTPR: Land Tenure and Property Rights
- MCA: Multi-Criteria Assessment
- MCE: Multi-Criteria Evaluation
- MEA: Millennium Ecosystem Assessment*
- MEP: Ministry of Environmental Protection
- MOHURD: Ministry of Housing and Urban-Rural Development
- MSL: Mean Sea Level

NbS: Nature-based Solution

NDCs: Nationally Determined Contributions

NDRC: National Development and Reform Commission

NIE: New Institutional Economics

NUA: New Urban Agenda

PEC: Panyu Ecological Corridor

PRD: Pearl River Delta

QDA: Qualitative Data Analysis

SDGs: Sustainable Development Goals

SDG 3: Health and Wellbeing

SDG 11: Sustainable Cities and Communities

SDG 13: Climate Action

*SEA: Strategic Environmental Assessment*

SEEA: UN System of Environmental-Economic Accounting

SEPA: State Environmental Protection Agency

TEEB: Economics of Ecosystems and Biodiversity initiative

TSCD: Tianhe Sponge City Demonstration Site

UCLG: United Cities and Local Governments

UGS: Urban Green Spaces

ULT: Urban Land Teleconnections

UNFCCC: United Nations Framework Convention on Climate Change

WAVES: World Bank Wealth Accounting and the Valuation of Ecosystem Services

WHO: World Health Organisation

WWF: World Wildlife Fund

## CHAPTER I

### INTRODUCTION

#### **1.1 Urbanisation Trend, Environmental Degradation, and Climate Change Impacts in China**

The global urban population has grown rapidly since 1950, having raised from 30% to 55% in 2018 (UN DESA, 2018). In China, the urbanisation rate was even more extraordinary. It grew rapidly from 17.9% in 1978 to 53.7% in 2014; during this period, 560 million population have moved into cities and 465 new cities have been built (State Council of China, 2014c). The country is projected to reach 70% urbanisation rate with over one billion population living in cities by 2030 (Pan, 2016). The rapid urbanisation in China is considered to be one of the biggest human settlement challenges in human history, accompanied by profound social, economic, and environmental transformations (Bai et al., 2014; Bina, 2008). Environmentally, urban land-use and landscape patterns have changed as a result of rapid urban development and increase in total population (Dorning et al., 2015; Wu, 2010). In many emerging urban areas in China, the growth of land employed for urban development is much faster than that of population. Researchers (Bai et al., 2014) found the area of developed land in China grew by 78.5% between 2003 and 2013, while urban population grew only 46% during the same period. Another research reveals approximately 27% of total agricultural land, forests, and grasslands in China being converted to urban areas between 1979 and 2010 (Ren et al., 2013). The remarkable transformation of green spaces to built-up areas has even gained a reference as “landscape urbanisation,” in contrast to “demographic urbanisation” (Bai et al., 2012). Future land-use forecasts suggest even more dramatic increases in natural-to-urban land conversion, in other words, land in cities will be increasingly scarce, and more nature areas will be acquired by cities as they continue to grow. Researchers have forecasted a 110%~185% of increase in global urban land cover by 2030, with Asia accounting for nearly half of this increase (Angel et al., 2011; Seto et al., 2012).

Unplanned and rapid urbanisation, demographic change, and drastic climatic changes are among the primary drivers of disaster risks (UNDRR, 2015). In China, rapid increases in total population and urbanisation globally in recent decades not only have induced significant

changes in land-use and landscape patterns, but also have resulted in a series of ecological and environmental problems (Gong et al., 2018; Li et al., 2013). Today in China, research shows nearly half of the total urban environment in all city regions, including surface water, air and soil quality, has degraded and moderately degraded (He et al., 2017).

In addition, changes in climate in recent decades have caused negative impacts on natural and human systems globally, across all continents and oceans, including those of China (IPCC, 2014). These impacts include the increase of average surface temperatures and the possibility of extreme events or hazards, the increase in the numbers of most intense tropical cyclones, inland and coastal flooding, landslides, drought, increased aridity, water scarcity, air pollution, the continuously rising sea levels, storm surges, and fatal heatwaves (Elsner et al., 2008; IPCC, 2013; 2014; Walsh et al., 2014). Many of these climate change impacts are concentrated in urban areas, demonstrating further consequences on human health and wellbeing, livelihoods and assets (IPCC, 2014). Heatwaves, for example, impose both physical and mental danger, such as heatstroke, depression and anxiety (Berry et al., 2010; Haines and Patz, 2004), influencing especially the physically vulnerable and economically underprivileged population. In China, heatwaves have significantly increased mortality risk across regions of high heterogeneity, primarily in urban or densely populated communities (Ma et al., 2015). Research show an evident increase in heatwaves and high temperature days in Guangdong province in the last five decades, in which Guangzhou city is the capital (Du, 2011). Projecting into the future, premature mortality by climate change-attributed air pollution is expected to increase greatly, particularly in the areas of India and East Asia (Silva et al., 2017). Another negative climate change impact for health is air pollution, primarily induced by transport, energy and industrial production systems that rely on fossil fuels and occasionally aggravated by wildfires nearby urban settlements that release particulate matter and other toxic substances (Finlay et al., 2012), for instance, the air quality in much part of California in the summers of 2018 and 2020 during the wildfire season. In 2017, the *Lancet Commission on Pollution and Health* declares air pollution as “the largest environmental cause of disease and death in the world today.” According to this report, air pollution was responsible for an estimated 9 million premature deaths globally (16% of all deaths) in 2015 alone (Landrigan et al., 2018). In China, many provinces have an increasing trend of overall mortality attributable to air pollution in the last three decades. Despite ambitious policies and effort in recent years trying to reduce air pollution from all industries, PM<sub>2.5</sub> concentrations throughout the country still exceed the

WHO Air Quality Guideline<sup>1</sup> for the entire population (Yin et al., 2020). In Guangzhou, a fast-paced Southeast megacity with 15 million urban population<sup>2</sup>, ambient O<sub>3</sub> and NO<sub>2</sub> were found to be the main drivers for increased mortality rate (Wu et al., 2019). A study in 30 Chinese provinces shows that air pollution in 2007 affected 72 million labor forces and caused 346 billion Yuan losses, which equals approximately 1.1% of the national GDP (Xia et al., 2016). Similarly in Europe, pollution from heavy goods vehicles alone in the European Environment Agency member countries costs 43-46 billion euros in health annually (EEA Release, 2013). The physically and financially costly impacts of air pollution makes it a pressing issue for many urban governments.

Furthermore, climate change impacts affect urban population and infrastructure with rising sea levels and tropical cyclones of increasing frequency and intensity (Elsner et al., 2008; Walsh et al., 2014). Floods and windstorms can adversely affect health through drowning, injuries, hypothermia, and infectious diseases, especially dengue fever (Schnitzler et al., 2007; Jakubicka et al., 2010). For example, Guangzhou, the megacity located on the low-laying estuary of the Pearl River Delta in Southeast China, is ranked globally as the 4th city most at risk regarding population exposed to flooding and storm surge (Hallegatte et al., 2013a; Hanson et al., 2011; IPCC, 2014). In addition to physical health, the increased intensities of the strongest tropical cyclones and the rising sea levels globally continue impacting the social, economic, and environmental determinants of mental health, potentially leading to fear and stress over exposure to high disaster risks and post-disaster traumas, or even the exact opposite - denial, paralysis, and apathy (Berry et al., 2010; Fritze et al., 2008; Swim et al., 2017). The risks also extend to the urban ecosystems. The observed urbanisation process accompanied by massive socio-economic changes under climate change, as described above, are also changing surface temperature and precipitation patterns, soil moisture levels, vegetation growth rates, water and aquifer levels, and air quality, thereby increasing the ecological vulnerability of cities (Kuttler, 2008; Rees and Wackernagel, 2008; Revi et al., 2014).

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<sup>1</sup> WHO guidelines for indoor air quality: selected pollutants. Available at: <https://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/2010/who-guidelines-for-indoor-air-quality-selected-pollutants>

<sup>2</sup> Bureau of Statistics of Guangzhou: Population size and distribution of Guangzhou in 2019 (in Chinese: 2019年广州市人口规模及分布情况). Available at: [http://tjj.gz.gov.cn/gkmlpt/content/5/5727/post\\_5727607.html#226](http://tjj.gz.gov.cn/gkmlpt/content/5/5727/post_5727607.html#226)

With the ongoing dynamics of change, coastal cities and financially mal-prepared city-regions are especially vulnerable (Malik et al., 2012). A global ranking of 10 megacities<sup>3</sup> with regard to property and infrastructure assets exposed to sea level rise and coastal flood risks showed eight megacities from Asia: Guangzhou, Kolkata, Shanghai, Mumbai, Tianjin, Tokyo, Hong Kong, and Bangkok; notably, Guangzhou was the most vulnerable (Hallegatte et al., 2013a; Nicholls et al., 2007). Cities broadly suffer from disaster-related life and economic loss due to climate change impacts; however, cities in developing countries often are particularly at risk due to their substantially higher concentration of population and much more dynamic socio-economic development profiles (Kraas, 2008). Towards this end, high level experts in climate change and urban health have urged for urgent, cross-sectoral, multi-level collaborative policies and actions (Liu et al., 2019).

### **1.2 Urban Green Infrastructure as Nature-based Solution and Common-Pool Resource**

On the one hand, cities in the future will increasingly have to grapple with these multidimensional, uncertain and costly impacts of climate change and environmental degradation (Bai et al., 2018; Dahiya, 2012; Gatzweiler et al., 2016). On the other, climate actions led by and in cities are also essential to successful global climate adaptation and environmental restoration, as cities are interconnected, complex adaptive systems that can lead actions via effective governance (Revi et al., 2014). In addition, urban governments are also uniquely situated to understand local contexts, raise awareness and respond to civil society's pressures with non-state actors (Brunner et al., 2005; Cash and Moser, 2000). The advantageous position of cities and the challenges they are facing put urban governments at the centre of successful urban actions, investments, policies, and legal frameworks (Revi et al., 2014).

One of the emerging climate adaptation strategies many cities began to adopt is Nature-based Solutions (NbS), sometimes also referred to as Ecosystem-based Adaptations (EbA) when it is more specifically referred to in the climate change adaptation context (Gill et al., 2007; Kabisch et al., 2016). NbS and EbA rely similarly on the installation of Urban Green Infrastructure

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<sup>3</sup> ≥10 million population, as defined by the United Nations. Available at: ["World Urbanisation Prospects, The 2018 Revision."](#) UN DESA.

(UGI), including Urban Green Spaces (UGS),<sup>4</sup> community parks, street trees, green roofs, green belts, green walls, beehives, urban food garden, ecological corridors, and the ecosystem services they perform, to mitigate the negative impacts of climate change and to deliver positive health benefits (European Environment Agency, 2017; Smith and Balakrishnan, 2009; World Health Organisation, 2017). UGI demonstrate great potential in improving the quality of urban environment, by moderating high temperatures through shading, purifying air, absorbing noise, filtering and storing rainwater, hence can serve as an ideal NbS (Pramova et al., 2012). UGI can therefore enhance the resilience of a city facing climate impacts, promote sustainable lifestyles and improve urban health and wellbeing (World Health Organisation, 2017).

Backed by increasing literature on the benefits of UGI, inter-governmental organisations are actively advocating urban governments to adopt UGI, more so in particular, UGS, as an NbS on the ground. For instance, UN-Habitat urges local governments to “*apply urban and territorial planning to identify, revitalise, protect and produce high-quality public and green spaces with special ecological or heritage value... and to avoid the creation of heat islands, protect the local biodiversity and support the creation of multifunctional UGS, such as wetlands for rainwater retention and absorption*” (UN-Habitat 2015: 22). Influenced by the advocacy by inter-governmental organisations, some level of awareness of the need for NbS measures is growing among urban governments (Revi et al., 2014). For example, Portland of Oregon, Philadelphia of Pennsylvania, and Malmö of Sweden have utilised green roofs, ditches, porous pavements, retention ponds, green space, and downspouts disconnection to reduce stormwater and increase climate resilience, as these methods were at much more cost-effective than increasing stormwater storage capacity (Foster et al., 2011; UNFCCC, 2015). Many cities in China also have begun to increase UGS under a national scheme ‘Sponge City’ since 2015 under the promotion of its national environmental governance framework *Ecological Civilisation*.

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<sup>4</sup> As a component of ‘green infrastructure’, urban green space (UGS) is defined by the WHO as “all urban land covered by vegetation of any kind. This covers vegetation on private and public grounds, irrespective of size and function, and can also include small water bodies such as ponds, lakes or streams (‘blue spaces’).” WHO Europe. 2017. *Urban Green Spaces: A Brief for Action*. P2.

From an economic perspective, UGS such as ecological corridors, parks, and wetlands are *de-facto* a type of *common-pool resource (CPR)* for their low *excludability* and high *subtractability* (Colding et al., 2013; Ondrejicka et al., 2017; Ostrom, 2005). UGS is a property highly subtractable due to the dependence on land availability within an urban territory, which is increasingly scarce in many urban areas. On the other hand, it is challenging to exclude users or residents from enjoying the benefits of UGS, both on the grounds of equity and biological processes. From an equity perspective, health is a fundamental human right as the WHO constitution recognises it.<sup>5</sup> The biological processes determine that all urban residents are dependent on the ecosystem services provided by UGS for essential health and wellbeing. However, at the moment, most academic research on UGS and NbS departs from the perspectives of *urban planning* and *urban ecology*. Insights from urban planning may have the potential to improve UGS accessibility, thereby achieving greater equity, while research from the urban ecology perspective could provide valuable information for urban planning on ecosystem services and ecological values. Nevertheless, both perspectives focus on the technical dimension of NbS implementation, which is unable to resolve problems related to a range of transaction costs incurred during the process of NbS implementation, such as costs of planning, negotiation, information acquisition, and time. The New Institutional Economics (NIE) is an interdisciplinary scientific branch that focuses on understanding the complexity of social, political and commercial life and the changes over a long period through a combination of economics, law, organisation theory, political science, sociology, and anthropology (Coase, 1998; Klein, 1998; Tadelis and Williamson, 2012). The evident research gap for institutional insights of NbS could potentially be filled through the NIE perspective (Colding et al., 2020).

### **1.3 The Challenges for Adopting Nature-based Solutions in China**

Despite increasing literature showing the evidence of NbS in climate adaptation and urban health improvement and advocacies of inter-governmental organisations, implementing a functional NbS sustainable for the long term is not necessarily easier in comparison to the so-called “hard engineering” solutions (Roberts et al., 2012). In addition to the need to reach technical maturity - data collection, expertise, and resource allocation, more complex

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<sup>5</sup> World Health Organisation. 2017. Human rights and health. Available at: <https://www.who.int/news-room/fact-sheets/detail/human-rights-and-health>

challenges such as urban land scarcity and institutional lock-ins remain obstacles for many urban governments.

In China, planning for new UGS or even conserving current UGS are often hindered by urban land scarcity (Accenture and Chinese Academy of Sciences, 2013). Implementing UGS, particularly in dense urban areas in China, like in many other countries, subsequently has led to a gentrification problem in which land prices and rent in the neighbour areas increased (Birge-Liberman ,2017; Song and Wu, 2010). Currently, many countries or regions govern UGS in combinations of public good (100% accessibility), club good (such as enclosed apartment complexes), and private good (such as a private beach). However, treating UGS as public good overlooks the possibility that the availability of UGS could change following the changes in urban land scarcity. Similarly, treating UGS as a club or private good decreases the equity for which UGS can benefit the health and wellbeing of all residents. More importantly, governing UGS as a public, club, or private good cannot most adequately reflect the value of its ecosystem services. In China, UGS as a category of urban development land is treated as a public good. The primary purpose of UGS is to serve urban development through planning and governance. During the last 30 years, China's urban land resources have been strategically allocated to primarily develop real estate, transport, and commercial infrastructures, which resulted in the country's rapid urbanisation and economic growth. The current institutional arrangements are not the most conducive to allowing the urban governments to plan more UGS as an NbS for climate adaptation and urban health improvement.

Enabling conditions and institutional frameworks for implementing NbS not only need to ensure direct benefits and co-benefits for all residents for greater equity, but also need to reframe the balance between urban population growth, health and wellbeing, land-driven economic development, and climate resilience (Revi et al., 2014). Such enabling conditions and institutional frameworks entail good urban government, or institutional structures, and principles of good governance. Good governance, argued by many scholars, necessitates institutional values, interests, awareness, analytical and decision-making capacities well fitting into a collaborative working process with other institutions and actors (Birkmann et al., 2010; Bulkeley, 2013; Garschagen, 2013; Moser and Luers, 2007). Moreover, to install an ecologically functional and well-managed, diverse network of UGS, it requires an appropriate understanding of how urban systems and their sub-systems function to provide goods and

services residents need and desire (Revi et al., 2014). After 30 years of rapid growth, China is currently confronted between prioritising economic development and developing an environmentally more friendly and more *people-centred* urbanisation paradigm (Bina, 2011; UNDP, 2020). The central government has launched each time more ambitious institutional reforms and schemes in the last decade, intending to treat environmental pollution, address climate change impacts and transition to a more *people-centred* economy (led by a new national development agenda *Ecological Civilisation*). However, whether these institutional reforms and schemes can eventually overcome the path-dependency or inertia of the economy-centred development strategies practised by Chinese local governments for the last 30 years and achieve real breakthrough in the challenges mentioned above, is a fascinating question for scholars across scientific domains and currently has no definite answers (Garnaut et al., 2018; Yang et al., 2016). In fact, the path-dependency problem of the current economic model is global, and it is diluting the possibility to achieve critical climate and sustainable development goals.<sup>6</sup> The need for speeding up actions and fundamental shifts is urgent.

### 1.4 Research Questions, Aims, and Objectives

Cities stand at the critical forefront of climate challenges as they account for a majority of anthropogenic impacts on Earth and potential solutions and China has a tremendous responsibility to take bold climate actions to protect its residents and secure its urban infrastructure by virtue of its population size and economic trajectory (Bina, 2011; Elmqvist et al., 2013; Frantzeskaki et al., 2016). This thesis examines China's governance of UGS for effective NbS through an institutional analysis with a meta-question "**Facing expeditious urbanisation and climate change impacts, how has China governed urban green spaces?**" as entry. The analysis will assess 1) **the interaction** between the Chinese local governments and other stakeholders based on the given rules (mandates, policies) for the planning and management of UGS, as well as 2) **the outcome of the interaction**, including a) the quality of UGS or the effectiveness of NbS and b) the resultant institutional changes / alternated institutional arrangements.

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<sup>6</sup> UN News. 16 July 2020. World off track in meeting 2030 Agenda, UN deputy chief warns, calls for solidarity in COVID-19 recovery. Available at: <https://news.un.org/en/story/2020/07/1068551>

**Four main research questions and sub-questions are thus proposed (see Table 1):**

<p><b>Q1. What institutional facilitations or challenges have Chinese urban governments received or confronted when planning and managing UGS?</b></p>	<p>Q1.1 What are the formal policy facilitations and challenges that Chinese urban governments have received or confronted when planning and managing UGS?</p> <p>Q1.2 What are the informal normative facilitations and challenges that Chinese urban governments have received or confronted when planning and managing UGS?</p>
<p><b>Q2. How have local governments managed to upscale UGS towards more effective NbS?</b></p>	<p>Q2.1 What has been the approach of the Guangzhou local governments for planning new UGS and managing them?</p> <p>Q2.2 Has the UGS in Guangzhou been effective as an NbS and enhanced local climate resilience and urban health and wellbeing?</p>
<p><b>Q3. What are the good practices to be shared?</b></p>	<p>Q3.1 What are the good practices in land-use from the three case studies?</p> <p>Q3.2 What are the good practices in UGS planning from these case studies?</p> <p>Q3.3 What are the good practices in urban governance in general from these three case studies?</p>
<p><b>Q4. Why some challenges persisted despite centralised government system and strong political determination?</b></p>	<p>Q4.1 How do the strong political determination and centralised government system manifest themselves?</p> <p>Q4.2 What are the remaining challenges to be resolved?</p> <p>Q4.3 Why is it challenging to resolve these remaining challenges?</p>

Table 1: Main research questions and sub-questions

**This thesis aims to**

- understand the institutional dynamics, facilitators, and underlying barriers Chinese local governments have faced in UGS governance,
- examine to which extent local governments have been able to advance and govern UGS and with what approaches, then,
- analyse the costs and benefits that Chinese local governments have taken into consideration for planning and managing UGS, and finally,
- identify intrinsic-value-related factors that have limited Chinese local governments to pursue long-term, sustainable UGS governance for greater climate resilience, health, and wellbeing.

**The main objectives of this thesis are to**

- fulfil the research gap that focuses on the institutional dimensions of NbS governance, particularly in Chinese cities,
- share successful practical experiences in the Chinese approach to UGS governance,
- provide Chinese local governments with insights from the common-pool resource (CPR) theory, thereby improving UGS governance, and finally,
- verify whether the current Chinese system reform is overcoming the path-dependence of the economy-centred development strategy and achieving *Ecological Civilisation*, the country’s new development paradigm and environmental governance framework.

The interdisciplinary, qualitative approach this thesis has taken to examine the institutions and actors in UGI governance in China is righteously backed by senior scholars in the domains of urban governance, risk reduction, climate change action and sustainability (Bai et al., 2018; Elmqvist et al., 2013; Lawrence and Gatzweiler, 2017; Ostrom, 2005; Renn, 2008; Romero-Lankao et al., 2017). The interdisciplinary NIE perspective is appropriate for unveiling the complex interactions of the stakeholders of UGS and the outcome across environmental, social and political spheres, as well as the changes over time in the Chinese political and urbanisation context. This thesis thus employs the NIE perspective and encompasses the disciplines of political sciences, organisation theory, sociology, and economics for institutional analysis on the governance of UGS for effective NbS in China. Insights of UGS from the perspectives of urban planning and urban ecology are used as the research foundation for this thesis. Science of climate change and insights of its impacts on urban health and wellbeing serve as background of this research.

<b>Background</b>	<b>Research question</b>	<b>Aims</b>	<b>Objectives</b>
<ul style="list-style-type: none"> <li>• Climate change impacts and environmental degradation prompting the need for NbS</li> <li>• Path-dependency of economy-centred development strategies of three decades</li> <li>• Top-down governance tradition</li> <li>• Conventional role of UGS (defined to serve urban development)</li> </ul>	<p><b>Q1. What institutional facilitations or challenges have Chinese urban governments received or confronted when planning and managing UGS?</b></p>	<p>A1. Understand institutional dynamics, facilitators, and underlying barriers</p>	<p>O1. Fulfil research gap of institutional insights of UGS within Chinese context</p>

## Urban Green Space Governance in China - Institutional Analysis

<ul style="list-style-type: none"> <li>• Unclear land tenure and increasing urban land scarcity</li> <li>• Strong political determination by central government</li> </ul>	<b>Q2. How have local governments managed to upscale UGS towards more effective NbS?</b>	A2. Examine the extent and approaches for UGS upscaling	O2. Share successful experiences
<ul style="list-style-type: none"> <li>• New insights needed to promote bolder NbS through planning and managing UGS</li> </ul>	<b>Q3. What are the good practices to be shared?</b>	A3. Analyse the costs and benefits taken into consideration	O3. Provide new insights from institutional analysis for local governments
<ul style="list-style-type: none"> <li>• Urgent need to shift fundamentally and speed up actions</li> </ul>	<b>Q4. Why some challenges persisted despite centralised government system and strong political determination?</b>	A4. Understand intrinsic-value-related factors of institutional barriers	O4. Verify the potential of institutional reforms for achieving <i>Ecological Civilisation</i>

Table 2: Overview of research questions, aims and objectives

This PhD research has two main innovative aspects. The first one is the institutional focus on UGS planning and management. Existing literature on UGS as a means of NbS for climate resilience and health primarily depart from the perspectives of urban planning and landscape ecology. The institutional lens to view and analyse UGS planning and management is an emerging trend. The second innovative aspect is the conceptual framing and research of UGS as a CPR. Despite being a country/region with probably the most abundant CPRs in the world, research on CPRs in China, a unique socio-economic and political context in the field of governance, remains rare, particularly in the urban context (Wang and Rosenau, 2009; Wang, 2017).

### 1.5 Research Design and Methodology

This thesis examines China’s governance of UGS for effective NbS through an institutional analysis using the Institutional Analysis and Development Framework (IAD Framework) as an analytical framework. The IAD framework was developed by American political scientist and Nobel laureate Elinor Ostrom and her colleagues in the 1980s at the Workshop in Political Theory and Policy Analysis at Indiana University<sup>7</sup>. It is intentionally created to “map” out institutions and help people understand how institutions affect the incentives confronting individuals and their resultant behavior (Ostrom, 1986 & 2005; Kiser and Ostrom, 2000). This framework (see Figure 7: The Institutional Analysis and Development framework contains a general set of variables that can be used to examine diverse institutional settings in which

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<sup>7</sup> Where the PhD Candidate has received a one-year Visiting Scholarship and visited between 2019 and 2020.

humans interact, e.g., markets, private enterprises, families, community organisations, legislatures, and government agencies (Ostrom, 2005). The IAD Framework has been applied by researchers throughout the world to understand the effect of rules on the outcomes of common-pool resource settings. It is compatible with multiple theories in institutional economics, including the transaction cost theory and the common-pool resource theory (Ostrom, 2010). Greater explanation on how this thesis analyses 1) **the interaction** between the Chinese local governments and other stakeholders for the planning and management of UGS, and 2) **the outcome of the interaction** through the IAD framework can be found in Chapter IV: Research Design and Methodology.

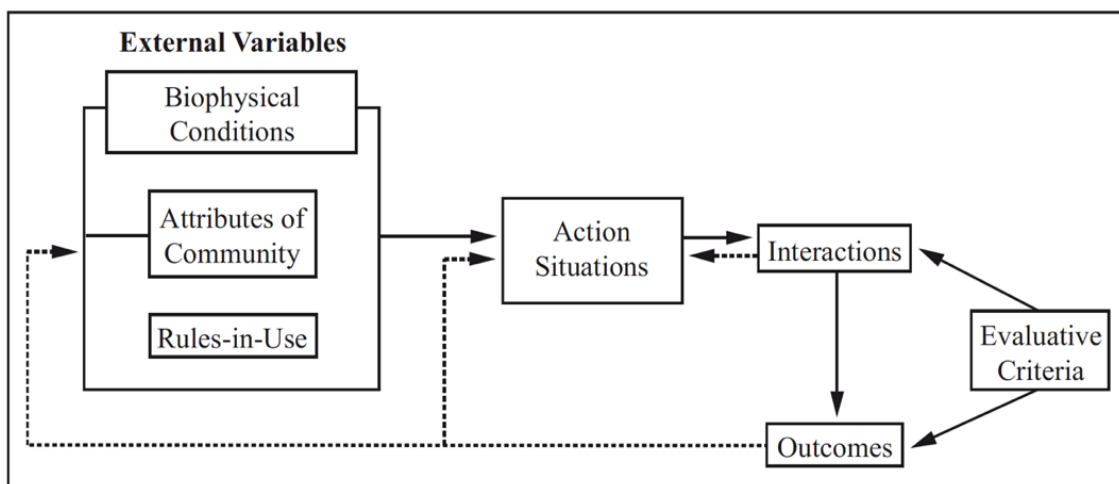


Figure 1: Institutional Analysis and Development framework.

Source: Adapted from Ostrom, 2005: 15

This thesis contains interdisciplinary, qualitative research of three UGS governance case studies through semi-structured, in-depth interviews, archive research, and observation. This research chose three UGS cases to make sense of the changes in UGS governance and the effectiveness of NbS. The three UGS governance case studies were chosen from Guangzhou, a fast-paced megacity with 15 million urban population located on the low-laying estuary of the Pearl River Delta in Southeast China facing multiple climate change impacts, as mentioned above. Facing the current rate of environmental deterioration and climate change impacts, how the city of Guangzhou plans and manages UGS as an NbS could provide valuable lesson not only for itself but also many other coastal cities with dense population. The case studies were

chosen within the same city to analyse observed changes in UGS governance over two decades following the changes of policy mandates within the same government system operated by the same urban government. The researcher interviewed 50 in total key informants, including academic researchers, urban planners, local government officials, economists, urban consultants, NGOs, and citizens. The interviews were complemented with archive research and review – policy documents, spatial plans, and media reports effective between 2000–2018. The three UGS governance cases in Guangzhou are:

1. **The Panyu Ecological Corridor (PEC)** case, which presents a conflict of interest between municipal and district governments. In this case, the municipal government of Guangzhou (GZ) aimed to promote a city-wide ecological corridor system; however, the district government of Panyu (PY) had an interest in economic development which would employ the land nearby or even within the PEC system.
2. **The Haizhu Wetland Park (HWP)** case, which represents a conflict of interest between GZ, farmers (land and homeowners), and urban migrants (tenants). The land property transfers only benefited the farmers but not the urban migrants because of the dual urban-rural household registration system, leaving urban migrants' quality of life unattended.
3. **The Sponge City Demonstration Site (TSCD)** case, which represents a conflict of interest between different branches within the municipal government, e.g., between the Bureau of Water Affairs and the Administration of Forestry and Gardening. In addition, for the equipment and service suppliers in the private sector with established connections to the conventional engineering solutions through public infrastructure construction projects, their vested interests are challenged by the Sponge City Initiative as it is a nature-based rather than engineering-based solution.

These three cases occurred across the span of the last twenty years, each representing different institutional settings, namely, different combination of preferences in urban development, property rights bundles, and governance arrangements. These differences will be analysed from an institutional economics perspective, namely, how transaction costs influence actor interactions and resultant institutional arrangements for UGS governance in China over time. The application of Ostrom's IAD Framework will help unravel the relevant stakeholders, rules, exogenous and endogenous institutional factors in place, and resultant changes over time.

# Urban Green Space Governance in China - Institutional Analysis

The structure of this thesis is shown in Figure 2:

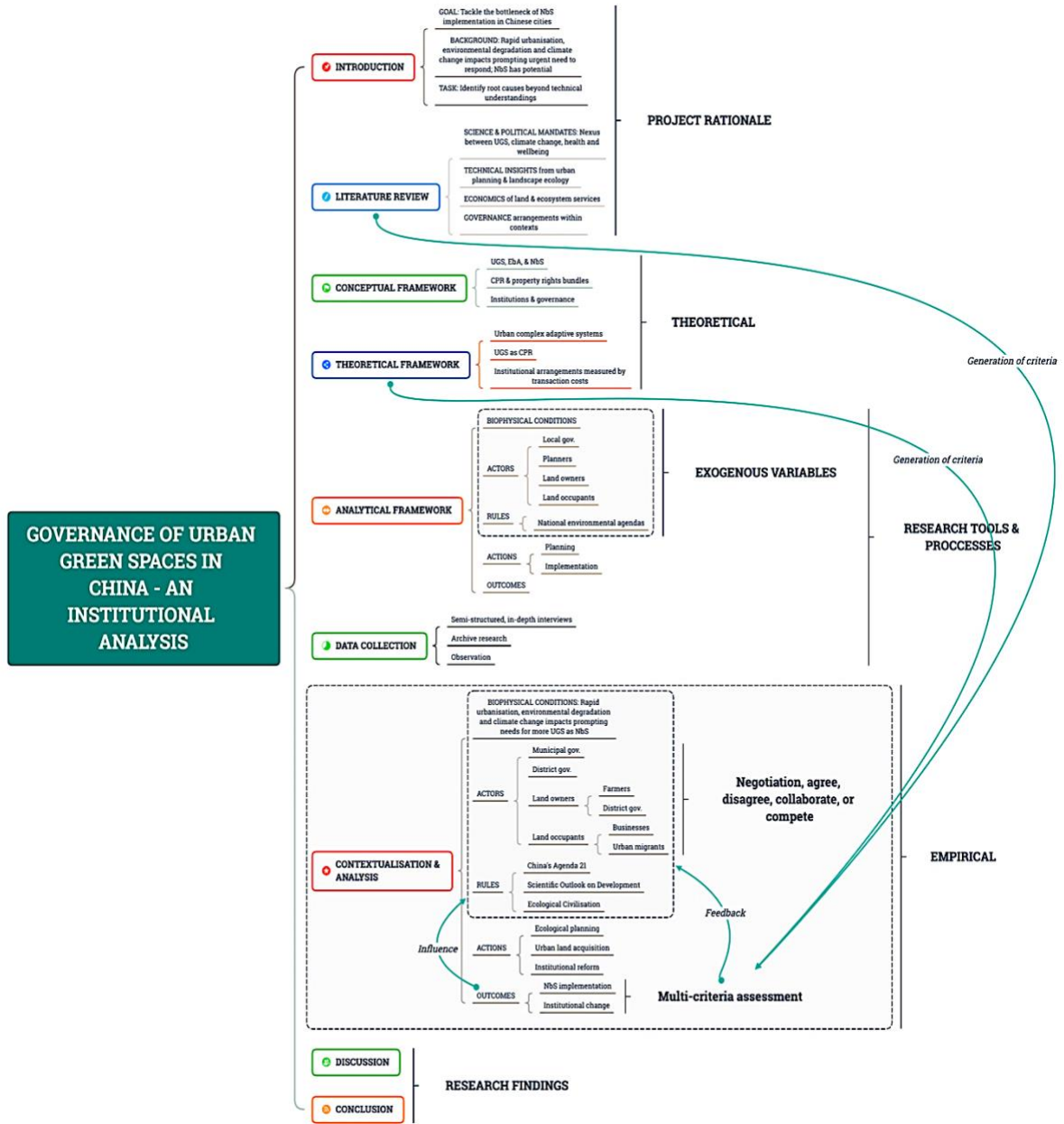


Figure 2: Structure of this thesis

## CHAPTER II

### LITERATURE REVIEW

#### 2.1 The Theories

##### 2.1.1 Ecological notion in Western urban planning theories

Urban planning in the post-war period (after 1945) and even before that in Europe and North America was widely perceived as physical planning and design in essence. First, urban planning was primarily concerned with the physical environment as opposed to the social and economic aspects. Urban planning around that time primarily valued aesthetic design, as architects, civil engineering, and surveying professionals were the main planners. For that reason, the standard of planning then often involved precise 'master' plans (Keeble, 1969; Taylor, 1998). A few examples include: the southern extension plan of Amsterdam designed by the early modernist architect Hendrik Petrus Berlage, the *Ville Radieuse* (the Radiant City) by modern architect Le Corbusier, and the Broadacre City urban development concept proposed by American architect Frank Lloyd Wright (Howard, 2013). These planning approaches were criticised later for overly emphasising the physical aspects of urban environment and relying on precise and inflexible plans, which resulted in a lack of community consultation and exclusion of social and economic dynamics (Taylor, 1998). This period thus was referred to as 'utopianism' or 'romanticism' (Fishman, 2016; Jacobs, 1961).

As response, new theories rose in the 1960s to view urban areas as complex systems and urban planning as rational processes (Foley, 1973; Taylor, 1998). The 'systems view' of planning was brought forward by British planning theorist Brian McLoughlin through his book *Urban and Regional Planning: A Systems Approach* (1969). McLoughlin essentially views and analyses urban areas and regions as systems. A system, as defined by the Oxford English Dictionary,<sup>8</sup> is 'a set of things working together as parts of a mechanism or an interconnecting network; a complex whole.' McLoughlin argues that components of the urban system include location of the land as well as human interactions with the land through communications networks (McLoughlin, 1965). He finds support for systems thinking through reflecting on the inter-

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<sup>8</sup> <https://www.lexico.com/definition/system>

relatedness of natural phenomena in ecosystems and drawing examples from human-nature interaction failures. Taylor (1998) considers the systems view beneficial for understanding the social and economic dynamics of cities as complex, adaptive systems.

Another emerging urban planning theory throughout the 1960s was the 'rational process' view of planning (also commonly known as the 'procedural planning theory' into the 1970s), which emphasises the process of planning as a rational process of decision-making. This view is a normative response to the criticism on "blueprint" planning, as it treats planning as a form of social action in which the process and method of planning are the focus, rather than the end-state of plans (Taylor, 1998). Compared to the first-generation 'physical design' urban planning approach, the complex systems view, and the rational process view of planning demonstrate greater comprehensiveness to both the process and the objects of planning.

However, soon the systems view of urban planning was also criticised for being unnecessarily associated with highly abstract, technical and mathematical terms such as 'modelling' and 'optimising,' and for treating cities as if they "were some kind of a machine that had one politically uncontentious optimal state" (Taylor, 1998: 78). Urban planning critics addressed the need to improve these planning theories by including the social and political actors and their values in context (Friedmann, 1969; Scott and Roweis, 1977; Thomas, 1979).

The progress of urban planning theories in the 1960s and 1970s based on reason and science had its support from the era of modernism, in which planning was viewed as an application of scientific method to support policy-making (Faludi, 1973). The criticisms towards these two views of planning helped reveal the nature of planning as value-laden and political, and prompted theorists to shift attention to public participation and value representation of stakeholders in the planning process in Western political and economic context (Arnstein, 1969; Long, 1959; Pickvance, 1977; Taylor, 1998). In particular, the critical role of market was examined regarding how it approaches private land property rights and land transactions for planning alongside local planning authorities, and how planning results respond to or serve the need of urban development in liberal economies. Pickvance (1977) argues that it is market forces that are primarily responsible for determining the pattern of land development. But rather than competing with governments, planning theorists generally argue that the role of market was positive and in fact, worked closely with governments to deliver plans which

served urban development in liberal economies (Taylor, 1998). To conclude, planning theories in the 1970s reached consensus that urban planning must be viewed, analysed, conducted and examined rationally through communication with diverse actors within political and economic contexts, and that both planning implementation and market forces play crucial roles in determining the outcomes of planning practice (Misgeld et al., 1981).

Entering the 1980s, the 'regime theory' emerged to question the assumption of involving government authorities necessarily to accomplish desired planning outcomes and to explain the increasing cooperation phenomenon between governmental and non-state actors (Stone and Feagin, 1990). Regime theory works on the precondition that in liberal societies, often, significant decisions affecting individuals' lives are made by firms operating within the market system rather than by the government. Thus, different urban planning regimes may arise in different political and economic circumstances in which degrees of market freedom vary. Another theory - the 'problem-centred' planning theory was proposed during the late 1970s to place greater focus on the issues and problems which urban planning seeks to address. The 'problem-centred' planning theory seeks to address problems of five main areas: 1) the continued economic decline of some urban areas, 2) social divisions and inequalities, 3) the life-threatening ecological changes and planning for greater sustainability, 4) the aesthetic quality of urban environments, and 5) degree of public participation in planning (Taylor, 1998).

To conclude, Western urban planning theories evolved 1) from viewing cities as simple physical to complex social-ecological systems, 2) from focusing on the aesthetic and comprehensive 'end-state' of planning to the rational process of planning, 3) from political and economic context insensitive to context-sensitive, 4) from local market and civil actors exclusive to local actors inclusive, and 5) from focus on the method of planning to focus on the practical problems that planning seeks to resolve. These evolutions of urban planning have gone hand in hand with the changes within the larger Western political and economic contexts, which evolved from post-war reconstruction to modernism further to postmodernism. During each of these phases, the power of government has been shared further with other social and economic actors.

### ***2.1.2 Ecological notion and Governance philosophy in China***

Taoism is arguably the most acknowledged traditional Chinese philosophy that cast a theoretical influence on spatial planning in China (Gaubatz, 1999; Zhang, 2008). Tao (道) means ‘the Way,’ and it is the primary principle by which all things exist and interrelate. In the Taoist view, each part of the universe is comprised of complementary aspects known as *yin* and *yang*. *Yin* can be described as passive, dark, secretive, negative, weak, feminine, and cool, while *yang*, on the contrary, is active, bright, revealed, positive, masculine, and hot. *Yin* and *yang* as two contrasting aspects interact and shift from one extreme to the other constantly, giving rise to the rhythm of nature and unending change (Ely, 2009). The core philosophy of Taoism is primarily embedded in the relation between humans and nature, and ‘Wu Wei’ (无为), which literally means ‘take no (forceful) action or inaction’, is the central philosophy of Taoism and a proposal for approaching and governing nature. Mountains, for example, have long been imagined as having sacred power, manifesting nature’s vital energy, or *qi* (气). Such power gathered the rain clouds that watered farmer’s crops, and concealed medicinal herbs, fruits, and alchemical minerals projecting the hope of longevity. Ordinary Chinese people wandered in mountains and practised meditation in caves and grottoes, which were considered gateways to other realms. Caves and grottos are referred to as “cave heavens” (洞天) for spiritual enlightenment and projection of hope for immortality. Poets celebrated the beauty of nature, city dwellers have built country estates to escape the dust and pestilence of crowded urban centres, and officials retreated to the mountains as places of refuge during periods of political turmoil. In ancient Chinese thought, nature is conceived as self-generating, interconnected, complex, and constantly evolving systems. This proverb from *Tao De Jing*, the most prominent Taoism classic literature, written by Laozi (or Lao Tzu): “*Men emulate earth; earth emulates heaven; heaven emulates the Tao; the Tao emulates spontaneity.*” Laozi further advised the governing class (Chapter 64) not to overvalue “*materials that are hard to come by*”, instead, to desire and learn “*what others do not*” and redeem “*the errors of the masses.*” In the Taoists’ view, the essence of Tao is about following the laws of nature and not to intervene because the law of nature is the natural intervention that the system needs to maintain a peaceful, natural evolution. So, if a leader could follow the principle of Tao to govern its territory and people (Chapter 37), “*everything will develop, evolve, and die by themselves, therefore completing many comprehensive nature cycles.*”

While the Taoism philosophy emphasises human-nature relationships, Confucianism evolved to become the dominant school of thought for the governance of good morals. For instance, in the dialogue between the Duke Jing of Qi and Confucius recorded in Chapter 12:11 of *Confucian Analects*, the Duke asked Confucius about government, Confucius replied: “*Let the ruler be a ruler; the minister, a minister; the father, a father; the son, a son.*” The Duke responded: “*Truly, if the ruler is not a ruler, the subject is not a subject, the father is not a father, and the son is not a son, even if I have revenue, will I enjoy it?*”<sup>9</sup> The Confucian school of thought was essentially a moral education that enabled government officials to exercise proper judgment, as it comprises a complex series of rules and rituals for government officials. The Confucian philosophy functioned well in guiding governance. The doctrines were studied by officials to put general rules in specific contexts by their proper or moral judgments (Fukuyama, 2016). In summary, the Taoist philosophy of human-nature harmony and the Confucian school on the moral education of government officials constituted the hallmarks of the Chinese central planning and governance (Fukuyama, 2016). Under these influences, traditional Chinese urban settlements often had their street networks and primary architecture aligned with the cardinal directions to conform with the Chinese Taoist geomancy and were separated from one another with walls. These traditional Chinese towns or urban areas primarily evolved around clan or family relationships, and reflected the complex composition of a hierarchical society and was described as having applied the classical top-down approach of the “emperor ruling.” (Gaubatz, 1999).

Moving onto more modern times, the Western theories and practices of urban planning have also influenced planning in Chinese cities. The Western rational and comprehensive process view of planning along with the socialist theory were adopted in China during the Maoist period between 1949 and the end of 1970s (Douay, 2008; Gaubatz, 1999). The year 1949 marks a starting point of a new era for urban planning in China as the new government sought to rebuild for a socialist society conformant to Soviet communism. Thus, in the 1950s, China established its planning committees under the influence of socialist theory and Soviet centralism (Gaubatz, 1999). In the socialist context, the Chinese urban planning delegated state-led urban plans and policies downwards (Wu, 2000). In practice, China’s urban planning in the 1950s and 1960s were conducted under the notion of ‘strategic planning,’ which has an aged origin from the

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<sup>9</sup> Chinese Text Project. Available at: <https://ctext.org/analects/ens>

military domain to help implement strategies in the context of war (Douay, 2008). The socialist planning during 1949-late 1970s has been described as centralised socialist planning, or “big government” (Douay, 2008). In this period, the central government took major decisions and regulation for urban planning, while municipal officials had limited influence over the form or content of urban development (Zhang, 2008). Only a small cohort of traditional actors, namely, government officials and planning experts were in the legal position to conduct urban planning and they interacted. This period was thus referred to as urban planning of elitism (Douay, 2008; de Jong, 2019). The aim of the socialist urban planning was to “serve the people,” but in practice, it was often bureaucratic with planning experts and political elites focusing on technical issues and was rarely open to external actors (Douay, 2008). During this period, the planning principles primarily served political or ideological purposes rather than ecological and was operated primarily by the state (Yeh and Wu, 1999).

As China took a shift for economic liberation reform in 1979, the Western urban regime theory, which explains the increasing influence of private sectors in the urban planning process, also gained popularity in China for understanding the emergence of contemporary cities in the post-Maoist period. Overall, the period of Chinese urban planning and development since the national economic liberation and reform in 1979 has been viewed as efficiency-driven (Bina, 2011). After the economic reform and along the waves of neoliberalism from the 1980s, the notion of strategic planning demonstrated even greater influence on the Chinese economic development planning, e.g., special economic zones and technology development zones along China’s urban coastline. The Chinese strategic planning in this period also included the introduction of the market economy system, opening the planning process out to private actors, and reforming land property rights and rules of land transfer. Between the 90s to early 2000, the urban planning realities in China had rapidly evolved to be more complex, thus required new theories to understand better the potentials of public-private sector collaboration in urban planning (Douay, 2008). For this purpose, the urban regime theory proposed by Western urban planning scholars became popular (Douay, 2008). During this period, the land-dependent and market-led economic development took off and created many new cities, often outpacing the capacity of urban planning land-use regulation institutions (Wang, 2015). The mismatch in the pace between market-led development and state-led planning generated multiple social and environmental externalities, e.g., the exclusion of the migrant workers from accessing and the degradation of urban living environment (Douay, 2008). The urban regime theory was popular

but again, was a lens of political economy rather than ecological. As China enters an era of major governance and technological efforts for urban sustainability, new theories or perspectives are needed to address these problems and guide Chinese urban planning for a socially and environmentally more sustainable way of development (Elmqvist et al., 2013; Wang, 2015).

## **2.2 The Practices**

From an urban systems perspective, UGS are viewed as one of the various types of urban infrastructures for public services; hence are referred as urban green infrastructures (UGI). UGI includes green biological corridors, green roofs, parks, alley and street trees, as well as urban forests (bigger parks). UGI are properties of multiple dimensions, including environmental, technical, economic, social, and political/jurisdictional dimensions which concern a wide range of urban stakeholders - public policymakers, professional planners, private investors, maintenance crews, and users or beneficiaries across all levels and scales (Vincent, 2018).

### ***2.2.1 The environmental dimension: nexus between urban green spaces, climate change, health and wellbeing***

Increasing scientific literature is supporting the nexus between UGS and climate change. UGS can cool down urban areas effectively by shading and reducing evaporation, thereby mitigating urban heat island effect and heatwaves, and reducing energy consumption (Lindén et al., 2016; Nowak et al., 2017; Oliveira et al., 2011; Zhang et al., 2014; Zhang et al., 2017a). If planned and managed adequately, UGS can also provide urban residents with decent access to nature, maintain and protect urban biodiversity, sequester CO<sub>2</sub> through photosynthesis, reduce air pollution and noise, retain floodwater and fixate soil, maintain surface moisture, and mitigate the impacts of extreme weather events (see Table 3) (Alberti et al., 2018; Escobedo et al., 2010; Hall et al., 2012; Hartig et al., 2014; Strohbach and Haase, 2012; Zhang et al., 2017b). Due to these potentials, UGS are increasingly considered as a NbS to restore degraded environment, mitigate and adapt to climate change impacts (Gill et al., 2007; Kabisch et al., 2017).

<b>Functions of UGS</b>	<b>Purpose</b>
Carbon sequestration	Climate mitigation
Energy saving (cooling, biomass)	
Climate regulation	Climate adaptation
Soil fixing	
Stormwater infiltration	
Water and air purification	
Biodiversity conservation	
Cultural services (aesthetic, spiritual and educational)	

Table 3: Functions of UGS for climate change mitigation and adaptation

In addition to mitigating and adapting to climate impacts, the nexus between UGS and physical and mental health is also evident. Physical inactivity, a likely result of poor walkability and lack of access to recreational areas, is found to be the fourth leading contributor to diseases and account for 3.3% of deaths globally (Beaglehole et al., 2011; World Health Organisation n.d.). Accessible UGS can facilitate physical activity and relaxation, and form a refuge from noise (González-Oreja et al., 2010; Irvine et al., 2009). Decently distributed trees and vegetation can promote the production of oxygen, decrease levels of airborne particulate matter and atmospheric CO<sub>2</sub> through photosynthesis and carbon sequestration (Chen, 2015; Hartig and Kahn, 2016; Lee and Maheswaran, 2011; Rowe, 2011; Strohbach et al., 2012; Whittinghill et al., 2014). In addition, by promoting physical activity, better air quality and more pleasant temperature, UGS can help reduce heart rate, blood pressure and cortisol levels, hence reduce cardiovascular morbidity and prevalence of type 2 diabetes (Gascon et al., 2016; Lanki et al., 2017; Richardson et al., 2013; Tamosiunas et al., 2014; Ulmer et al., 2016; WHO, 2016). UGS is also beneficial for mental health and cognitive functions, such as improved memory and better creativity (Gascon et al., 2015; Nutsford et al., 2013). Hence, making UGS accessible is a relevant issue particularly for schoolchildren (Cherrie et al., 2018; Dadvand et al., 2015). Connection with nature has a significant positive effect on autonomy, personal growth, and a sense of purpose (Hartig, 2008; Hunziker et al., 2007). Furthermore, UGS can foster social interactions and promote a sense of community, trust, shared norms and values, positive and friendly relationships, and feeling of belonging (Peters et al., 2010; Ruijsbroek et al., 2017; De Vries et al., 2013). Increasing research has showed the positive association trend between UGS created and urban health and wellbeing, however, results have been context dependent (e.g.,

coastal, urban, rural), locally focused, and overall not been robust enough to yield efficient policy actions (Kabisch et al., 2017; Scarano, 2017).

In summary, increasing scientific literature is supporting the nexus between UGS, climate change mitigation and adaptation, as well as human health and wellbeing. However, critical insights for policymaking, such as quantification of the economic values, costs and benefits of UGS implementation, are existing knowledge gap yet to be addressed.

## ***2.2.2 The technical dimension***

### ***2.2.2.1 From the perspectives of land-use and land economics***

The Chinese government has had various approaches towards land-use and urban planning in different phases of economic development in the last seven decades with the overall tendency of decentralisation, and planning based on pragmatic economic valuation. Between 1949 and the end of the 70s, the state had both the ownership and usage right of land during the socialist period; as the government administrated all functions of land, the value of land could not be adequately reflected (Lin and Ho, 2005).

The economic reform in 1979 resulted in the marketisation of land use rights to accommodate private sector interests in land-based urban development while the public land ownership was kept, and decentralised decision-making to local urban governments. The marketisation of land-use rights was formalised into what scholars referred to as the asymmetric ‘dual-track’ land market system in the fiscal reforms of the mid-1990s (Lin and Ho, 2005). Under this dual-track land system, the economic potential of urban land was more pronounced; cities quickly built many infrastructure facilities that are conducive to economic development, such as transport, commerce, industry, and housing. The profits brought by the dual-track land system have gradually become an essential source of revenue for local urban governments, as they authorise not only the transactions of land-use rights (or, land leasing) but also the conversion of rural land to urban land. These practices have become a major incentive for local governments to approve rural-urban land conversion (Bai et al., 2012b; Ping, 2011). Between the 80s to early Millennium, China’s total urban land area increased most significantly; industries and infrastructures promoted by foreign direct investment were the most significant

driver for the rural-urban land conversion, also thanks land subsidies provided by the State government (Deng et al., 2008; Seto and Kaufmann, 2003; Tao et al., 2010).

The dual-track land system has contributed to social equity issues broadly, as the benefits of land-based urban economic development remain in cities and not shared among rural communities (Ding and Lichtenberg, 2011). Besides, the large scale of rural land conversion and disordered urbanisation also resulted in modification of the natural landscape and soil pollution (Chen et al., 2018). Even when local governments began to consider the potential of UGS for strategic planning at the new Millennium, the main purposes were to boost land supply and economic productivity and foster more clustered developments to counteract urban sprawl. Scholars have identified social externalities associated with such strategic planning, namely, disconnection of the initial place-based social connections and displacement of urban migrants (Ng, 2019).

#### 2.2.2.2 From the perspectives of urban ecology and landscape ecology

Research on urban systems from the urban ecology perspective went through the stages of examining ecology in, of, and for cities (Childers et al., 2015). Initially, it focused on what is 'in' cities, e.g., the terrestrial and aquatic patches within cities and the ecological performances of urban plants and animals (Pickett et al., 2016). More recently, the discipline gained an amplified focus on what is 'of' cities, treating entire urban mosaics as social-ecological systems in which biological, social, and built components interact with each other (Pickett et al., 2016; Sukopp, 2008). Today, the discipline of urban ecology is recognised as one that seeks to understand urban growth through characterising the biophysical expansion, metabolism, succession and fluxes of energy and materials in urban areas and urban dwellers (Alberti et al., 2003; Burgess, 2008). The study of urban ecological systems has attracted much interest, particularly in the last two decades. Scholars revealed limits on both the urban-oriented and nature-oriented approaches to understanding the urban environment as a complex, human-dominated system, in which urban dwellers play an equal role as the plants and animals in urban territories in influencing urban metabolisms. Mainstream urban ecology focuses on how human activities shape urban environments, including urban climate resulting from different uses of built-up areas such as urban-heat-island effect and transport-induced air pollution (Kuttler, 2008). As urban population outnumbered rural ones, there is an emergent need also to understand how humans are affected by their urban surroundings (Grimm et al., 2008). In

recent literature, urban ecology has been a useful perspective to reveal the relations between social arrangements (political powers, economic investments and institutional setups) and the size, distribution and connectivity of areas which host plants and animals in cities (Grimm et al., 2008). Studies in urban ecology have revealed significant contributions of natural processes, or ecosystem services, to human health and wellbeing (Syrbe and Walz, 2012). However, questions have persisted regarding the practicality of urban ecology studies for informing policy design, integration, and inspiring civil actions, despite being an interdisciplinary science field (Ahern, 2013; Pataki, 2015). The questioning, plus recently increasing social-ecological complexities and climate uncertainties in urban environments, prompted the discipline of urban ecology to shift to what scholars referred to as a new paradigm – ecology ‘for’ cities, with greater concern for urban sustainability and a focus on holistic social-ecological systems (Childers et al., 2015; Pickett et al., 2016).

Landscape ecology as a similar discipline was created in the early 1980s to study interactions among landscape elements (Li et al., 2005). Compared to urban ecology, it focus more specifically on natural ecosystems and to offer new concepts, theory, and methods that reveal the importance of spatial patterning and the dynamics of interacting ecosystems (Gill et al., 2007; Turner et al., 2003). The discipline has inspired planners and architects to integrate ecological principles in urban planning and design process. Today, landscape ecologists have validated the potential of urban green landscapes, or green infrastructure, in restoring degraded urban environments (Foster et al., 2011; Gill et al., 2007; La Greca et al., 2011; Zhang et al., 2011). Similarly, landscape ecology as a scientific discipline rapidly advanced in the last two decades thanks to emerging computer power and technology such as geographical information systems (GIS) (Turner and Gardner, 2015). The emerging needs of cities to mitigate and adapt to climate change impacts further underlined the importance of understanding spatial patterns in ecological systems. Landscape ecologists refer to the approach of planning urban natural landscapes and utilising ecosystem services to reduce the vulnerability of ecosystems as ‘ecosystem-based adaptation’ (EbA) (Revi et al., 2014).

Even though EbA has been identified as a key contributor to urban resilience, the landscape-oriented or ecology-oriented urban plans have often been criticised as technical, and lacking socio-economic stakeholder inclusion (Nesshöver et al., 2017; Revi et al., 2014). Besides, although the EbA strategy seems to be able to provide multiple ecosystem benefits and is not

dependent on high technology, it is far from an easy and affordable approach. The costs of EbA in urban contexts might be higher than expected largely because costs are higher for land acquisition and ecosystem management (Cartwright et al., 2013; Roberts et al., 2012). For these reasons, scholars call for moving ecology sciences towards an integrated urban science (McPhearson et al., 2016).

### ***2.2.3 The economic dimension: economics of urban land and valuation of urban green spaces***

Existing literature has presented several main reasons for which governing UGS remains challenging in China. To begin, the Chinese urban planning system has first commanded and later commodified land primarily as a resource of space (Alix-Garcia et al., 2016). As the central government declared for economic reform and liberation in the late 1970s, land-use rights became tradable and had been quickly commodified for infrastructural development in cities and for building new cities. Rapid land commodification during the country's rapid urbanisation process resulted in ambiguous property rights arrangements of urban land in many Chinese cities. In many cases, the delineation of property rights by government officials only incurred after the actual occupation or use of urban land (Liu et al., 2019; Zhu, 2008). The consequence is that land consumption has occurred at speed much higher than that of urban population growth. Between 2000 - 2011, the built area in Chinese cities increased by 76.4%, much higher than the rate of urban population growth, which increased by 50.5% (State Council of China, 2014b). In addition, urban land scarcity became increasingly evident particularly in coastal cities, prompting local officials and planners to emphasise even more on achieving economic efficiency from existing urban land resources (Mao et al., 2020). In general, economists consider land resources as the most valuable natural resource considering its scarcity and critical role for production for almost all goods and services crucial for human life (Samuelson and Nordhaus, 2010). Land scarcity determines that it is critical to producing the highest amount (quantity and quality) of economic goods and services from the land available in any development or management activities.

Furthermore, quantifying the ecological values of UGS and translating accurately into monetary terms has been a significant technical difficulty to environmental economists. Costs of technical planning, equipment, and implementation are easily identifiable. However, the costs of potential change to the local ecosystem (increasing or decreasing biodiversity) and

potential influence in neighbour property values, residents health and wellbeing cannot be anticipated appropriately (Choumert and Salanié, 2008). Current valuation methods of UGS, e.g., contingent valuation, choice experiment, hedonic price modelling, and the travel cost method, approach the value of UGS either through proxies or through a hypothetical estimation (Lo and Jim, 2010; Powe et al., 2005; Randall et al., 1990). For example, a study on the value of UGS in Guangzhou, China focused on residents' willingness to pay for recreation-amenity use (Jim and Chen, 2006). While the study showed positive monetary value for the recreation-amenity use of UGS in Guangzhou, it focused only on the cultural ecosystem services, plus the positive monetary value achieved by the contingent valuation method was hypothetical. Another study focusing on more comprehensive types of ecosystem services in Beijing using the hedonic price modelling method was able to generate suggestions on the ideal patterns and sizes of UGS for the best ecological outcome (Xu et al., 2016). Nevertheless, the study lacked compelling cost-benefit reasoning for policymakers. Hence, these methods are limited in reflecting the comprehensive values of UGS. Even when scholars attempt to calculate directly the potential of UGS in improving air quality, the technical challenge of calculation due to the diversity of, e.g., vegetation configuration, pollutant emissions, meteorology, and tree-health, makes it hard to apply the finding directly to policy settings outside the study area (Baró et al., 2014). Plus, this type of study still cannot adequately convert the UGS potential into cost-benefit relative terms.

In summary, land resources were first commanded and later commodified for urban development primarily as a resource of space by the Chinese urban planning system. Rapid land commodification during the country's rapid urbanisation process resulted in ambiguous property rights arrangements of urban land in many Chinese cities. urban land scarcity became increasingly evident particularly in coastal cities, prompting local officials and planners to emphasise even more on achieving economic efficiency. Furthermore, quantification of the ecological values of UGS, which can be an advantageous piece of information for policymaking, has been a significant technical challenge. Finally, implementing UGS as a measure to compensate the negative environmental and social externalities from urban economic development might also lead to externalities of its own, such as gentrification.

#### ***2.2.4 The social dimension***

Implementing UGS as a measure to compensate for the negative environmental and social externalities from urban economic development might also lead to externalities of its own. For example, property values can often be increased, intentionally or not, if a decent amount of neighbourhood UGS is provided, resulting in gentrification<sup>10</sup> (Wolch et al., 2014; Cole et al., 2017; Rigolon and Németh, 2018). Such urban gentrification often results in various degrees of social exclusion, especially those who are socio-economically underprivileged (Gould and Lewis 2012; Seddon et al., 2020; Small et al., 2017). Most existing literature on the social dimension of UGS focuses on Anglo-American settings and scientific studies on the social impacts of UGS in China only emerged fairly recently (Wolch et al., 2014). The primary UGS governance approach in China has been based on regulatory measures without proper considerations of economic or social costs (Zhu and Zhou, 2015). Among the emerging Chinese literature, the social value and performance of UGS, e.g., accessibility and equity, have been identified as effective indicators of UGS quality, urban health and wellbeing (Yin et al., 2008). UGS accessibility has widely accepted measurement metrics, for example, distance to residential area or the average size of UGS per capita, but intangible concepts such as social values are hard to measure and remain a knowledge gap regardless of contexts.<sup>11</sup>

#### ***2.2.5 The political dimension***

##### ***2.2.5.1 International environmental and climate governance frameworks***

Numerous international governance frameworks on climate and environment have highlighted the nexus between climate change and urban health, including WHO guidelines, the United Nations Sustainable Development Goals (SDGs), and a few recent accords of the United Nations Framework Convention on Climate Change (UNFCCC). As early as 1986, the WHO had launched the Healthy Cities program which is now promoted in thousands of cities

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<sup>10</sup> According to Investopedia.com, gentrification is “*the transformation of a city neighbourhood from low value to high value. Gentrification is also viewed as a process of urban development in which a neighbourhood or portion of a city develops rapidly in a short period of time, often because of urban renewal programs. This process is often marked by inflated home prices and displacement of a neighbourhood's previous residents.*” Available at: <https://www.investopedia.com/terms/g/gentrification.asp#:~:text=Gentrification%20is%20a%20process%20of,costs%20brought%20about%20by%20gentrification.>

<sup>11</sup> Cities4Forests: *Gaps in Knowledge*. Available at: <https://cities4forests.com/lg-urban-forests/gaps-in-knowledge/>

worldwide. The program aimed to set health as an overarching goal on the agendas of decision-makers and to develop comprehensive local strategies for health protection and sustainable development. The program functioned well in many cities, with communities gaining a greater understanding of the nexus between health and environment and sectors creating partnerships (Donchin et al., 2006). The 61st World Health Assembly in 2008 led to the creation of the WHO *Work Plan on Climate Change and Health*, which focus on supporting member states to protect health from climate change with four priorities, including raising awareness, strengthening partnerships, enhancing scientific evidence as well as health systems (WHO, 2015). The WHO (2018) frames the *Paris Agreement* which launched in 2015 as ‘potentially the strongest health agreement of the century.’<sup>12</sup> The UNFCCC also recognises health as a critical element in its legal framework. The *Paris Agreement* framed the right to health as a fundamental human right in its preamble (United Nations, 2015a) and urges member state governments to respect, promote, and consider their respective obligations on the right to health when taking climate actions. Besides, the *Paris Agreement* recognises the central role of mitigation actions and their co-benefits for adaptation, health, and sustainable development, if enhanced response were taken before 2020 (UN, 2015b). Furthermore, it advocates for connecting and defining health in the Nationally Determined Contributions (NDCs) for both mitigation and adaptation. The WHO also recognises valuable opportunities for improving health through integrating climate mitigation and adaptation policies across sectors, as, e.g., energy supply and electricity production, households and buildings, transport as well as agriculture and food systems (WHO, 2018b). In addition, the WHO identifies potential health gains in infrastructure and governance improvement and recommended a Health in All Policies (HiAP) approach.<sup>13</sup> As for the SDGs, Scholars assert that SDG 11 ‘Sustainable Cities and Communities’ and SDG 3 ‘Health and Wellbeing’ have a quasi-unidirectional relationship, that means, the condition of urban health is highly subjected to the quality of urban environment. One critical target of SDG 11 is to integrate policies of climate mitigation and adaptation substantially into urban development plans by 2020, making SDG 11 synergistic with SDG 13 ‘Climate Action.’ Furthermore, SDG 13 can also be synergistic with SDG 3, for a climate-resilient urban development approach could improve environmental quality and thereby support urban health and wellbeing (Nilsson et al., 2017). The synergy is affirmed

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<sup>12</sup> WHO. Climate Change – Overview. Available at: [https://www.who.int/health-topics/climate-change#tab=tab\\_1](https://www.who.int/health-topics/climate-change#tab=tab_1)

<sup>13</sup> WHO. Health in All Policies - Helsinki Statement Framework for Country Action. Available at: <https://apps.who.int/iris/handle/10665/112636>

by the World Bank Group.<sup>14</sup> Similarly, the Sendai Framework for Disaster Risk Reduction 2015-2030 also underlines the role of urban planning for the implementation of ecosystem-based approaches at both global and regional levels to build resilience.<sup>15</sup>

What is the role of UGS then? WHO has primarily emphasised the health potential of UGS, while the SDGs as well as the New Urban Agenda (NUA) have primarily accentuated the importance of UGS for equity, and the accords of the UNFCCC have focused on the technical aspects of UGS as an NbS for climate adaptation (UNFCCC, 2015). The WHO's review show effectiveness of UGS on human health and the organisation has actively promoted UGS as a tool for action for health and wellbeing (WHO Europe, 2016 & 2017). The SDGs, on the other hand, have highlighted the role of UGS particularly in SDG 3 (health), SDG 11 (cities), and SDG 13 (climate). The potential of UGS is emphasised primarily in SDG 11: "*Making cities sustainable... involves investment in public transport, **creating green public spaces**, and improving urban planning and management in participatory and inclusive ways.*"<sup>16</sup> One of the targets of SDG 11 is to provide accessible and inclusive UGS universally by 2030, particularly for the underprivileged population. Similarly, the NUA recommends cities to conduct: "*... participatory, promote civic engagement, engender a sense of belonging and ownership among all their inhabitants, prioritise safe, inclusive, accessible, **green and quality public spaces** that are friendly for families,..., recognising the specific needs of those in vulnerable situations*" (UN-Habitat, 2015: 13; 2016). Furthermore, the UNFCCC has provided technical guidance on planning UGS for climate adaptation through case studies, tools, and technical reports.<sup>17</sup> Notably, the Global Assessment Report produced by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has also endorsed UGS as possible pathway to transform urban biodiversity (IPBES, 2019).

Together, these international governance frameworks on climate and environment have advised cities to increase UGS as an NbS to climate impacts and have shown synergies and

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<sup>14</sup>World Bank Group Climate Change Action Plan. Available at: <https://ccacoalition.org/en/resources/world-bank-group-climate-action-plan>

<sup>15</sup> *Sendai Framework for Disaster Risk Reduction 2015-2030* - Priority 2: Strengthening disaster risk governance to manage disaster risk. P18. Available at: <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

<sup>16</sup> Sustainable Development Goals - Goal 11: Make cities inclusive, safe, resilient and sustainable. Available at: <https://www.un.org/sustainabledevelopment/cities/>

<sup>17</sup> Results from searching 'Green Space' on the UNFCCC webpage. Available at: <https://www4.unfccc.int/sites/nwpstaging/Pages/Search.aspx?k=green%20space>

interconnections. For instance, SDGs 3, 11, and 13 could play synergistic roles for each other, and UGS could act as a leverage point – adopting UGS as an NbS can contribute to mitigating and adapting to climate impacts, as well as improve urban living environment, thereby bringing health co-benefits. However, the potential of UGS to serve as a synergistic leverage point to advance climate actions and improving urban health has not been sufficiently highlighted.

### 2.2.5.2 National strategies and action plans

The nexus between climate change and health also has been well stated in national policies and plans in China, particularly since China surpassed the U.S. and became the biggest CO<sub>2</sub> emitter in 2007 and gained international attention on the urban environmental quality from hosting the International Olympic Games in 2008. The central government reframed environmental quality as a public good, claimed responsibility for provision, and did place the focus of climate action in urban areas. However, the proposition of UGS as an NbS to climate change and health problems is still substantially lacking. The first national action plan to address the environment-health nexus is the *National Environmental Health Action Plan (2007–2015)* coordinated by the Ministry of Health and 16 other ministerial agencies.<sup>18</sup> The Plan identifies environmental degradation, loss of ecological balance, and subsequent health impacts as key constraints to economic growth and societal development and seeks to establish more people-oriented governance in the process of tackling them. The Plan also proposes action to focus on environmental health impact assessments, early warning systems as well as emergency response plans. The first national plan to focus on climate change adaptation, then, is the *National Strategy for Climate Change Adaptation*, which debuted during the Warsaw COP 19 in 2013.<sup>19</sup> It frames human health as one of the seven crucial tasks and outlines a systematic transition framework which focus on climate change assessment and adaptation planning on both national and city levels. The Strategy sets the goal to protect health from increasing risks of many diseases, particularly temperature-sensitive illnesses, and post-disaster infectious diseases. In the same year (2013), the *Action Plan on Prevention and Control of Air Pollution*

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<sup>18</sup> State Council of China. 2007. Notice on Issuing the National Environment and Health Action Plan (in Chinese: 关于印发《国家环境与健康行动计划》的通知). Available at: [http://www.gov.cn/zwggk/2007-11/16/content\\_807439.htm](http://www.gov.cn/zwggk/2007-11/16/content_807439.htm)

<sup>19</sup> State Council of China. 2013. National strategy for climate change adaptation (in Chinese: 国家适应气候变化战略). Available at: <https://www.gov.cn/gzdt/att/site1/20131209/001e3741a2cc140f6a8701.pdf>

was approved. It is the first plan to frame decent environmental quality as a public good and as a responsibility of local governments, and to set ambitious, specific targets for air pollution reduction. China moved forward with greater determination on climate change actions with the *National Plan on Climate Change (2014–2020)* and the *Action Plan for Urban Adaptation to Climate Change 2014*, both of which were made under ‘Ecological Civilisation,’ the country’s emerging national environmental governance framework. With the latter, notably, China placed the focus of climate change adaptation in urban areas, concerning the concentrated health and economic impacts.

Similarly, China set the first national medium- to long-term action plan focusing on promoting healthy lifestyles, improving health services and the industry with the *Healthy China 2030 Initiative* launched in 2016.<sup>20</sup> The Plan defines health as a basic condition for socio-economic development and improvement in national health governance as a proactive contribution to the 2030 Sustainable Development Agenda. In actionable terms, *Healthy China 2030* seeks to resonate with the HiAP approach of WHO. The *Healthy China 2030* also gained an urban focus with the *Shanghai Consensus on Healthy Cities 2016* approved the International Mayors Forum.<sup>21</sup>

In summary, numerous international governance frameworks on climate and environment have highlighted the nexus, including WHO guidelines, the SDGs, and recent accords of the UNFCCC. Together, these frameworks have advised cities to increase UGS as an NbS to climate impacts and have shown synergies and interconnections. However, the potential of UGS to serve as a synergistic leverage point both to advance climate actions and improve urban health has not been sufficiently highlighted. Similarly, in national policies and plans in China, the nexus between climate change and health also has been well stated. The central government reframed environmental quality as a public good, claimed responsibility for provision, and did place the focus of climate action in urban areas. However, the proposition of UGS as an NbS to climate change and health problems is still substantially lacking in these action plans.

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<sup>20</sup> WHO. 2016. Health Promotion: Healthy China 2030 (from vision to action). Available at: <https://www.who.int/healthpromotion/conferences/9gchp/healthy-china/en/>

<sup>21</sup> WHO. 2016. Health Promotion - Shanghai Consensus on Healthy Cities 2016. Available at: <https://www.who.int/healthpromotion/conferences/9gchp/healthy-city-pledge/en/>

## **2.3 The Institutional Perspective**

### ***2.3.1 Relevance of the institutional perspective***

Institutional elements and capacities, e.g., the behaviour, values, social norms and political interests of key actors, authorities and their legal and regulatory responsibilities, play a critical role in promoting the implementation of urban development and climate adaptation plans (Berkhout, 2012; Dietz et al., 2008; Jim 2013; Klein et al., 2015; Mimura et al., 2015; Moser and Ekstrom, 2010; Ostrom, 2014; Revi et al., 2014; Romero-lankao and Wilhelmi, 2018). Studies have documented institutional barriers to planning and implementing climate adaptation, e.g., contesting values, conflicting objectives, tensions, and trade-offs between different policy agendas and priorities (Adger et al., 2009; Storbjörk and Hedrén, 2011). In addition to the ignorance of the influence of institutional elements, the scientific challenge to capture institutional dynamics has also been a reason why urban plans often failed when put into practice (Jim, 2013; Zhao, 2005). In the case of NbS, the lack of capacities and capabilities of local authorities has been identified as a major knowledge gap (Knoblauch et al., n.d.). Complexities of governance networks of multiple actors and institutions are proven barriers of adaptation (Carlsson-Kanyama et al., 2013; Juhola and Westerhoff, 2011; Sosa-Rodriguez, 2014). The difference in governance approaches, e.g., in how to create adaptation plans, has concrete implications for adaptation outcome and merits further analysis (Bai et al., 2016 & 2018; Mimura et al., 2015).

### ***2.3.2 Critiques on various governance approaches***

#### ***2.3.2.1 Top-down and bottom-up governance***

The two main tendencies - top-down and bottom-up - have marked the history of urban planning in the past seven decades with an overall shift from top-down towards bottom-up (Healey et al., 1982). Despite so, the appreciation of technical expertise, which is a characteristic of the top-down approach, has been increased (Pissourios, 2014). A top-down approach is one that originates from “the top,” and is often directed based on decision-making from “the top,” whilst a bottom-up approach describes data collected and processed, decisions made and acted upon at the local level (Nicholls et al., 2015). In urban planning, the top-down

governance approach offers advantages of efficiency and economies of scale (Nicholls et al., 2015; Pissourios, 2014). In climate change adaptation, national governments have primarily assumed a coordinating role of adaptation actions for subnational and local level governments, including information provision, strategies incentivization, legal and policy frameworks for implementation and supervision, actions to protect vulnerable groups and providing financial support for sub-level governments (Mimura et al., 2015). National level governments overall have played a key role in climate change adaptation planning and implementation, and subnational governments have played a complementary role to national governments that are reflective of the governance structure (Uk Climate Impacts Programme, 2007). The top-down governance approach has received criticism for its tendency to prioritise, overly or sometimes even solely appreciate professional and scientific “expert” knowledge, thereby neglecting local actors and their knowledge and needs, and denying citizen participation (Sabatier, 1986; Smith, 2008).

As a response, the bottom-up governance approach has gained popularity over the years for appreciating and incorporating local people and their knowledge, skills, needs, and experiences into decision-making (Smith, 2008). In climate change adaptation planning and implementation, local governments are increasingly recognised as playing a central role in addressing the challenges (Blanco et al., 2009; Matthews, 2012; Sanchez-Rodriguez, 2009). Local authorities can play a significant role in removing barriers for climate adaptation by realigning the incentives of individuals with societal goals, providing the public goods needed for adaptation, or helping with behavioural and cognitive biases (Chambwera et al., 2015). In urban planning, the bottom-up approach is often considered better or more accurate, thanks to the possibility of immediate and small-scale data collection reporting, thereby can be more cost-effective (Nicholls et al., 2015). The bottom-up approach is sometimes referred to as the community-based approach and is endorsed by, e.g., the UNFCCC, for its potential in climate change adaptation and resilience-building (IPCC, 2014).

Despite growing popularity, the bottom-up approach functions well typically at a small and local scale and has limited capability in coping with complexities of large scales (Pissourios, 2014). Besides, bottom-up governance approach could fall short for occasions where there is no ‘bottom level,’ for instance, a new settlement or a large city plan expansion with no actual residents yet (Pissourios, 2014). In climate change adaptation, local agencies and planners are

often confronted by the technical challenge to obtain credible data of local vulnerabilities and potential impacts, as well as to understand the information properly (Mimura et al., 2015). For many urban governments, how to cope with the high complexity of climate change impacts across levels within the conventional, often siloed government structures and operational culture across countries remains an operationalisation challenge (Mimura et al., 2015). Extensive literature has highlighted the need for a comprehensive, institutionally innovative combination of the top-down and bottom-up approaches, as well as local horizontal network governance approach, to facilitate learning and coordinated actions across multiple authorities (Lowe et al., 2009; Mimura et al., 2015; Pissourios, 2014).

#### 2.3.2.2 Multi-level governance

Compared to the top-down governance approach highlighted by a command-and-comply trait, multi-level governance (MLG) is conducted through more sophisticated rules of power distribution, responsibility sharing, as well as mechanisms and strategies of policy-making (Daniell and Kay, 2017). Multi-level governance is an approach with established arrangements for multiple actors to participate in policy-making activities within and across various politico-administrative institutions at different territorial levels (Stephenson, 2013). “Multi-level governance” and “cross-level coordination” are interchangeable references of the same governance approach. One of the earliest and most prominent practice to date in multi-level governance is perhaps the European Integration following the Maastricht Treaty that entered in force in 1992 (Marks, 1993), which established the ‘subsidiarity’ principle particularly in environmental policy, a gesture of political desire to implement policy action at the local level if needed (Golub, 1996). Since the emergence of the term, research on multi-level governance has increased over the past three decades, particularly in the field of governance of resources and services which are non-jurisdictional or produce cross-border externalities, such as climate change impacts (Quilligan, 2008). Similarly, global governance can be considered as a form of multi-level governance, for its entirety of political institutions are put forward to de-globalise and to solve specific national and regional problems, or to provide transnational common goods and services (Zürn, 2012).

Scholars consider the multi-level governance approach as having the potential to create positive incentives for sustainable use of resources because of its characteristic of shared responsibility, thereby facilitate learning and adaptation that are context specific, and based on the values and

mutual trust of local actors (Adger et al., 2005; Armitage, 2007; Newig and Fritsch, 2009). A wide range of research, from forest management to urban planning to climate change mitigation and adaptation, widely affirms the need to establish multilevel institutional coordination mechanisms between different political and administrative levels for effective implementation of policies (Mimura et al., 2015; Revi et al., 2014). Research show that factors such as the consistency of legal frameworks, power distribution, competences, and information flows, are crucial for increasing trust and empowering local actors for policy integration and implementation (Juhola, 2016; Ravikumar et al., 2015). For example, empirical examinations on climate change mitigation and adaptation policy-making processes in land use sector in Brazil and Indonesia reveal that, cross-level trust building and collaboration between national and sub-national levels remain challenging, mostly due to power being disproportionately distributed across governance levels (Di Gregorio et al., 2019). Yet, how exactly political power from higher level impacts the learning and integration of policy-making processes across levels are not yet well understood (Bache, 2012; Doherty and Schroeder, 2011; Marquardt, 2017). In addition, governments at different levels often have different preferences or priorities: national level governments engage more extensively in mitigation and local governments focus more on adaptation (Measham et al., 2011).

### 2.3.2.3 Collaborative and participatory governance

Literature on collaborative governance emerged in recent decades to describe the approach in which public and private stakeholders are brought together for consensus building and planning for environmental management (Ansell and Gash, 2007). “Collaborative” and “collective” are interchangeable terms. Contrary to the declining trend of the commanding style in policy processes, collaborative governance relies on face-to-face dialogue, trust building, and the development of commitment and shared understanding to prevail (Ansell and Gash, 2007).

**Participatory governance** seeks to enable citizens to participate in policy processes (Fischer, 2012). “Participatory,” “democratic,” and “inclusive” are interchangeable terms to describe governance approaches that emphasise citizen participation and explore aspects related to citizen competence, empowerment, capacity building, and their impacts on the service delivery, equity, and political representation (Ron, 2012). Scholars, as well as international organisations, recommend the participatory governance approach for climate change adaptation, as the approach not only does justice to civil rights, but also facilitates the incorporation of local

resources such as information, knowledge, and finance (Agarwal, 2009; Fritz et al., 2019; Tompkins and Eakin, 2012; UNDP, 2010; World Development Report, 2010). For example, many early case studies on the governance of forest and water resources in Nepal, Japan, Indian and Sri Lanka prove that community-participated governance delivers sustainable outcomes (Ostrom, 2010). Despite so, governments often have contradictory attitudes towards participatory governance approach, for citizen participation can inform decision-making but in the meantime, it increases uncertainty and costs in policy-making and implementation processes (Phillips, 2012; Ron, 2012).

The two governance approaches share the characteristics of democratic nature and potential to improve governments' capacity for problem-solving in the long term. In comparison, the collaborative approach tends to demonstrate higher potential in improving governments' capacity to solve problems as it emphasises more on equal stakeholder collaboration; whilst the participatory governance approach focuses more on the degree of democratic contribution in policy-making processes (Papadopoulos, 2012). Research shows that collaborations with the private sector in climate adaptation can increase time and economic efficiency (Engle and Lemos, 2010; Tompkins and Eakin, 2012). Research on irrigation systems in Nepal and forests around the world suggest that the key to succeeding in participatory or collaborative governance is communication (Ostrom, 2010).

#### 2.3.2.4 The emerging 'urban' focus in governance literature

Urban governments are responsible for a substantial share of essential infrastructure and service provision, therefore, their decisions are crucial to the interface between urban economic development and environmental change (Bulkeley and Kern, 2006; Hall et al., 2013). The importance of urban governments has been highlighted by increasing literature in the last two decades. Between 1990 and 2015, the literature focused on the 'urban' theme increased by 14 times roughly (Bai et al., 2018). Particularly, scholars are seeking a greater understanding of the continuous global and local urbanisation processes to resolve emergent, complex environmental and climate change problems (Wolfram et al., 2016). Scholars view cities as a crucial actor for addressing climate change impacts and achieving the Paris Agreement (Bai et al., 2018). Often, urban governments face the challenge of balancing the so-called traditional push and pull factors, namely in between 1) short-term priorities of economic growth and

competitiveness, and 2) long-term commitment to restore the urban environment and address climate change impacts (Bai et al., 2014; Leichenko, 2011; Romero-Lankao et al., 2017). Besides, scholarly interests on establishing “urban” as a scientific discipline based on complex systems sciences are also on the rise. This new discipline of urban sciences views cities as self-organised, adaptive complex socioecological systems or sociotechnical systems (McPhearson et al., 2016; Portugali, 2006). This discipline considers urbanisation as a multifaceted phenomenon that encompasses profound changes in demographic, land-use and other resource consumption in environmental, social, cultural, and institutional spheres across local, regional, national and global scales (Bai et al., 2014; Friedmann, 2006; Bai et al., 2018).

### ***2.3.3 Major institutional challenges in urban governance, globally and in China***

Studies on how institutional dimensions limit or enable policy-making and implementation for climate change adaptation at different levels and in different sectors in both developing and developed countries have increased in recent years (Biesbroek et al., 2013; Engle and Lemos, 2010; Glaas and Juhola, 2013; Moser and Ekstrom, 2010; Rodima-Taylor et al., 2012). Most of the literature has reported on how current institutional arrangements restrict the mainstreaming of climate adaptation across contexts and scales (Biesbroek et al., 2013; Mimura et al., 2015). While middle- and high-income countries report more on institutional barriers such as professional silos, low-income developing countries report on weak institutional environments (Mimura et al., 2015). Several international studies have shown that silos and compartmentalisation between local governments and administrations due to differences in internal norms, values, and priorities are the barriers to mainstreaming climate adaptation policies (van den Berg and Coenen, 2012; Wilby and Keenan, 2012). For example, studies on water management in multiple municipalities across the world suggest that the current institutional structure and regulatory policies are poorly matched for achieving urban climate adaptation objectives (Aylett, 2015; Eisenack and Stecker, 2012; Herrfahrtdt-Pähle 2013).

In China, rapid economic growth and urban expansion have further highlighted the institutional rigidity and mismatch. Studies have identified evidence of responsibility overlaps and policy contradictions due to the silos and compartmentalisation in the administrative system (OECD, 2005). In the case of building smart eco-cities in China, the environmental and social objectives

became harder to achieve as the projects were implemented within the conventional institutional structure. The conventional institutions rely primarily on administrative means of implementation conducted by technical experts and officials and commit more to economic and technological solutions, rather than involving private actors and citizens and focusing on social and environmental well-being (Chai, 2015; Xie, 2019).

For both developed and developing countries, scholars indicate at least three key areas where institutional arrangements can be improved to facilitate the making and implementation of climate adaptation plans: 1) institutional coordination between different political and administrative levels, 2) the horizontal interplay within local governments, and 3) the coordination between formal governmental and administrative agencies and social and private stakeholders (van den Berg and Coenen, 2012; Engle and Lemos, 2010; Jonsson et al., 2012; Preston et al., 2013; Robinson and Berkes, 2011; Runhaar et al., 2012; Wilby and Keenan, 2012). While the institutional arrangements in current urban governance across country contexts vary, good governance should facilitate policy and decision processes across public, private and civil actors and foster the co-production of knowledge, learning and action over time (Revi et al., 2014; World Bank, 2017).

## CHAPTER III

### THEORETICAL FRAMEWORK

This chapter begins by clarifying the semantic differences of some key terms used in this research between the international scientific literature (as reviewed above, in English) and the language of the empirical research context (Chinese). It then follows with the overarching theoretical framework of governing UGS as a common-pool resource (CPR) for climate resilience, urban health and wellbeing across scales and levels. After providing an overview of the theoretical framework, it follows by a section which interprets UGS as part of the urban social-ecological system (SES). Furthermore, to understand the stocks and flows of UGS in an urban social-ecological system and how to manage them, the common-pool resource theory is introduced as the main theory. This chapter ends with an analytical tool to operationalise the theory in the empirical case studies beginning from Chapter V.

#### 3.1 Semantics Matter

So far, key concepts such as *urban green spaces* (UGS), *governance*, *institutions*, and *social costs* and relevant literature have been reviewed without careful examination of the semantics. It is necessary to zoom into the semantics now, at the beginning of constructing a theoretical framework, as they matter for the empirical case study analysis, which is context-sensitive politically and culturally. Table 4 presents several examples of concepts, the meanings of which differ in English and Chinese. For example, in Chinese, to *govern*: 治理 (pronounce as zhì lǐ) means “to treat and to organise”, which can be used not only in social or political terms but also in many other fields, including medical and agricultural fields, a disease, or a type of pests. In comparison, in English, the term to govern applied more strictly in social or political terms and targets exclusively items, structures, and forms created by human. Another example is the term urban green spaces, the focal object of this research, which refers mainly to its functions as services. While the term in Chinese: 城市绿地 (chéng shì lǜ dì) literally means “urban green land”, which emphasises its land property feature. A third example is the term *institutions*, which could be used to refer to an established/formalised practice. The corresponding term for *institutions* in Chinese is 制度 (zhì dù), which literally means “a crafted measurement, degree, or extent”. It may be argued that the reference for *institutions* in Chinese

contains greater meticulousness. One might have similar observations on the term *citizens*, which corresponds to four different terms in Chinese: 公民 (gōng mǐn) - a person who has the legal right to belong to a particular country, 居民(jū mǐn) - residents, 市民(shì mǐn) - people who live in a city, and 公众 (gōng zhòng) - public audience. This brief showcase of semantics serves as a teaser of contextualisation in this thesis and a foundation for building the theoretical framework.

Term in English	Meaning	Term in Chinese and Pronunciation	Meaning
<b>Govern</b>	To control and direct the public business of a country, city, group of people, etc.	治理 zhì lǐ	To treat and to organise
<b>Costs</b>	1. The amount of money that you need to buy, make, or do something	成本 chéng běn	The <b>foundation</b> needed to establish (something)
	2. The effort, loss or damage that is involved to do or achieve something	代价 dài jià	The <b>sacrifice</b> made to achieve (something)
<b>Urban green spaces</b>	A component of “green infrastructure” and an important part of public open spaces and common services provided by a city	城市绿地 chéng shì lǜ dì	Urban green <b>land</b> (property)
<b>Institutions</b>	1. An established/formalised practice	制度 zhì dù	A crafted measurement, degree/extent
	2. An organisation founded for a certain purpose	体制 tǐ zhì	A social, economic, or political system
<b>Citizen</b>	1. A person who has the legal right to belong to a particular country	公民 gōng mǐn	=
	2. A person who lives in a particular place	居民 jū mǐn	Residents
	/	市民 shì mǐn	People who live in a <b>city</b>
	/	公众 gōng zhòng	Public audience
<b>Civilisation</b>	A state of human society that is very developed and organised	文明 wén míng	The total wealth created by human beings, especially spiritual wealth, such as literature, art, education, science
	A society, its culture, and its way of life during a particular period of time or in a particular part of the world		

Table 4: Semantics matter: examples of key terms for this research and their meanings in English and in Chinese

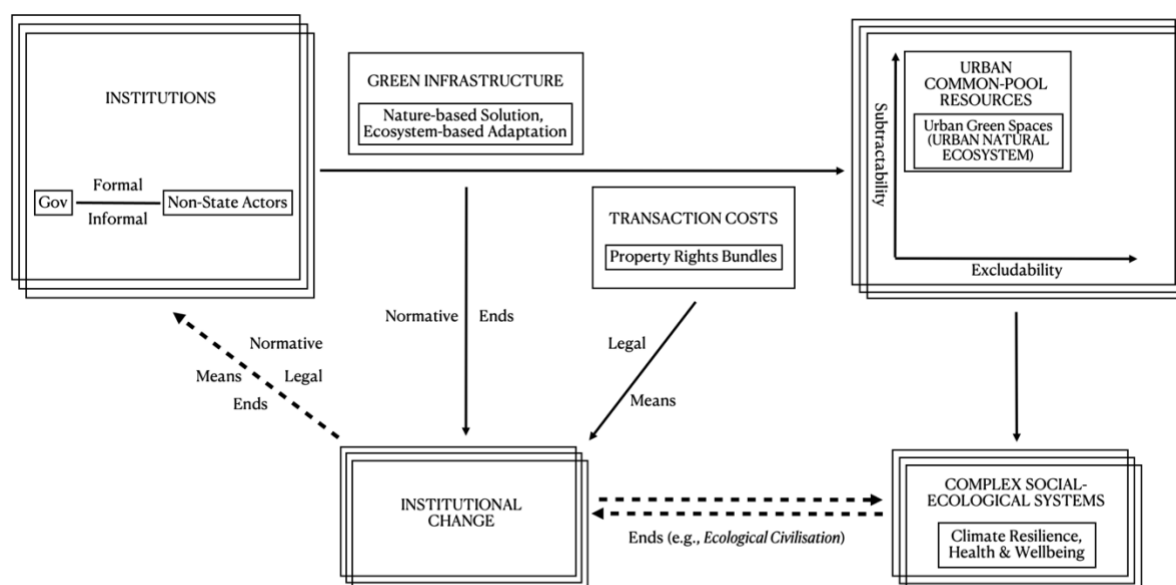
### 3.2 Overview of the Theoretical Framework

Having established the semantic foundation of key concepts used in this research, a theoretical framework outlining the essence of UGS as part of the urban social-ecological systems and centralising the common-pool resource theory is created to understand three empirical UGS governance cases in the natural, social-economic, political, and cultural context of Guangzhou, China, as shown in Figure 3. In a nutshell, UGS are essential part of the urban social-ecological systems, the stock and flows of which are critical for the overall stability of the system, including climate resilience, and health and wellbeing. To manage the stock and flows of UGS as a resource, considering its high subtractability and low excludability, it is best governed as a common-pool resource. The property rights arrangements among the actors of UGS governance influence the transaction costs, which influence actors' interactions, ultimately leading to formal and informal changes in UGS institutions.

The meanings of each box of the theoretical framework (see Figure 3) are as the follows:

- The upper left box shows that governments and non-state actors relate and interact with each other or within themselves through formal and informal institutions, as reasoned in Sections 3.4.3.1 Governance and actors, and 3.4.3.2 Institutions.
- The upper middle left box shows that green infrastructure (GI) includes Nature-based Solutions (NbS), which includes Ecosystem-based Adaptation (EbA), as reasoned in Section 3.3 Urban Social-Ecological Systems.
- The upper middle right box shows that property rights bundles constitute transaction costs. The way different property rights are bundled together influences transaction costs, as reasoned in Sections 3.4.3.3 Property rights bundles and 3.4.3.4 Transaction costs.
- The upper right box shows that urban green spaces (UGS) are a type of urban common-pool resources (CPR), the excludability of which is low, and the subtractability is high. As reasoned in Section 3.4.2 Why urban green spaces are common-pool resources, UGS provides a wide range of ecosystem services for all urban residents. The subtractability of UGS increases as urban population density grow, and land-driven economic development advances. The availability of UGS depends upon the total amount of urban land, which often has a geographical boundary.

- The lower right box shows that the status of complex ecological systems is dependent on its level of urban health and wellbeing and climate resilience, as reasoned in Section 3.3 Urban Social Ecological Systems.
- The lower left box shows that institutional change. The types of institutional change (*means* and *ends*) and the mechanisms (e.g., *normative, legal, formal, informal*) are reasoned in Section 3.4.3.5 Institutional change.
- The layers of the boxes mean different *levels* and *scales*, see reasonings about the *levels* and *scales* of institutions in Section 3.4.3.2 Institutions.



Theoretical framework: Governance of urban green spaces as a common-pool resources for climate resilience, health and wellbeing across scales and levels

Figure 3: Theoretical framework: Governance of urban green spaces as a common-pool resources for climate resilience, health and wellbeing across scales and levels

The causal relations between the boxes of this theoretical framework are as follows:

- The upper part shows that government and non-state actors interact and together govern UGS (which is a CPR), through applying EbA (a type of NbS, which is based on utilising GI) and arranging property rights bundles (to manage transaction costs).
- The right part shows that the results of UGS governance or intervention influence the status of resilience to climate change, urban health and wellbeing, thus influence the stability/quality of the urban social-ecological systems.

- The lower part shows that the degrees of resilience to climate change, health and wellbeing are end goals that contribute to institutional change.
- The middle right part shows that changing how property rights are bundled together constitute legal changes in the institutions, or the institutional change of the means.
- The middle-left part: Applying NbS contributes to achieving the end goal of climate adaptation and resilience enhancement. Changing the way NbS is perceived is a normative or informal institutional change, as reasoned in Section 3.4.3.5 Institutional change.
- The left part: institutional change might further influence the relationships between governments and non-state actors, through legal or normative measures, which might change the means or the ends of the interactions between governments and non-state actors.

The next Section outlines the essence of UGS as part of the urban social-ecological systems, in which trendy policy concepts such as GI, NbS, and EbA are also reexamined.

### **3.3 Urban Social-Ecological Systems**

UGS, such as parks, woods and artificial meadows, ecological corridors, urban wetlands, and other natural ecosystems, are an integral part of the urban natural ecosystems. According to The Economics of Ecosystems and Biodiversity (TEEB) global initiative,<sup>22</sup> UGS provide four essential types of ecosystem services: provisioning, regulating, supporting, and cultural services. Provisioning services include the provision of food, fresh water, medicinal and raw material resources. Regulating services include local climate regulation, air purification, carbon sequestration and storage, moderation of extreme events, wastewater treatment, soil fixation, and pollination. Supporting services include habitats for species and maintenance of genetic diversity. Cultural services include recreation, mental and physical health, tourism, aesthetic appreciation and inspiration for culture, art and design, spiritual experience, and sense of place. In general, the regulating and cultural services play a more significant role for cities than the provisioning or supporting services (Larondelle et al., 2014).

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<sup>22</sup> <http://www.teebweb.org/resources/ecosystem-services/>

The work which involves ecosystem services in research, policy and practice spheres have been popularly referred to through various terms, such as green infrastructure (GI), nature-based solutions (NbS), ecosystem-based adaptation (EbA) in recent years, particularly in urban climate change and sustainability governance, although they have mostly been applied with a rather utilitarian, human-nature dichotomic gesture (Welden et al., 2021). The European Environment Agency defines GI as ‘a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services’ in both rural and urban settings.<sup>23</sup> ICLEI – Local Governments for Sustainability defines NbS as “actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.” (ICLEI, 2017). In the Nature-based Solutions Initiative of the University of Oxford, NbS is defined as “actions that work with and enhance nature to help address societal challenges.”<sup>24</sup> While the IPCC Assessment Report 5 *Climate Change 2014: Impacts, Adaptation, and Vulnerability* lists many types of EbA options, including soil conservation, ecological restoration, afforestation and reforestation, GI and ecological corridors, fisheries control and co-management, seed and gene banks (IPCC, 2014). The conceptual scope of these three terms is: GI > NbS > EbA, as GI refers broadly to all plant species and the subecosystems that thrive around them, while NbS focuses on instrumentalising certain subecosystems to solve problems, and EbA even much more specific. These definitions and references share the common wish for yielding the most benefits from the ecosystems possible to tackle natural or man-made environmental challenges and serve people better, which shows an instrumental or technocratic approach to various extents. Besides, some scholars argue that the definition of NbS is rather vague, overarching with other similar concepts and therefore impractical (Nesshöver et al., 2017), and that the ecosystem services that the NbS concept is based on are not always beneficial (e.g., human allergic reactions to pollens and insects) (Lyytimäki, 2013).

For some reason, these terms recently gained popularity particularly in urban policy and practice. The GI approach is endorsed by the C40 City Climate Leadership Group for climate

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<sup>23</sup> European Commission, 2013, Green Infrastructure (GI) — Enhancing Europe’s Natural Capital – COM (2013) 149. Available at: <https://www.eea.europa.eu/themes/sustainability-transitions/urban-environment/urban-green-infrastructure/what-is-green-infrastructure>

<sup>24</sup> The Nature-based Solutions Initiative: *What are Nature-based Solutions?* Available at: <https://www.naturebasedsolutionsinitiative.org/what-are-nature-based-solutions/>

change adaptation. The emerging concept *Sponge City* and recent application of nature-based flood water treatment schemes in Chinese cities is one type of NbS. It means that the city can be like a sponge and has good "flexibility" in adapting to environmental changes and responding to natural disasters. Absorb, store, seep, and purify water from time to time, and "release" the stored water when needed and make use of it. The concept *Sponge City* resonates with two other concepts – GI and Low Impact Development (LID) technology (Jia et al., 2017). The term LID refers to engineering practices that "use or mimic natural processes that result in infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat."<sup>25</sup> The Global Assessment Report produced by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has also endorsed UGS as possible pathway to transform urban biodiversity and as a urban nature solutions to climate change impacts (IPBES, 2019).

While these terms might be in various ways limited, they share a common intention of trying to operationalise what essentially are complex ecological systems to address these interconnected environmental problems for greater social wellbeing in less artificial manners. Essentially, urban areas are hot spots of complex and dynamic interactions across ecological, social, cultural and economic systems, which scholars have referred to as 'urban social-ecological systems' (SES) (Elmqvist et al., 2019; Frank, 2017; Li et al., 2014; Liu and Gatzweiler, 2020; McPhearson et al., 2016). This definition is more holistic compared to the previously mentioned ones – GI, NbS, and EbA, and conveys the image of nature-human coexistence as integrated, complex living organisms (Kuzevanov and Gubiy, 2014). UGS is part of the natural ecosystem, which, together with man-made ecosystems, compose the entirety of an urban social-ecological system. As Figure 4 shows, if managed by collaborative agents (people and organisations) through *integrative institutions*,<sup>26</sup> a diverse range of services produced by both the natural and man-made ecosystems will together contribute to enhancing the climate resilience and human wellbeing of the entire urban social-ecological system; while *segregative institutions* would do the opposite (Armson et al., 2012; Hartig et al., 2014; Panno

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<sup>25</sup> Environmental Protection Agency (EPA). n.d.a. "Urban Runoff: Low Impact Development" Available at: <https://www.epa.gov/nps/urban-runoff-low-impact-development>

<sup>26</sup> According to Hagedorn's (2008; 2015) 'Institutions of Sustainability' theory, institutions can also be distinguished as *integrative institutions* and *segregative institutions*. *Integrative institutions* are the ones that can reduce unintended externalities that burden the health and wellbeing of vulnerable groups in society or the environment. For more, please see Section 3.4.3.5 *Institutional change*.

et al., 2017; Tyler and Moench, 2012; Zölch et al., 2017). Understanding the essence of UGS as part of the complex urban social-ecological systems is critical to see where UGS stays a resource in the entire system, how its stock flows within the system, and how to manage it.

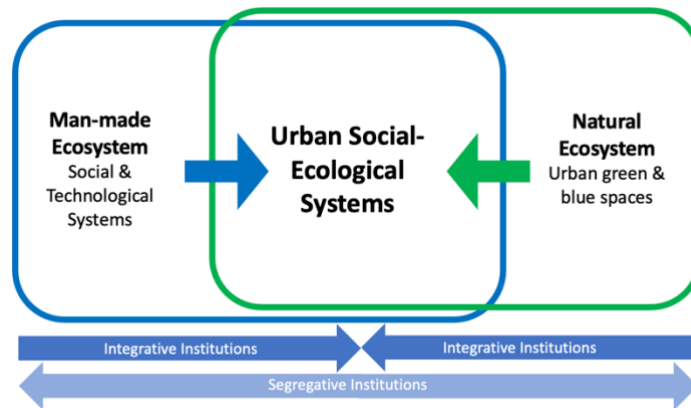


Figure 4: Urban social-ecological systems and effects of integrative and segregative institutions

Source: adapted from Liu and Gatzweiler 2020.

### 3.4 The Common-Pool Resource (CPR) Theory

This section zooms in to establish the theoretical foundations for understanding how to manage urban green spaces (UGS) as a resource as a common-pool resource (CPR). It is composed of four parts:

- 1) What is a common-pool resource (CPR)
- 2) Why UGS are CPRs
- 3) Critical elements to be considered in CPR governance, and
- 4) an analytical framework to analyse how these elements determine CPR governance in empirical settings.

In a nutshell, the CPR theory contradicts Hardin's "tragedy of the commons" model, and convenes that: compared to state-dominated public or market-oriented private approaches, goods that are non-excludable to community members but are rivalrous in consumption can be governed more sustainably in small scales and through collectively-designed rules including adequately arranged property rights, monitoring, and sanctions, despite that humans are

supposedly selfish and boundedly rational (Ostrom, 1990, 2005; Schlager, 2004). The CPR theory is developed mainly by Nobel Economics Laureate of 2009, Professor Elinor Ostrom, together with her collaborators, backed by decades of empirical research on resource governance across contexts (e.g., see Chhatre and Agrawal, 2009; Coleman and Steed, 2009; Gibson et al., 2005; Ostrom and Nagendra, 2006).

#### ***3.4.1 What is a common-pool resource (CPR)?***

In Ostrom's own words, CPR refers to "a natural or man-made resource system that is sufficiently large as to make it costly, but not impossible to exclude potential beneficiaries from obtaining benefits from its use" (Ostrom, 1990: 30). Ostrom (1990) established the concept of CPR to improve the broad distinction of goods as being public or private goods (see Figure 5). Essentially, all economic goods and services can be distinguished by two dimensions: excludability and subtractability. Excludability refers the quality of excluding users from consuming certain goods, while subtractability refers to the quality of rivalry for one user vs. for other users, or in other words, the impact of the consumption by one user on the quantity available for other users. Public goods, also referred to as 'social goods' or 'collective consumption goods', are those that have both low excludability and low subtractability (Samuelson and Buchanan, 1965; Bowen, 1943; Musgrave, 1939; Samuelson, 1954 & 1955). This means, the cost of extending the service of such goods to an additional person is zero, and it is impossible or expensive to exclude individuals from enjoying, or can only exclude them at a very high exclusion cost (Nordhaus, 2009). Air, water, and soil are typical examples of public goods. Peace and security of a community are also public goods. Private goods, on the contrary, have high excludability and high subtractability. This means the governance options are rather limited to individuals or groups that own them, with little possibility for governance disputes.

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Figure 5: Four basic types of goods

Source: adapted from Ostrom, 2005: 24

Essentially, the goal of governing public goods is to achieve a balance between the supply and demand ends of goods and services. This balance builds on four assumptions: 1) perfect information flow, 2) zero opportunity costs, 3) zero stock externalities, and 4) rational decision-making (Nordhaus, 2009; Samuelson and Nordhaus, 2010). However, neither state or market governance approaches to public goods have always been successful in addressing social and environmental externalities due to the following factors:

- 1) *Information mismatch*. The *Laissez-faire* (French: “allow to do”) market economy theory assumes buyers and sellers are completely informed about a transaction they make, but in fact, information flow in any real-world transactions, in general, is imperfect.
- 2) *Opportunity costs*, which refers to ‘the value of the most valuable good or service forgone’ (Samuelson and Nordhaus, 2010: 139). For example, deforestation of a forest area rich of biodiversity for timber bears the opportunity cost of missing the carbon sequestration and biodiversity maintenance services that the forest has to offer. A growth-oriented and high-emission urban development model bears the opportunity costs of public health and wellbeing, quality of the urban environment, and urban biodiversity.
- 3) *Stock externality*, which refers to the impact of negative externalities that accumulates over time (Samuelson and Nordhaus, 2010). For example, Coastal land resources are a good example. Coastal erosion due to sea-level rise and intensified storms are results of global warming. They affect both the quality and the quantity of coastal ecosystems and coastal population negatively, both of which accumulate slowly over time. The consequences of coastal erosion – loss of coastal biodiversity and human settlements – are often long-lasting

and maybe even irreversible. The stock externalities of public goods also project uncertainties into time, spatial, and political dimensions (Nordhaus, 2009). On the time dimension, for example, it is nearly impossible to estimate the impact of global warming on coastal land resources by 2100 accurately. On the spatial and political dimensions, for example, it is challenging to estimate the impact of China's CO<sub>2</sub> emission on the potential flash flood damages in the Himalaya region. National governments have the legal and political powers to arrange institutions to internalise negative externalities, but only within their spatial/territorial boundaries.

4) *Bounded rationality* (Ostrom, 1990; Samuelson and Nordhaus, 2010). Arrow (1974: 16) argues that economists often "...thinks of himself as the guardian of rationality, the ascriber of rationality to others, and the prescriber of rationality to the social world." In reality, economists and government officials make judgements and decisions the same way as any lay people in imperfect conditions that prevent them from thinking things through, such as constraints of earlier choices, undiscovered, ignored, or misunderstood facts (Rothman, 2019). Simon (1956 & 1990) refers to this imperfect human cognitive conditions as *bounded rationality*. Both market and state approaches tend to function with rational assumptions about information flow and propensity for efficiency, which led to the spillover of externalities (Chambwera et al., 2015; Kostka, 2015; Samuelson and Nordhaus, 2010). The failures to govern many natural resources sustainably largely are due to the inadequate consideration of the high subtractability of many resources, and the above assumptions taken by the conventional state-oriented or market-oriented approaches.

Although Ostrom (1990) came to create the term common-pool resources (CPR), the notion of 'commons' was first defined by Garrett Hardin through his notable essay *The Tragedy of the Commons*. Nonetheless, Hardin's attempt has been widely criticised for being simplistic and proposing market-oriented solutions which were not able to mitigate social and environmental externalities. Compared to public goods such as peace and security of a community, or knowledge, CPRs have the same non-excludability feature as public goods, however, unlike public goods, the subtractability of CPRs is high (again, see Figure 5). Ostrom distinguishes many non-excludable but rivalry goods, such as forests, water systems, fisheries, and the global atmosphere as CPRs. These natural resources, once used by one user, inevitably becomes less available for others; and yet, they are of immense importance for human survival on Earth. Furthermore, both public goods and CPRs face the problems of free-riding or opportunism.

The costs of excluding other potential users for both public goods and CPRs are high (Ostrom, 1990). Despite facing similar free-riding issues, CPRs are, however, more precarious than public goods, as the subtractability of CPRs is lower than that of public goods. Studies on the commons emerged in the mid-1980s as the International Association for the Study of the Commons was established to dedicate on this rising subject. The field gained accelerated interests, particularly as Ostrom won the Nobel Prize in Economics in 2009. Since then, studies using the *Commons* lens has propagated from the initial focus on the environment or natural resources, such as forestry and irrigation systems, to a diverse range of items such as conservation sites, climate change, and many other non-traditional CPRs (Wang, 2017). The *commons* perspective in this thesis is particularly relevant in the context of global climate change impacts and sustainability challenges, which are complex and uncertain, with diffused benefits which discount in the long-term, and transcend sovereign boundaries.

#### **3.4.2 Why urban green spaces are common-pool resources?**

UGS can be considered as a type of CPRs crucial for urban health and climate resilience. as Wendell Berry (1987) portraits: “... *is a commonwealth: a place, a resource, an economy. It answers the needs, practical as well as social and spiritual, of its members – among them the need to need one another.*” Viewing UGS resources from the *Commons* perspective responds to the big picture in which not only the needs of the current generation are considered but also those of the future generations. UGS such as urban parks, urban wetlands, ecological corridors, and street trees, have both the low excludability and high subtractability characteristics. UGS users are urban residents who use them for physical exercises, better air, water and soil quality, contact with nature, and mitigation of the impacts of extreme weather such as heatwaves and urban inundation. UGS users could also be urban land users, such as the local government, enterprises, and urban residents. UGS is a non-excludable resource with the provision of a range of ecosystem services for all urban residents. The subtractability of UGS increases as urban population density grow, and land-driven economic development advances. The availability of UGS depends upon the total amount of urban land, which often has a geographical boundary.

Similarly, urban land also shares the characteristics of CPR. Economists deem land resources as the single most valuable natural resource for both its scarcity and significance for the production of almost all businesses (Samuelson and Nordhaus, 2010). Urban land has a

pronounced scarcity, which makes it essential to produce goods and services of adequate quantity and quality within available urban land spaces, including vital ecosystem services.

Urban infrastructures are increasingly recognised as strategic arenas for climate change action (Broto, 2017). Within this context, UGS is increasingly conceptualised as a CPR globally and the term ‘urban green commons’ emerged from the perspective of property rights to address the governance issues of UGS within various land ownership conditions (private, public, club, or hybrid) (Colding et al., 2013) In China, the knowledge gap of CPRs is even more evident. **Despite being a country with highly diverse and abundant CPRs, including watershed, forests, environment, regional ecosystems, and governance practices in the world, scientific research from the perspective of commons in China or about Chinese CPRs are lacking, and much less has been communicated within the international scientific community (Wang, 2017).**

### *3.4.3 Critical elements in common-pool resource governance*

#### *3.4.3.1 Governance and actors*

The concept of *governance* has come to be defined each time more comprehensively in literature. The Commission on Global Governance (1995) broadly defines *governance* as the sum of the many ways in which individuals and institutions, public and private, manage issues. While the Natural Resource Governance Institute (2017) works with the definition of *governance* emphasising the role of state actors: “the form of political regime or the manner by which authority is exercised in the management of a country’s social or economic resources for the public good.” The World Bank (2017) defines *governance* more comprehensively as “the process through which state and non-state actors interact to design and implement policies within a given set of formal and informal rules that shape and are shaped by power - the ability of groups and individuals to make others act in the interest of those groups and individuals and to bring about specific outcomes”. Similarly, the UN-Habitat sourcebook on *Integrating Health in Urban and Territorial Planning* defines governance comprehensively as “the political and administrative management of places that involves partnerships (formal or informal) between governments at different levels but also the private sector and civil society organisations” (Grant, 2020).

More broadly speaking, *governance* is basically the processes and outcome of decision-making as a result of interactions between state and non-state actors according to the rules given. State actors refer to governments of different administrative levels. American economist Arrow (1974: 25) defines *government* as “one of a large number of collective institutions which distinguishes itself from others primarily by its monopoly on coercive power, although even that monopoly is not absolute.” State actors seek rent through providing a series of services, such as protecting property rights, providing public services, and military defense. In this perspective, state actors, to their best capabilities, make policies based on pragmatic calculations of costs and benefits in economic, social, environmental, and political spheres. Non-state actors, on the other hand, encompass individuals, associations, ethnic groups, organisations, and institutions across regional and local levels that are not governments. Non-state actors influence state decisions directly through interactions with states or indirectly through the dynamics in between each other, such as including information sharing, capacity building or even competing (Andonova et al., 2009). Non-state actors play a significant role in urban planning and environmental governance across levels (Biermann et al., 2010). In fact, non-state actors - urban planners, developers, and citizens are also considered to be the pragmatic ‘economic man’ who seek to maximise their own benefit-cost ratios (environmental, social, or economic).

### 3.4.3.2 Institutions

*Institutions* are crucial for urban sustainability governance as they structure interactions within governments as well as between government and non-state actors by reinforcing norms and commitments, facilitating coordination, and promoting cooperation and implementation (Bridges, 2016; Latour and Douglas, 1988; World Bank, 2017). One of the most widely cited definitions of *institutions* is by American economist Douglass North, Nobel laureate in Economics (1984): “(*institutions* are) contractual arrangements between principals and principals and agents, made to maximise their wealth by realising the gains from trade as a result of speciasation (including speciasation in violence or coercion).” In North’s definition, an agent is someone who explicitly or implicitly gives up control over his/her own decision-making power and submits authority to a principal. For example, a worker to an employer or manager, a bureaucrat to a government official are relationships of agents to principals. North extended the definition of *institutions* as “the humanly devised constraints that structure political, economic and social interaction.” North (1991) distinguishes institutions as

containing both *informal institutions*, such as strategies, ethics, norms, customs, sanctions, taboos, traditions, and codes of conduct, and *formal institutions*, including constitutions, laws, property rights, legal statements, and policies” Hodgson (2006) puts *institutions* more simply as “systems of established and embedded social rules that structure social interactions.” Ostrom defines *institutions* as “the prescriptions that humans use to organise all forms of repetitive and structured interactions including those within families, neighbourhoods, markets, firms, sports league, churches, private associations, and governments at all scales.” (2005: 3). According to Ostrom, institutions exist whenever interdependent individuals act in an organised way, their high complexity is a result of the diverse situations in contemporary life. The variations in levels, scales, and types of human organised social life make institutional arrangements, or the rules of the game, highly complex.

Reasonably designed, functional institutions can structure human behaviour and actor interactions and generate efficiency in a long-lasting way (Vatn, 2005). Acemoglu and Robinson, the authors of *Why Nations Fail* (2012), explained the origin of the rise and fall of nations through the study of various countries throughout different eras. They argue that institutions of a country can directly lead to its prosperity or turmoil. *Functional or inclusive institutions* can promote the research and development of new technologies and are the foundation of sustainable economic development. *Extractive institutions*, however, even if they promote economic growth, can only lead to a temporary improvement in efficiency, which is difficult to sustain. In urban planning, it is not uncommon to see technically sound planning ideas fail to be implemented and sustained in practice, as planners often neglect or it is out of their professional reach to make institutional adaptations accordingly (Zhao, 2005).

Besides, the dimensions of *levels and scales* can impact the effectiveness of institutional arrangements fundamentally. Analysis of urban environmental governance necessitates understanding interactions among actors and the impacts of institutional arrangements on them across these two dimensions, due to the complexity of institutions and actors in broader field settings (Ostrom, 2010). The *levels* of institutions are generally related to the structures, administrative or legislative, through which governments organise non-state actors to participate in social and economic activities and interact with the environment (Cash et al., 2006). Administrative levels include the levels of nation, province, and local levels such as city, district, town, township, and village. Legislative levels include constitutions, laws, regulations,

and context- or case-specific operating rules. The *scales* of institutions commonly related to the dimensions of time, geography, population, and quantities of goods and services. Gibson et al., (2000) define *scale* as “the spatial, temporal, quantitative, or analytical dimensions used to measure and study any phenomenon” and level as the unit of analysis that are “located at the same position on a scale.” For example, climate change impacts and biodiversity loss can appear locally, but can extend to global scale thorough cause-and-effect-chains and transcend existing administrative territorial jurisdictions or levels (Newig and Fritsch, 2009). Besides, institutions of resource use or environmental governance at local levels in general are embedded in and influenced by institutions at regional, national, and global levels. Increases in administrative levels and geographic scales lead to increased complexity and uncertainty, both in ecological conditions and governance operations (Olsen et al., 2011). In climate adaptation, multilevel institutional coordination between different political and administrative levels in society is increasingly challenging in both developing and developed countries (Glaas and Juhola, 2013; Rodima-Taylor et al., 2012). Establishing a multilevel institutional coordination mechanism between different political and administrative levels is a crucial for promoting urban adaptation planning and implementation outcomes (Engle and Lemos, 2010; Glaas and Juhola, 2013; Revi et al., 2014). In addition, building institutional capacity at the local level, e.g., in local governments, is critical too (Mimura et al., 2015).

Ostrom (2015) summed up eight common characteristics (in Ostrom’s original words, “design principles”) in long-enduring CPR governance regimes. Most successful CPR governance cases have:

- 1) Clearly defined boundaries, including resource boundaries and user boundaries,
- 2) Proportional equivalence between benefits and costs for all actors (individuals or groups),
- 3) Collective-choice or public participation arrangements,
- 4) Effective mechanisms of monitoring,
- 5) Graduated sanctions of actors who violate the rules collectively agreed upon,
- 6) Effective conflict resolution mechanism via affordable means,
- 7) Minimal recognition (by state-actors, e.g., upper-level governments) of the rights to organize, and lastly,
- 8) Nested enterprises in which the resources in governance are considered part of a larger ecosystem or the governance activities are integrated into a multi-level governance scheme.

Over the years, economists have concluded that the market oriented approach is incapable of governing common-pool resources effectively, for it 1) generates negative externalities in the process of goods and services distribution, 2) quantifies the costs and benefits of the diverse ecosystem services narrowly, which undermines ecological and community values, particularly of those socially and economically underprivileged changes constantly in economic value; and 3) constantly changes in economic value (Gatzweiler, 2003; Samuelson and Nordhaus, 2010; Chambwera et al., 2015). Besides, the model of the liberal economy often proclaims that technological means (e.g., direct air carbon capture and storage, abbreviated DACCS) and economic progress can overcome biophysical limitations of the Earth or any reckless, exploitative, or even violent human behaviours.

Thus, the role of public authorities gradually gained significance in natural resource governance for their potential to regulate the market-driven distribution of goods and services to reduce uncertainties, inequities and behavioural biases (Chambwera et al., 2015). Public authorities are considered as pragmatic and self-interested organisations, which are of no exception but a member of the numerous actors in the market whose motives and behaviours obey the rules of the market game and to gain the maximum surplus (Zhao, 2005). Arrow considers authority as “the centralisation of decision-making” and can serve “to economise on the transmission and handling of information” (1974: 69). For example, a direct cost-benefit focused approach would assess the risks of flooding related to intensified tropical cyclones and storm surge in dense urban areas through the direct costs of damaged infrastructure, interruption of productivity, and hospitalisation. A progressed, state-supervised version of disaster impact assessment could go one step further to consider the social costs of the underprivileged communities as well as the indirect costs of recovery induced in the foreseeable future. However, even a more progressed, state-supervised assessment could not provide 100% of information certainty or availability over time due to the changing dynamics in the complex social-ecological systems. As examined more recently with community-based conservation, simple policy prescriptions to entrust resources to a state actor, a free market, or even to decentralised user groups may also fail, if institutional complexity of levels, scales, objectives, actors and the social contexts are not appropriately taken into account (Berkes, 2007; Meinzen-Dick, 2007).

3.4.3.3 Property rights bundles

There are two major problems associated with CPR governance: overexploitation and free riding. Overexploitation occurs easily in situations where the difficulty of excluding other beneficiaries is high. Free riding occurs when those who benefit from the CPRs do not pay for them, which results in under-provision of those resources. For example, a well, constructed by villagers to fetch water, has costs of construction and maintenance. When some villagers do not want to share the maintenance cost with other villagers, the well could go into a mal-maintained state and eventually become dried up.

These problems can be resolved by defining and clarifying *property rights* (Coase, 1992; Ostrom et al., 1961). Alchian (1989) defines *property rights* as socially enforced rights to select uses of an economic good. More specifically, North (1990) considers *property rights* as rights that individuals or groups appropriate over their own labour and the goods and services they possess. Zhao (2005) argues that the essence of the use of CPRs is not the exchange of goods and services itself, but the exchange of a set of *property rights*. The value of the goods or services traded also depends on the range or the clarity of the property rights that are transferred in a transaction (Coggan et al., 2010; McCann et al., 2005). Demsetz (1974) and Coase (1998) consider that the prerequisite for all human interaction activities are institutional arrangements, which are essentially a kind of power to exercise certain behaviours between individuals or groups. Building on the same line of thought, Zhao (2005) argues that the primary tasks of institutional intervention are to define the property rights of individuals or groups to resources, stipulate what they can do, and then maximise the total social product through the transaction of their property rights.

Resources are often classified into different types, partially depending on their ownership and partially on other property rights. CPRs can be owned and managed as government, private, community properties, or owned by no one (Bromley, 1986). Through extensive meta-analysis of existing field cases, Ostrom (2005) and her colleagues have identified five types of property rights that individuals or groups using a CPR:

- (1) Access – the right to enter a specified property,
- (2) Withdrawal – the right to harvest specific products from a resource,
- (3) Management – the right to regulate internal use patterns and to transform a resource

- (4) Exclusion – the right to decide who will have access, withdrawal, or management rights, and
- (5) Alienation – the right to lease or sell any of the other four rights.

The concept of CPRs and these identified property rights is now widely accepted by scholars who have studied resource management issues in diverse systems around the world (Degnbol and McCay, 2007; Paavola and Adger, 2005; Trawick, 2001). Identifying and acting upon the right property rights are critical to achieving success in resource management. As Zhao (2005) exemplified, many historical districts and traditional buildings with the best construction quality in Beijing deteriorated drastically within the last few decades, mainly due to the misplacement of property rights. Residents, who are entitled to access and maintain these buildings and are in the best position to do so, were excluded from such rights. Property rights arrangements are critical for effective coordination and fair, efficient distribution of resources among the population for sustainability (Heltberg, 2002).

Ideally speaking, the property rights bundles in UGS governance should be considered in two folds. The first is associated with the urban land resources and the second is associated with the ecological resources - the ecological networks, the ecosystems, plus the goods and services that these ecosystems provide. In the case of private urban land properties, the rights to the land are mostly equivalent to those to the ecological resources that grows directly on it. For public land, the rights of ownership could belong to a public entity, such as a state organisation, but the ecological resources and the ecosystem goods and services on public land could be private or communal, and the rights to manage could be attributed further to other entities. Investigation into the property rights of UGS necessitates recognition of the complex property rights bundles to both 1) urban land, which could be public, private, or club lands (e.g., residential compounds), and 2) the ecological resources within the same geographical boundary. In the CPR theory, communities who are the most direct bearers of climate change consequences and access UGS for physical and mental health and wellbeing purposes, with the respective property rights attributed among actors in proper levels and scales, can organise an efficient, sustainable UGS governance regime. The institutional arrangements in urban planning are, in essence, distributions of property rights among actors. If property rights are well defined, particularly when there are few affected parties, negative externalities could be avoided more easily (Samuelson and Nordhaus, 2010).

3.4.3.4 Transaction costs

In practical terms, economic activities involve costs in many processes to soothe the political or economic relationships and interactions between individual or group actors, e.g., the process of searching for and analysing information, reaching and implementing an agreement (Vatiero, 2020). In many cases, the exact costs of a transaction are not easily quantifiable, but the concept *transaction cost* serves the purpose of informing the imperfection of transactions. Coase initially introduced the concept of *transaction costs* to explain the emergence of firms, or the internalisation of production of a particular good or service, as driven by the need to avoid or reduce costs included in the price of the good or service, such as costs of search and information acquisition, bargaining or negotiation, as well as enforcement, access to new markets, and many others (Coase, 1937 & 1960; Williamson, 1979). Another institutional economist Douglass North defines *transaction costs* as “the costs of specifying and enforcing the contracts that underlie exchange and therefore comprise all the costs of political and economic organisation that permit economies to capture the gains from trade” (North, 1984). North estimates the percentage of transaction costs in the gross national product (GNP) in advanced Western countries to be as much as 50%. The concept of *transaction costs* redirects the core principle of economic activities from obtaining the largest economic gains to reducing transaction costs. It helps organisations make decisions not only based on weighing the value of what is obtained but also the value of what is sacrificed to obtain it and choose for the economically efficient option (Chambwera et al., 2015).

Broadly speaking, when multiple actors or actor groups are involved in a decision-making setting, the *transaction costs* can also be viewed as the costs to achieve agreement or consensus, see Figure 6. Situation A and B represent decision-making situations in which the costs to achieve consensus is assumed manageable. Situations C and D represent situations in which the costs to achieve consensus is assumed beyond manageable. Situations A and C are when the differences of interests or information among actors or organisational members influence the costs more than the quantity of interests or information. In situations A and C, there is more drive for authority and less room for consensus seeking. In Situations B and D, the quantity of interests or information among actors or organisational members influences the costs more than differences of interests or information. In these circumstances, there is less drive for authority and more room for consensus seeking. The way to promote actors in a decision-making setting

to interact towards consensus-seeking is to stay within the ideal quantity-versus-difference ratio of interests or information among actors. Situation B represents such a ratio. For Situation A, communication is needed to reduce the differences of interests or information for cost-benefit sustainable consensus-seeking. For Situation C, communication is needed to reduce the differences of interests or information, besides, down-sizing the number of actors or organisational members is also needed for cost-benefit consensus-seeking. For Situation D: down-sizing is proposed to reduce the quantity of interests or information to make the consensus costs manageable.

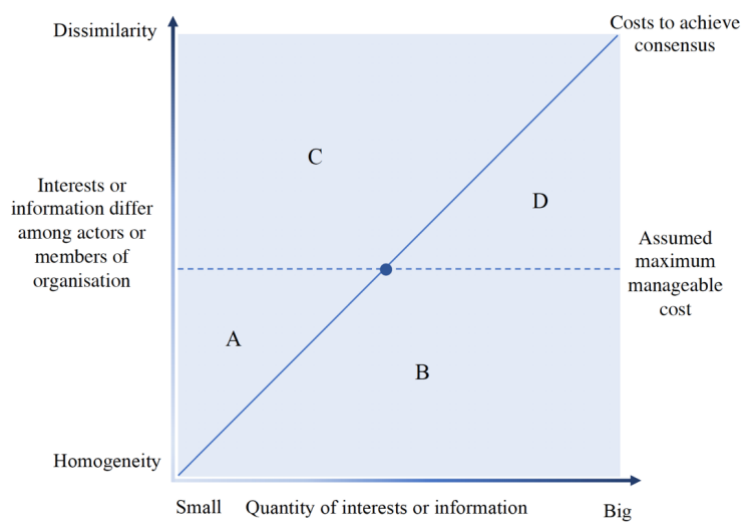


Figure 6: Costs to achieve consensus dependent on the quantity and similarity of interests or information (and thereby power) between actors

State actors are pragmatic actors who also pursue the maximum benefits within environmental, social, and political spheres. At times when transaction costs are implicit or hard to detect, it is often due to the existence of hierarchies which are effective in allocating efficiency (Coase, 1937). Due to the universality of uncertainty and bounded rationality, contracts, or deals, decisions, are necessarily incomplete (Williamson, 1977). In these occasions, hierarchy serves to construct a superior-subordinate relationship through which *transaction costs* are distributed or disseminated along with the downsizing of scales and levels. At least two actors, individuals, or groups, are involved in any transactions. This is also a prerequisite for institutions to emerge. Therefore, some scholars also refer to *transaction costs* as *institutional costs* (e.g., Cheung, 1989). Ostrom (2010) and Schlager and Heikkila (2011) suggest that the keys to reduce

transaction costs among large groups of individuals when coping with complex social dilemmas are to communicate and make context-appropriate rules collectively.

In climate change mitigation and adaptation, a major transaction cost is information acquisition, e.g., the technical challenge to obtain updated climate and weather data or access to the existing one, or to quantify adequately the benefits of UGS for the ecosystem services they provide (Cimato and Mullan, 2010). As a public good, information suffers the under-provision problem by private actors, hence requires public authorities to support its procurement and dissemination, e.g. through research funding (Fankhauser et al., 1999; Trenberth, 2008). *Adjustment cost* represents another barrier, especially in the presence of uncertainty and learning. Fankhauser et al. (1999) define *adjustment costs* as a barrier to early capital replacement to adapt to a different climate. Kelly and Kolstad (2005) define *adjustment cost* as the cost incurred while learning about new climate conditions. These definitions suggest that *adjustment cost* can represent a significant share of climate adaptation costs. *Adjustment cost* also includes the cost of defining the property rights to climate mitigation benefits and costs (Libecap, 2014). In urban planning, analysis mainly focuses on two types of transaction costs, one is *technological cost*, e.g., when it involves engineering techniques or technologies, and the other one is *institutional cost due to the mismatch or imperfect flow of information*, as well as due to the credibility of agreements, or rules, such as property rights arrangements (Ho, 2017; Zhao, 2005). However, despite the theoretical value of *transaction cost*, how to measure it accurately for effective policy making often remains a methodological challenge.

#### 3.4.3.5 Institutional change

##### **Types and mechanisms of institutional change**

Institutions are dynamic and evolutionary by nature, and they change over time. North (1990: 3) notes that, as institutions structure incentives in human interactions in political, social, and economic spheres, “institutional change shapes the way societies evolve through time and hence is the key to understanding historical change.” *Institutional change* refers to the innovation and breakthrough of an institutional framework. *Institutional change* “typically consists of marginal adjustments to the complex of rules, norms, and enforcement that constitute the institutional framework” (North, 1990: 83). Institutional change is a result of actors’ interactions within given institutional arrangements over time. Different institutional arrangements expand or limit the choices and behaviours of actors.

Broadly speaking, institutional change can be distinguished as *process-oriented* or *goal-oriented*, or in other words, institutional change of the *means* or the *ends*. The common-pool resource theory tends to focus on the *process-oriented* institutional changes. Blomquist and Ostrom (2008) define *institutional change* as entailing institutional design, assessment, and modification and propose that it necessarily takes place within the constraints and opportunities afforded by existing institutional arrangements. North (1990) argues that the process of institutional change could be either *discontinuous* or *incremental*. While a *discontinuous change* of formal institutions might occur overnight because of political decisions, *incremental change* often refer to informal institutions such as tradition and cultural norms. In addition, depending on the actor(s) who induce the process of change, institutional change could be distinguished as *bottom-up* or *top-down* (North, 1991). *Bottom-up* institutional change occurs when the change is induced by demand, e.g., changes that are initiated, organised and realised by individual or group actors as they are attracted by the opportunities to profit from a potential new institution. While *top-down* changes occur when the change is induced by supply, e.g. when authorities introduce changes in the form of regulations and law (Wegerich, 2001).

One example of institutional change of the *means* or that is *process-oriented* is the governance shift towards *polycentric governance* from state or market-oriented approaches. The quest of polycentric governance focuses on the means - how to approach a subject, a resource, or a service, to achieve higher efficiency in all the desired dimensions. Institutional change of the means does not change the broader institutional context, or deeper lying institutions which define the ends, e.g., fundamental values or principles. The concept of *polycentric governance* builds on the premise that social-ecological systems, e.g., how people organise resource use of various scales across local, regional, and national levels, are becoming increasingly interconnected and complex (Berkes, 2006; Blomquist, 2009). Ostrom et al. (1961) and Ostrom (2005) define the concept of *polycentricity* as connotating multiple centres of decision-making which are formally independent to one another and can function together within interdependent systems depending on contexts or cases. *Polycentric governance* emphasises the collective gesture of community organisation and the dispersed in many small groups or communities surrounding the access of goods and services (Nagendra and Ostrom, 2012). Another example of process-oriented institutional change of the *means* is the people-centred health approach endorsed by the World Health Organisation (WHO), which "consciously adopts the perspectives of individuals, families and communities, and sees them as participants

as well as beneficiaries of trusted health systems that respond to their needs and preferences in humane and holistic ways." (WHO et al., 2015: 10-11). According to the WHO, people-centred health services need to reflect a set of core principles, such as comprehensiveness in responding to people's evolving health needs and aspirations, equity, sustainability, prevention, empowerment, and systems-thinking. The WHO emphasises "the right care at the right time in the right place" (WHO et al., 2015: 14). The definition by the WHO for its member states in health service provision, hence, is one that calls for institutional change primarily on the *means* of public service. The *means* is the inclusion of citizen's rights both to health benefits and to participation.

The other broad type of institutional change is *goal-oriented*, or institutional change of the *ends*. This type of institutional change focuses on the end goals and objectives more so than on the process or the means to achieve certain change. For example, according to Hagedorn's (2008; 2015) 'Institutions of Sustainability' theory, institutions can also be distinguished as *integrative institutions* and *segregative institutions*. *Integrative institutions* are the ones that can reduce unintended externalities that burden the health and wellbeing of vulnerable groups in society or the environment, such as pollution, extinction, and degradation (McPhearson et al., 2016). In this circumstance, the degree of *institutional fit* for the end goal (such as urban health, climate adaptation) is high (Epstein et al., 2015; Young, 2002). *Integrative institutions* can evolve towards *segregative institutions* or *institutional mismatch*, when external environments change, resulting in changes in the end goals and objectives, thus stimulating institutional change. Neale (1993) considers that institutional change occurs when actors learn, adapt and respond accordingly by putting forward demands for new institutions in order to achieve the expected increased benefits. Only when the expected benefit is greater than the expected cost, actors will make adaptation or changes to existing institutions (North, 2012; Zhao, 2005).

In some cases, the *people-centred* approach may also focus on the *ends* of development. According to Robertson (1994), a member of the People-Centred Development Forum, people-centred development is one that facilitates the transition to a new civilisation a sharp contrast to more familiar forms of development that have taken their mission to be the Euro-American civilisation and modernisation. In this Euro-American development model, wealth is augmented by ever-increasing exploitation of the Earth, governed by impersonal systems, and possesses greater legitimate power than people. According to Korten (1987), *people-centred*

development strategies emphasise the need to strengthen institutional capacity to support greater local control, accountability, and self-reliance regarding access to physical and financial resources. The *people-centred development* defined by the People-Centred Development Forum is one example that focuses on the *end* goal of development. In this model, how development is achieved is not necessarily as relevant as it facilitates the arrival of a status that is the opposite of the existing one. Similarly, scholars argue that an overarching goal or “ultimate end” in the Sustainable Development Goals (SDGs) is critical for articulating the sub-goals and targets and for providing synergies towards the larger goal (Costanza et al., 2014; Lim et al., 2018). Costanza et al. (2014) propose that ‘*equity & human wellbeing* - a prosperous, high quality of life that is equitably shared and sustainable’ should be considered as the ultimate ends of sustainable development, while goals related to economic performance, technological advancements, political measures, and normative advocacies should be considered only as intermediate means of sustainable development. Such a view prioritises on institutional change of the ends.<sup>27</sup>

### **Barriers to institutional change**

If for some reason, intended institutional changes did not occur, it is referred to as *institutional barriers* or *barriers of institutional change*. *Institutional barriers* in general are dynamic and context-dependent across sectoral, spatial, and temporal scales (Mimura et al., 2015). Literature has indicated three major types of *institutional barriers* to climate change adaptation in both developed and developing countries. The first type is barriers that impede *multilevel institutional coordination* between different political and administrative levels in society (Preston et al., 2013; Robinson and Berkes, 2011). In climate change adaptation, some scholars have defended the need for top-down institutional change - national requirements or guidelines, regulations, policies, and codes - to occur, as currently climate adaptation is commonly inhibited by unclear roles and responsibilities across multiple levels and actors (Brown et al., 2013). The second type is the *institutional rigidity* which limits the horizontal interplay within local governments, where climate adaptation is seen as the isolated task of a singular sector

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<sup>27</sup> Williamson’s levels of institutional change resonate with this broad categorisation of institutional change of the means and ends. Equity and human wellbeing are often considered as end goals of development. They are also a value or a norm, or a right which might not change frequently. If so, it would be a slow changing institution at Williamson’s embeddedness level.

(van den Berg and Coenen, 2012; Runhaar et al., 2012; Wilby and Keenan, 2012). In this case, past policies, decisions, habits, and traditions constrain the extent to which systems can learn or adapt to climate change, which scholars also referred to as *path dependency* (Preston et al., 2013; Runhaar et al., 2012). Sometimes *institutional rigidity* also exists in the form of *institutional barriers*, including competing values, conflicting objectives, tensions, and trade-offs in political dimensions, namely between different actors, policy agendas, and priorities in planning and implementation (Adger et al., 2009; Mimura et al., 2015; Storbjörk and Hedrén, 2011). It is not uncommon for governments and local authorities to fail in presenting optimal solutions, possibly due to their cognitive and behavioural biases (Krueger, 1990; Podsakoff et al., 1990). The third type is barriers that impede *coordination between formal governmental and administrative agencies and social and private stakeholders* in order to create participatory approaches suitable for the localised and contextual nature of climate adaptation (Engle and Lemos, 2010; Jonsson et al., 2012). Scholars consider private sector involvement as a way to increase the efficiency of climate adaptation (Engle and Lemos, 2010; Tompkins and Eakin, 2012). Besides, key actors, advocates, and champions are decisive for initiating, mainstreaming, and sustaining momentum for climate adaptation planning and implementation in different national settings (Moser and Ekstrom, 2010; Romero-lankao and Wilhelmi, 2018).

### **3.5 Analysing Common-Pool Resource Governance through the IAD Framework**

Common-pool resource governance can be analysed through the Institutional Analysis and Development (IAD) framework (see Figure 7). The IAD framework was intentionally developed to "map" out institutions and help people understand how institutions promote or obstruct human collaboration and governance (Ostrom, 2005). Ostrom and her colleagues developed the IAD framework based on many empirical studies that revealed the complexity and diversity of the field settings (Kiser and Ostrom, 2000; Ostrom, 2005; Ostrom and Ostrom, 1977). The meta-theoretical language enables researchers to discuss any theory or compare theories and identify influential variables in various empirical settings. The IAD framework has already been widely applied in empirical studies of CPRs such as irrigation systems, forest management, and Green House Gases (GHG) emission for climate change mitigation, as well as within urban contexts (e.g., Mincey et al., 2013; Ostrom, 1972; Ostrom et al., 1979).

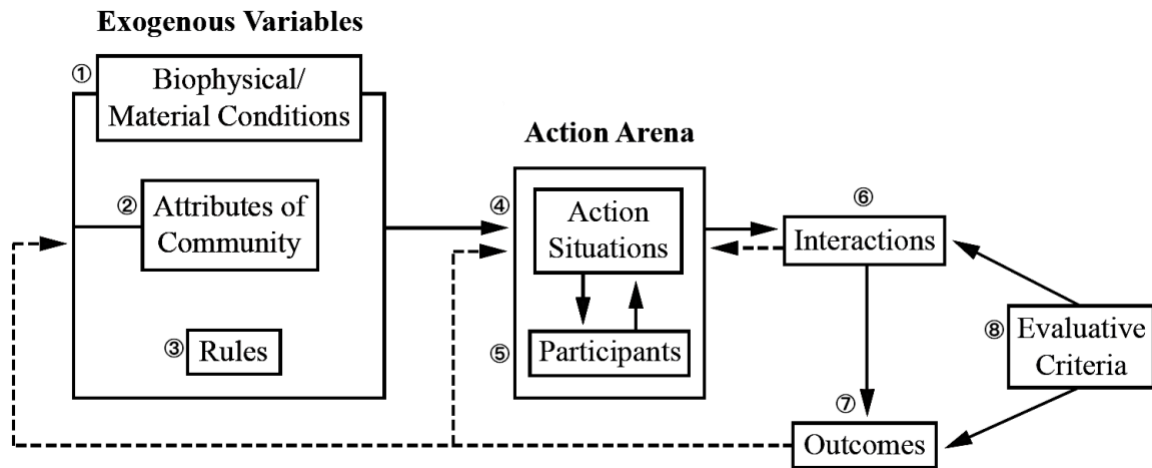


Figure 7: The Institutional Analysis and Development framework

Source: Adapted from Ostrom 2005: 15.

Ostrom and her colleagues designed the IAD framework with a group of elements so that when analysing the governance of a particular resource, depending on the researcher's needs, one can analyse each of the elements multiple times. These elements are: ① *Biophysical conditions*, ② *Community attributes* and ③ *Rules-in-use*, which can affect an ④ *Action situation*, often considered the core of the IAD framework, ⑤ *Actors or participants*, ⑥ *Interactions*, ⑦ *Outcomes*, and ⑧ *Evaluative criteria*.

① *Biophysical conditions* refer to the natural environmental conditions in which the institutional arrangements are applied. Sometimes it can be simplified as one of the four types of economic goods (public, private, club, and common-pool goods), as Ostrom defines (2005). It could also refer to general conditions such as climate change, environmental degradation, and resource scarcity in general.

② *Attributes of community* are the socio-economic as well as cultural, historical, and political characteristics of a community. They could include the history of prior interactions, internal homogeneity or heterogeneity of key attributes, and the knowledge and social capital of those who could participate or be affected by others.

③ *Rules-in-use* includes regulations, norms, agreements, agendas, or anything that has a bidding effect – legal, political, or moral, to the actors involved in a decision-making setting potentially across several levels. They are the information which forms a common

understanding of those involved related to who must, must not, or may take which actions affecting others depending on incentives or sanctions (Crawford and Ostrom, 1995). Ostrom (2005) defines seven types of rules-in-use:

- *Boundary rules* define which actors are included based on specific criteria, e.g., geographical boundary, natural and socio-demographic conditions such as age and level of education
- *Position rules* define in what way actors are participating in decision making
- *Choice rules* define what actors can do, must or must not do
- *Information rules* define what information can be circulated among which actors, in what frequency and language
- *Aggregation rules* define how actors collectively make decisions
- *Scope rules* define the range of possible results within the action situation
- *Payoff rules* define reward or sanction

Ostrom further specifies that the ③*Rules-in-use* may evolve or self-consciously change the rules in a collective-choice or constitutional-choice setting (Ostrom, 2005), which could directly influence an ④*Action situation*.

These elements together impact an ④*Action situation*, which then generate patterns of interactions and outcomes. These outcomes may be evaluated by participants in the *action situation*, and potentially by researchers, which further feeds back on both the external variables and the *action situation* (Ostrom, 2005). The ④*Action situation* is often treated as the core part or the focal point of the IAD framework, as participants interact with each other within an *action situation* from the *position* they are assigned to, and make decisions depending on the *information*, power to *control*, and the *net costs and benefits* given. The internal structure of an *action situation* is demonstrated in Figure 8. The costs and benefits include direct, monetary costs and benefits such as the costs of planting, pruning, removal, irrigation and the benefits of cooling energy savings; as well as indirect, non-monetary costs and benefits, such as interception of particulates, stormwater runoff reduction, residents' relative wellbeing, and influences on local biodiversity (McPherson, 1992).

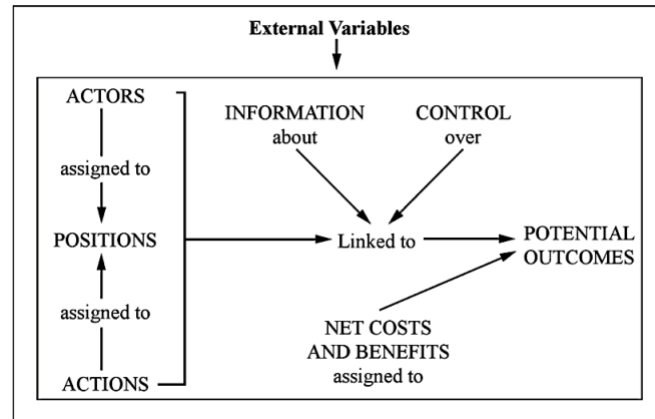


Figure 8: The internal structure of an action situation.

Source: Adapted from Ostrom 2005: 33.

⑤ *Actors or participants* of CPR governance, which may include governments and non-state actors.

⑥ *Interactions*. The original IAD framework automatically assumes that all types of actors within an action arena participate by interacting with other actors, such as agreeing, coordinating, cooperating, negotiating, or supervising. However, in this research, the researcher argues that not all situations fit this assumption. Hence, it is necessary to include the possibilities of non-participation, which also includes two possibilities: 1) not informed and not participating, and 2) informed but not-participating. Only based on information can interactions happen. Based on information, two types of participation are anticipated: partial and substantial participation, in which actors agree, coordinate, cooperate, negotiate, or supervise (see Table 8: Categories, codes and sub-codes for the qualitative content analysis using MaxQDA as well as the subsequent analysis in Chapter 6).

The ⑦ *Outcomes* may include, 1) decisions and actions a certain governance issue, such as UGS planning and implementation, and 2) the resultant formal and informal institutional changes, e.g., on the positions of actors and the property rights they hold.

⑧ *Evaluative criteria* will be established to evaluate ⑥ *Interactions* and ⑦ *Outcomes*. The original evaluative criteria defined by Ostrom (2005) are:

- 1) *Economic efficiency*. It is the flow of net benefits associated with an allocation or reallocation of resources.
- 2) *Equity*. It includes procedural equity and substantive equity, e.g., the right to participate is a procedural equity and the health and wellbeing benefits is a kind of substantive equity.
- 3) *Adaptability, resilience, and robustness*. It relates to the effect of intervention/implementation on the community, the environment, and the institutions overtime.
- 4) *Accountability*: refers to the acknowledgement and assumption of responsibility by respective actors for their actions at the corresponding level or the next upper level.
- 5) *Conformance to general morality*. It refers to three aspects of morality – informational, legal, and ethical.

Now, despite that the IAD framework has been well acclaimed by scholars for its overall potential in analysing CPR governance, the ⑧ *evaluative criteria* is the least developed part subjected to future contestation as scholar research advances (Cole, 2017). Considering that it is also the most flexible part of the IAD framework that allows context-specific readjustments, in this research, these five criteria are used as a structural reference, according to which a more comprehensive set of criteria is established (see Section 4.3.2.2 Applying multi-criteria assessment in this research).

Research on governance issues in China using the IAD framework is emerging quickly and seems to have successfully addressed a broad range of topics, particularly since Ostrom won the Nobel Prize in Economics in 2009. These emerging research primarily concentrates on water/irrigation system management (Araral and Wu, 2016; Fan et al., 2019; Wang et al., 2017), conflicts of land-use/expropriation (Cao and Zhang, 2018; Wu et al., 2018), urbanisation issues (Ma et al., 2019; Xiong et al., 2020), unexpected natural and human events (disasters and protests) (Liu and de Jong 2017; Ran et al., 2020). Among these studies, Ma et al. (2019) used the IAD framework to analyse Chinese farmers' willingness to settle in urban areas and its influencing factors. Fan et al. (2019) used the IAD framework to assess the effects of community perceptions and institutional capacity on smallholder farmers' responses to water scarcity in China's arid Northwestern region. Liu and de Jong (2017) used the institutional design principles of the IAD framework and the concept of common-pool resource to understand the institutional causes of environmental protests in China. Ran et al. (2020) studied the governance of geo-disasters in the Three Gorges Reservoir Region in China under the IAD

framework. It is evident that scholars are increasingly finding the IAD framework convincing for analysing a vast range of action situations regardless of context. This is also thanks to the powerful meta-language that Ostrom (2005) and her colleagues were able to develop after decades of theoretical inquiry and empirical testing.

## CHAPTER IV

### RESEARCH DESIGN AND METHODOLOGY

#### 4.1 Research Design

##### *4.1.1 Designing the empirical analysis with the IAD framework*

The previous chapter established the IAD framework as an analytical tool for dissecting and examining the quality of CPR governance cases in empirical settings. This research applies the IAD framework to understand three UGS governance cases in Guangzhou, China. It is used in three ways:

- 1) define independent and dependent variables
- 2) confirm this research's core variables, which is the ③ *rule-in-use* and the ④ *action situation*.
- 3) guide the composition of the in-depth and semi-structured interview questions, aiming to find adequate and consistent information about the different variables in three case studies.

First, the IAD framework is used here to define the independent and dependent variables. The three exogenous variables: ① *biophysical conditions*, ② *community attributes* and ③ *rules-in-use* are the independent variables at the beginning of the research time frame. Within the research time frame, they gradually become dependent variables as the ⑦ *outcomes* feedback to them (see Figure 9). The ① *biophysical conditions* in this research refer to the conditions of the UGS in the city of Guangzhou, including wetlands, urban parks, and ecological corridors. For ② *community attributes*, three community clusters – local governments, communities or residents, and landowners, each has their attributes. Local governments include the city and district governments, communities or residents are those who reside and/or make their living within the study area. Landowners refer to those who legally own the land and/or the property above who do not necessarily reside or make their living within the study area. The ③ *Rules-in-use* includes the national development agendas, urban macro plans, local norms, or regional preferences of urban development, as well as the legal and political positions where various public and private actors across several levels are placed in decision-making settings regarding UGS planning and management in the city of Guangzhou.

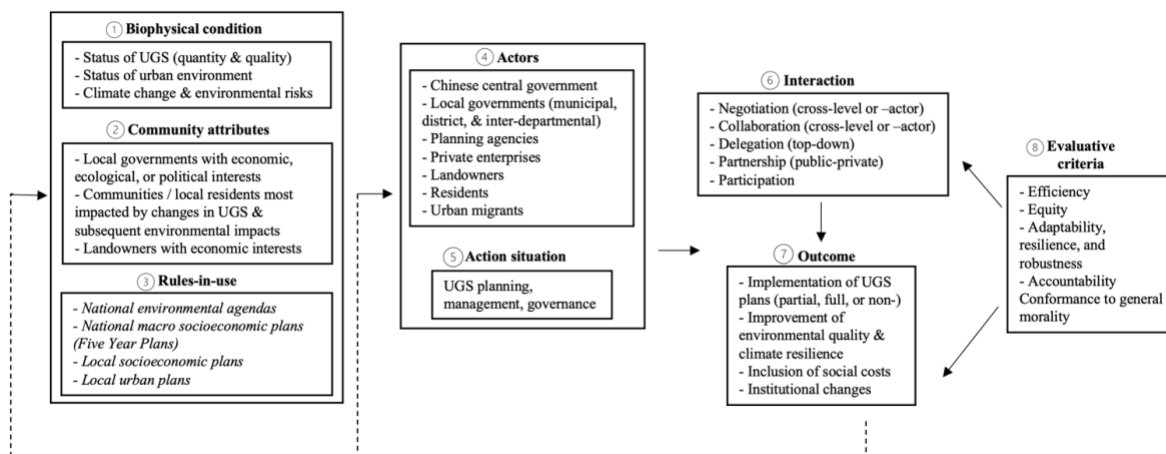


Figure 9: The IAD framework applied in this research

Second, the IAD framework is used to confirm the core variables of this research, which is the ③ rule-in-use and the ④ action situation. Particularly, ④ action situation is the focal point where various actors communicate, negotiate, agree, or disagree, collaborate or delegate towards certain outcomes in the three UGS planning and governance cases, including the implementation of UGS plans, the improvement of environmental quality and climate resilience, the inclusion of social costs, and potential institutional changes.

Furthermore, the IAD framework is also used to structure the in-depth and semi-structured interview questions, aiming to find adequate and consistent information about the different variables in three case studies. Table 5 shows the four main research questions and their correspondent variables and reveals the methods of data collection and analysis suitable for analysing the variables to answer these main research questions.

Aims	Research Questions	Key Variables	Data Collection Methods	Data Analysis Methods
<b>A1. Understand institutional dynamics, facilitators, and underlying barriers</b>	<b>Q1. What institutional facilitations or challenges have Chinese urban governments received or confronted when planning and managing UGS?</b>	① Biophysical condition ② Community attributes ③ Rule-in-use ⑤ Actors ⑦ Outcome ⑧ Evaluative criteria	In-depth interviews Archive research	Qualitative content analysis

<b>A2. Examine the extent and approaches for UGS upscaling</b>	<b>Q2. How have local governments managed to upscale UGS towards more effective NbS?</b>	① Biophysical condition ③ Rule-in-use ④ Action situation ⑤ Actors ⑥ Interactions ⑦ Outcome ⑧ Evaluative criteria	In-depth Interviews Archive research	Qualitative content analysis Multi-criteria assessment (MCA)
<b>A3. Analyse costs and benefits taken into consideration</b>	<b>Q3. What are the good practices to be shared?</b>	③ Rule-in-use ⑥ Interactions ⑦ Outcomes ⑧ Evaluative criteria	In-depth Interviews Archive research Observation	Qualitative content analysis MCA
<b>A4. Understand intrinsic-value-related factors of institutional barriers</b>	<b>Q4. Why some challenges persisted despite centralised government system and strong political determination?</b>	② Community attributes ③ Rule-in-use ⑤ Actors ⑥ Interactions ⑧ Evaluative criteria	In-depth Interviews Archive research Observation	Qualitative content analysis MCA

Table 5: Overview of research design

#### 4.1.2 A qualitative, case-study-based research approach

The institutional focus of this research determines its qualitative and case-based approach. Scholars have applied institutional analysis on environmental and social challenges as long-term consequences of formal and informal institutional arrangements interplayed at different levels and scales, most of which were qualitative studies (Cumming et al., 2006; Young, 2002). The complexity of real-world decision-making contexts and processes mean that many factors or variables can be too intricate to be measured accurately and described comprehensively by quantitative methods (Schlüter, 2010). A qualitative case study approach can carry out an in-depth description and analysis of decision-making contexts and processes and their complex scenarios without the omission of factors caused by the assumption of preconditions. Ostrom's IAD framework is precisely based on a meta-analysis of many case studies. The qualitative approach focuses on making sense of or interpreting social phenomena, e.g., experiences, behaviours, organisational functioning, social movements, interactional relationships, and cultural descriptions. The qualitative approach is also used to study phenomena in their natural settings instead of labs or experimental settings. Furthermore, a qualitative approach allows researchers to interpret phenomena in terms of the meanings actors bring to them (Denzin and Lincoln, 2000).

The qualitative case study approach used in this research is an inductive and open process, in which the researcher is the primary instrument for data collection and analysis through iteratively conducting fieldwork. The qualitative case study approach attends to descriptive data of low inference, which focuses on the detailed description of *How* vs. *How Many*. The purpose of this research is to contextualise, interpret, and understand how different actors behave about UGS governance. The research subject is context-specific in socio-economic, political, temporal, and environmental dimensions. Hence, the qualitative approach can better attend to the specificities of cases and their details through the researcher's contact with people and their insights. 'The devil is in the detail.' as the idiom goes, the qualitative approach, therefore, can contribute to this research more so than a quantitative one.

#### ***4.1.3 Case selection, study period, and administrative level***

This research includes three cases of UGS planning and governance in the city of Guangzhou, all of which were implemented within the last two decades: an ecological corridor, an urban wetland park converted from an orchard, and a Sponge City demonstration site (for the definition of *Sponge City* please see 5.3.4 *Tianhe Sponge City Demonstration Site*). Choosing all three case studies in the same city allows this research to explore the interaction of multiple actors, various organisations and the complex arrangements of each case within the same institutional, geographical, natural, cultural, socio-economic and political context. Guangzhou is an ideal city for studying UGS planning and governance due to the city's natural and urban condition: an emerging, compact megacity located in a low-lying estuary and in a sub-tropical climate zone with a high scarcity in land resource and high risk of climate change impacts (see 1.1 *Urbanisation Trend, Environmental Degradation, and Climate Change Impacts in China*). The natural, socio-economic context of Guangzhou will be introduced in greater detail in Section 5.1.1 Natural and socio-economic conditions.

As for study period, this research defines the study period of empirical cases between the New Millennium and the current time for two main reasons. All three chosen case studies incurred since 2000. Firstly, in the New Millennium, for the first time the Chinese central government included *sustainable development* as one of the primary goals in the nation's *10<sup>th</sup> Five-Year Plan (FYP) for Socio-Economic Development*, which states "the main expected goals of sustainable development are: ... The trend of ecological deterioration will be curbed, the forest coverage rate will be increased to 18.2%, and the green coverage rate in urban built areas will

be increased to 35%. The urban and rural environmental quality will be improved, and the total discharge of major pollutants will be decreased by 10% compared with that in 2000” (State Council of China, 2001). Secondly, Guangzhou's municipal government considered the New Millennium as a great timing for long-term strategic urban development planning to enable and sustain further urbanisation. A macro-level strategic urban development plan was created, which included the merging of two neighbouring counties - Panyu County and Huadu – into the city's metropolitan territory, and a conceptual plan of an ecological corridor network (also termed the "Ecological City" Plan) throughout the new metropolitan area (Guangzhou Daily, 2018).

The ecological corridor network resulting from the conceptual plan became the first case study of UGS planning and governance in this research. The second case - the Haizhu Wetland Park is another major case of UGS planning and governance in Guangzhou occurred around 2011, a decade after the first case - the ecological corridor network conceptual plan. The second case is relevant as it explored a new UGS planning and governance model through the transfer of property rights. The third case - the Tianhe Sponge City demonstration site was implemented around 2015 with the specific goal of adapting to the increasing urban inundation and flash floods aggravated by climate change. The third case represents a new kind of UGS planning and governance for the technical and political challenges it presented.

On administrative level, this research focuses on UGS planning and governance in China at the city/municipal level, for two main reasons. First, Chinese cities as the local administrative units make independent plans and policies on UGS governance depending on their status of land-use, economic and social needs, based on the broad policy guidance provided or the goals proposed in the national Five-Year Plans (FYPs) by the central government. More about the central-local decision-making and coordination mechanism in the Chinese administrative system can be found in Chapter 5.2.4 A multi-level, nested hierarchical system of land-use and spatial planning. Second, it is the local level that directly absorbs the externalities induced by improper UGS planning and governance, again prompting the need to focus on the local level.

## **4.2 Data Collection**

This research uses Grounded Theory as a methodological philosophy for data collection and analysis. As the term suggests, Grounded Theory is a general, inductive methodology ‘grounded’ in qualitative data that is systematically gathered and analysed (Charmaz, 2015; Noble and Mitchell, 2016). Proposed by (Glaser and Strauss, 1968 & 2017), Grounded Theory is commonly used in social and behavioural sciences to uncover social processes: “...*The researcher begins with a broad query in a particular topic area and then collects relevant information about the topic. As the action processes of data collection continue, each piece of information is reviewed, compared, and contrasted with other information. From this constant comparison process, commonalities and dissimilarities among categories of information become clear, and ultimately a theory that explains observations is inductively developed*” (DePoy and Gitlin, 2016: 107). Essential features of Grounded Theory include: 1) data collection and analysis occur simultaneously, 2) categories and analytic codes are developed from data rather than from pre-existing conceptualisations (Noble and Mitchell, 2016).

This research applies Grounded Theory in data collection and analysis in the following ways. First, the researcher spent an extensive amount of time in the field gathering data. Second, the data collection is semi-structured and evolving rather than entirely structured. The researcher seeks pluralism and complexity in the data collection process. Third, data is categorised and coded to reduce raw data to themes, which is also a complex and time-consuming process. Fourth, there is extensive writing to show multiple perspectives to find potential patterns as well as to substantiate findings.

### **4.2.1 Data collection methods**

Based on Grounded Theory as a methodological philosophy for data collection and analysis, this research uses 1) in-depth semi-structured interviews, 2) archival research, and 3) observations as methods to collect data (see Table 6).

## Urban Green Space Governance in China - Institutional Analysis

Data Collection Methods	Type of data	Sources	Quantity
<b>IN-DEPTH INTERVIEWS</b>	Response from interviewees	Government officials	50
		Urban planners	
		Urban governance consultants	
		Academic researchers	
		Land appropriators	
		Communities/ residents	
<b>ARCHIVE RESEARCH</b>	Urban plan/Policy texts	National environmental agendas	94
		National climate plans	
		National urban plans	
		Local environmental agendas	
		Local climate plans	
		Local urban plans	
<b>OBSERVATION</b>	Observation notes	Researcher	/

Table 6: Overview of data collection methods

### 4.2.1.1 Semi-structured in-depth interviews

In this research, semi-structured in-depth interviews are conducted with government officials, urban planners, urban governance consultants, academic researchers, land appropriators, and communities/residents. The aim is to gather focused, qualitative descriptive data about the decision-making processes and outcomes in the three UGS planning and governance cases in Guangzhou. The interviewees are selected based on the principle of maximising the variety of viewpoints: individuals with extensive work experience, insights, or local knowledge from each actor category - government officials, urban planners (including landscape architects), urban governance consultants, academic researchers, land appropriators, and residents are selected and interviewed.

Semi-structured in-depth interviews is an ideal data collection method for this research as it provides the flexibility to follow up on valuable threads that emerged during interviews. Semi-structured interviews are verbal interchanges “*where one person, the interviewer, attempts to elicit information from another person by asking questions ... Semi-structured interviews unfold in a conversational manner offering participants the chance to explore issues they feel are important*” (Longhurst, 2010: 103). It allows the researcher to begin with comparatively general questions before shifting to inquire more specific insights later and allows both parties to clarify questions and terminologies, therefore enriching the depth and validity of this

research. Besides, during a face-to-face in-depth interview, researchers can observe the non-verbal behaviours of the interviewees, such as body movement and facial expressions, which are informative for the researchers to ask follow-up questions. Furthermore, face-to-face interviews require interviewees to answer questions spontaneously without much time for filtering information or reframing.

### **Designing semi-structured interview questions**

In the previous sub-chapter, the IAD framework, the variables and the logic of their interactions are explained. In this sub-chapter, questions designed for the semi-structured in-depth interviews are structured based on the variables and their interaction in the IAD framework and are primarily open-ended (see Annex 2. Semi-Structured In-Depth Interview Outline) Three major thematic parts are defined to understand the empirical part: 1) land resources and land economics, 2) urban landscape ecology / green space planning, and 3) urban governance and institutions. Based on these three thematic parts and the main research questions, 44 semi-structured interview questions altogether are designed and are oriented for experts in each field:

- 1) for insights into land resources and land economics: government officials, land economics scholars, and urban governance consultants are interviewed
- 2) for insights into urban landscape ecology / green space planning, government officials, urban planning scholars and practitioners, and residents are interviewed
- 3) for insights into institutions and governance, which include government officials and scholars are interviewed

Questions are both designed for the overall urbanisation and institutional contexts of China's urbanisation and the city of Guangzhou, as well as for the specific three case studies chosen in the city of Guangzhou.

### **Selecting interviewees and preparing for the interviews**

The interviewees for this research are chosen based on their knowledge and experience related to the research topic, the socio-economic and political context of China's urbanisation, and the three case studies. 50 people representing different stakeholders/actors in the planning and governance of UGS in Guangzhou were chosen to participate in the interview. The interview questions are composed of both general and specific questions to capture information in detail and to avoid misunderstanding. The aim of the interviews was to understand how each (group

of) stakeholder/actor experience, interact with each other and make sense of their actions in the underlined circumstance.

1) The initial method of interviewee selection: the researcher began the interviews with academic researchers in the researcher's professional network who were often consulted by the local governments on urban (UGS) planning issues and were friendly and supportive of this research project.

2) The following method of interviewee selection: the researcher asked the academic researchers who were interviewed to recommend potential interviewees, who could be government officials, urban planning professionals, consultants or others who are familiar with the context of this empirical research and the three case studies. The request of interviewee recommendations iterated several rounds until the researcher considered that sufficient data was collected for writing this PhD thesis.

3) Interview preparation: prior to the interviews, the interviewees were invited to sign a form of informed consent for the interview (see Annex 1. Form of Informed Consent for Interview 采访同意书, and to indicate their preference of data recording method (hand notes, audio recording, or video recording). In addition, to enable the most comfortable ambient conditions for the interviewees, most of the interviews took place at the interviewees' work location/office, while a handful of the interviews were conducted via phone calls due to the impossibility of physical in-person meetings.

#### 4.2.1.2 Archival research

In addition to the qualitative semi-structured interviews, this research also contains an in-depth inquiry into policy and media archives, print and digital, to collect complimentary data. Archival evidence can provide the researcher with original and formal policies, plans, and technical reports in details, which are valuable sources to understand policymakers' perceptions of the projects at the time and the cost-benefit calculations within their historical, situational, and communication contexts (Larson, 2017). Archival methods are considered beneficial for the robustness, contextuality and holism, particularly of a research endeavour that relates to the study of organisations in multi-disciplinary undertakings (Das et al., 2018).

The archival research conducted for this thesis contains altogether 88 documents, including strategic plans, conceptual plans, action plans, macro socio-economic development plans, special plans, government reports, assessment reports, communiqués, and regulation, all of which are effective between 2001–2019, the study period of this thesis (see Annex 5. List of Policy Documents).

- 1) **Strategic plans** entailing policies and actions at national and local levels on climate change, sustainable development (SDGs), public health, ecological protection, urbanisation, and instructional reform
- 2) **Conceptual plans** on how to concretise the concept of *Ecological Civilisation* and the concept of *urban ecological corridor network*
- 3) **Action plans** on air pollution prevention and control at the national level
- 4) **Macro socio-economic development plans**: including all the Five-Year Plans between 2000 and 2019 at central and municipal levels
- 5) **Special plan** on how to implement *Sponge City* at the local level
- 6) **Government reports** on China's actions and policies on climate change and the work of the local governments of Guangzhou in general
- 7) **Assessment reports** on the implementation of the ecological corridor network in Guangzhou
- 8) **Communiqués** of national land greening status during 2001-2019
- 9) **Regulation** on national environmental protection, the latest revision in 2014
- 10) **Technical guidelines** on the implementation of the ecological corridor network and the *Sponge City* program

These archival data come primarily from four sources:

- 1) Websites of the State Council, ministries, municipal and district governments
- 2) Physical archives located in government buildings (via in-person visits)
- 3) Physical documents shared/gifted by urban planning professionals exclusively for this study (via in-person meeting exchange)

It is necessary to note that none of the archival data collected is technically confidential; however, some of the documents are made for internal government reference, which has not been released to the public and will not be.

#### 4.2.1.3 Observation

Observation is the systematic description of the events, behaviours, and artefacts of a social setting (Marshall and Rossman, 2016: 143). It is a mature method often used in ethnographic, anthropological, and behavioural science studies (Baker, 2006; Jersild and Meigs, 1939). Observation is an ideal method to understand complex human phenomena, as it permits researchers to study people in their native environment to gain a more comprehensive and holistic understanding of the people and events from the researchers' perspective. It is a context-sensitive method complementary to direct interviews or laboratory measures and can capture aspects related to the social behaviour and preferences of the actors studied (Baker, 2006; DeWalt and DeWalt, 2010; Prus and Jorgensen, 1990). Using observation, the researcher can obtain firsthand insights into the mundane detail of interviewees' behaviours, attitudes, and language. It allows the researcher to learn about issues the interviewee may be unaware of, are unwilling or unable to discuss candidly during an interview (Frechtling et al., 2002).

This thesis uses observation as a complementary method to the two other qualitative data collection methods - semi-structured in-depth interviews and archival research. To the best ability, the observation is conducted respecting the principles of authenticity, trustworthiness, reflexivity, and particularity (Patton, 2015). The observation is conducted unstructured in natural settings alongside semi-structured interviews, in which the researcher and the interviewees have established informed consent and trust. The observation data obtained for this research exists primarily in the form of fieldnotes, which contain descriptions of the interview activities, interactions and behaviours of interviewees, actions of each actor and processes of the three cases from planning to implementation and management. The fieldnotes are then coded and analysed together with the interview transcripts.

#### **4.2.2 Ethical considerations**

- Data confidentiality: interviewees were invited to participate in the semi-structured, in-depth interviews voluntarily and was ensured that their answers would be kept confidential and used solely for the purpose of this research. All the interview data was collected, either in audio recording or just hand-written notes depending on the interviewees' preference, and then stored and treated in a confidential, anonymous, and codified way.
- Protection and anonymisation of interviewees: the interviewees were invited to sign a consent form (see Annex 1. Form of Informed Consent for Interview

- 采访同意书) prior to the interviews with the researcher.
- Data quality control: as introduced in the data collection methods above, there are multiple data sources and multiple methods to strengthen the credibility and robustness of the data. Besides, all the interviewees are invited to sign a form of consent prior to participating in the interviews, indicating their preferences of data collection (via audio recording or only handwritten notes). Prior to the interviews, they are also guaranteed that the interview subjects will be non-sensitive, non-discriminative and non-incriminating. Furthermore, this thesis contains a substantial chapter of contextualisation of the empirical study (see Chapter V), in order to explain why these kinds of qualitative data are collected (Krippendorff, 2018).

#### 4.2.3 Data collection timeframe

The researcher has spent an extensive amount of time in the field study location, Guangzhou, China, to gather data to ensure the depth, plurality, and complexity of the data for this qualitative case-based research. This includes four phases of data collection of nine months in total, between December 2017 – August 2019.

<b>Phases</b>	Dec 2017- Jan 2018 (2 months)	July - Sep 2018 (3 months)	Dec 2018 - Feb 2019 (3 months)	End-May - Mid-Jun 2019 & Mid-August 2019 (1 month)
<b>Fieldwork</b>	10 preliminary interviews, archival research, observations	20 formal interviews, archival research, observations	14 formal interviews, archival research, observations	6 follow-up interviews, Collect visual data (site images), archival research, and observations

Table 7: Overview of fieldwork

### **4.3 Data Analysis**

#### ***4.3.1 Content analysis using MaxQDA***

##### *4.3.1.1 Qualitative content analysis*

Content analysis is “a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use” (Krippendorff, 2004: 18). Content analysis is a scientific tool that assists the researcher to understand phenomena starting by recognising meanings and then systematically analysing them within a particular set of texts. The IAD framework presented above as the analytical framework for this research and the logic of the research questions are present throughout the process of content analysis. Qualitative content analysis in the eye of a reader often has the characteristic of extensive description and discussion. This is necessary to show multiple perspectives as well as to substantiate findings, not only within the qualitative data material gathered but also the context in which the data was gathered (Creswell, 1998; Krippendorff, 2004).

The aim of the qualitative content analysis in this thesis is to 1) understand the institutional dynamics, facilitators, and underlying barriers Chinese local governments have faced regarding the need and mandates to plan and manage UGS that could lead to more effective NbS, 2) examine to which extent local governments have been able to advance and upscale UGS and with what approaches, 3) analyse the costs and benefits that Chinese local governments have taken into consideration for planning and managing UGS, and 4) identify intrinsic-value-related factors that have limited Chinese local governments to pursue greater UGS quantity and quality, and effectiveness of NbS.

##### *4.3.1.2 Using MaxQDA qualitative data analysis software*

This research uses MaxQDA, a Qualitative Data Analysis Software (QDA software), for organising and analysing the qualitative data collected from semi-structured interviews, policy archival research, and observation field notes. MaxQDA has part of its name ‘Max’ associated to the sociologist Max Weber and is rooted in social science methodology. The software provides functions for transcribing, analysing and visualising qualitative data, hence can analyse all the data commonly collected in the context of empirical social science research (Kuckartz and Rädiker, 2019). A central feature of MaxQDA is the option of working with codes (categories) and assigning codes to selected parts of the data in order to organize large

volumes of text. As the empirical data in this social science research is qualitative and in large volumes, MaxQDA is therefore a suitable tool for data analysis.

#### 4.3.1.3 Organising data and coding

The data collected in this research include information gathered through semi-structured interviews and from archival research, and observations fieldnotes. The researcher used the mobile application “Voice Memos” as a tool to record the interviews when applicable. Some interviewees only agreed to the form of handwritten notes for recording the interview contents. Below are the steps of using MaxQDA software to process the data collected.

1. The first step is to transcribe and organise the audio recordings and handwritten notes. In addition to full transcription files, a summary for each transcription is also produced to organise and navigate effectively inside the software.
2. The second step is to categorising data and define variables according to the IAD framework. In this data analysis, there are 7 categories, and they are the same as the first 7 variables of the IAD framework: ① *biophysical conditions*, ② *community attributes*, ③ *rules-in-use*, ④ *action situation*, ⑤ *actors*, ⑥ *interactions*, ⑦ *outcome*.
3. The third step is to code the data within each category. The codes are generated by sorting and sifting through the text within each category. Codes are created when thematic commonalities are identified. Most of the codes have a set of sub-codes, or in other words, the coded themes have a set of sub-themes which are even more specific. For example, the first category ① *biophysical conditions* contains 3 codes or coded themes, which are then further distinguished with a set of sub-codes or sub-coded themes (see Table 8: Categories, codes and sub-codes for the qualitative content analysis using MaxQDA).

These codes and sub-codes serve to identify and mark the relevant texts for the content analysis. Furthermore, the codes for the last two categories - ⑥ *interactions* and ⑦ *outcome* are matched with the respective criteria in the Multi-Criteria Assessment (MCA) for the purpose of conducting the MCA. This will be explained in the following chapter 4.3.2 Multi-criteria assessment (MCA). For a complete view on the seven categories, 22 codes (themes) and 65 sub-codes (sub-themes), please refer to Table 8: Categories, codes and sub-codes for the qualitative content analysis using MaxQDA.

## Urban Green Space Governance in China - Institutional Analysis

CATEGORIES	CODES (THEMES)	SUB-CODES (SUB-THEMES)
<b>① Biophysical conditions</b>	1) Natural condition of Guangzhou	1) Natural landscape 2) Location 3) Climate
	2) Climate change impacts on Guangzhou	4) Types of impacts 5) Population impacted 6) Future trends
<b>② Community attributes</b>	3) Socio-economic conditions of Guangzhou	7) Status of urbanisation 8) Status of population growth 9) Status of urban land-use
	4) Environmental characteristics of the areas	10) Environmental characteristics of the areas
	5) Socio-economic characteristics of communities	11) Socio-economic characteristics of communities
	6) Urban planning status of the areas	12) Urban planning status of the areas
<b>③ Rules-in-Use</b>	7) Governance structure	13) Inter-departmental positionings 14) Central-local dynamics 15) Public-private relationships 16) Public-civil responsibilities
	8) Traditional political philosophy	17) Traditional political philosophy
	9) Contemporary political philosophy	18) Socialism with Chinese Characteristics 19) Scientific Development 20) Ecological Civilisation
	10) Environmental protection history	21) Pre 2000 22) 2000 – pre-Paris Agreement 23) Paris Agreement - present
	11) Land-use and spatial planning system	24) Typology of urban plans 25) Institutions of urban planning 26) Process of urban planning
	12) Property rights arrangements	27) Right to access 28) Right to withdraw 29) Right to manage 30) Right to exclude 31) Right to alienate
<b>④ Action situation</b>	13) Action situation	32) Action situation in case 1 33) Action situation in case 2 34) Action situation in case 3
<b>⑤ Actors</b>	14) Types of actors	35) Guangzhou Municipal Government 36) Panyu District Government 37) Haizhu District Government 38) Tianhe District Government 39) Farmland owners 40) Urban migrants 41) Small (informal) businesses 42) Ordinary citizens

	15) Information known by actors	43) Known environmental costs 44) Known environmental benefits 45) Known social costs 46) Known social benefits 47) Known economic/financial costs 48) Known economic/financial benefits 49) Other known costs 50) Other known benefits
	16) Information unknown by actors	51) Information unknown by actors
⑥ Interactions	17) Informing/informed	52) Not informed and not participating 53) Informed but not participating
	18) Partially participating	54) Agreeing 55) Coordinating
	19) Substantially participating	56) Cooperating 57) Negotiating 58) Supervising
⑦ Outcome	20) Plans/policies/UGS implementation	59) UGS goals from plans/policies 60) Implemented UGS
	21) Changes in institutions	61) Informal changes (norms, values) 62) Formal changes (new rules, laws, regulations)
	22) Implications	63) Climate resilience 64) Human health and wellbeing 65) Urban Climate governance

Table 8: Categories, codes and sub-codes for the qualitative content analysis using MaxQDA

### 4.3.2 Multi-criteria assessment (MCA)

#### 4.3.2.1 Multi-criteria assessment (MCA) for qualitative research

MCA is a “structured approach used to determine overall preferences among alternative options, where the options accomplish several objectives” endorsed by the UNFCCC for climate adaptation planning and practices (Bell et al., 2003; UNFCCC, 2002). MCA can help researcher understand dynamics between stakeholders during interactions and cost-benefit considerations or other policy tradeoffs, as well as the quality of the outcome. In MCA, attributes and indicators are first identified and then measured, by both monetary and non-monetary dimensions. In some cases, MCA can also be achieved by measuring qualitative attributes through quantifying their significance (e.g., weighting, scoring, and ranking). MCA is frequently used for estimating the quality of governance by assessing the decision-making processes, as well as the social, economic, and environmental impacts of relevant policies.

A similar method conventionally used by scholars is the cost-benefit analysis method, a comparatively more straightforward method used for project evaluation and can be viewed as a part of the MCA method. Scholars have argued that cost-benefit analysis could enhance understanding of urban greening benefits as people are more amenable to monetary than ecological values; the benefits and amenities could be expressed in dollars (Jim, 2013; Nowak and Dwyer, 2011). As a matter of fact, a few indirect cost-benefit analysis methods have been applied to assess the economics of UGS as they are not a marketable commodity. For example, the contingent valuation method explores citizens' willingness-to-pay to use UGS to prevent UGS loss or preserve urban biodiversity (Chen and Jim, 2010; Lo and Jim, 2012). Another method is called the hedonic pricing method, which has been applied to analyze and estimate property transaction prices attributed to urban greening and other natural areas (Garrod and Willis, 1994; Jim and Chen, 2007). The problem with these methods is that they cannot adequately address the complexity and transboundary characteristic of modern urban mobility (particularly for a rapidly growing megacity like Guangzhou) and the potential of the ecosystem services of UGS for climate mitigation and adaptation at the local level.

Compared to cost-benefit analysis, the MCA method can capture dimensions outside the range of direct economic appropriability effectively (Samuelson and Nordhaus, 2010). For example, land as a resource of scarcity, its fertility may be appropriately captured by the farmer who sells rice or apples produced on the land, in which case the land resource is called an appropriable resource. However, the vegetation and the ecosystem which are supported by land, the benefits brought by their ecosystem services such as provision, regulating, habitat or supporting so far cannot be accurately calculated in monetary terms. In this circumstance, the MCA method can address the indirect costs associated with UGS, e.g., the lack of UGS could lead to chronic health and wellbeing issues (highlighted during the COVID-19 pandemic, see Liu, 2021).

The MCA method is increasingly used in climate adaptation planning to evaluate better the risk and uncertainty dimensions of climate impacts on the social, environmental, technical, and economic spheres. MCA is, therefore, more comprehensive than conventional cost-benefit analysis and can provide more extensive information to support policy making (Chambwera et al., 2015). For example, *equity* is a crucial dimension to consider in climate adaptation planning, which comprises the gains and losses and impacts on individual citizens and communities,

especially vulnerable groups. Many of these gains and losses and impacts have low monetary calculability. MCA has been applied to an increasing number of climate change adaptation studies, including urban flood risk (Chambwera et al., 2015).

#### 4.3.2.2 Applying multi-criteria assessment in this research

##### **Developing criteria**

The criteria used in this assessment (see Table 9) are developed taking references from 1) the ⑧evaluative criteria in the IAD framework, 2) the universal principles for effective governance in the *Millennium Ecosystem Assessment (MEA)*, 3) the *Technical Assessment Synopsis Reports* of the European Green Capital Award,<sup>28</sup> and 4) the Multi-Criteria Evaluation (MCE) guideline<sup>29</sup> for ENavi - the Energy Transition Navigation System developed under the German Energiewende national energy transition scheme.

First, taking the ⑧evaluative criteria in the IAD framework as the initial reference helps to maintain the logical structure of the analysis as well as the theoretical rigor of this research. These evaluative criteria are: 1) *Economic efficiency*, 2) *Equity*, 3) *Adaptability, resilience, and robustness*, 4) *Accountability*, 5) *Conformance to general morality* (for more detailed definitions of these five criteria, please revisit Section 3.5 Analysing Common-Pool Resource Governance through the IAD Framework). Despite that the IAD framework has been well acclaimed by scholars for its overall potential in analysing CPR governance, the ⑧evaluative criteria is the least developed part subjected to future contestation as scholar research advances (Cole, 2017). Considering that this is also the most flexible part of the IAD framework that allows context-specific readjustments, it is therefore used as an initial reference.

Second, the *Millennium Ecosystem Assessment's* four universal core principles of effective governance contribute to the MCA particularly on the dynamics between governments and non-state actors during interactions, thereby can complement the initial reference. These four principles are: 1) compliance, 2) legitimacy, 3) interlinkages between institutions, and 4)

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<sup>28</sup>[https://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2013/02/EGCA\\_2020\\_Technical\\_Assessment\\_Synopsis\\_Report.pdf](https://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2013/02/EGCA_2020_Technical_Assessment_Synopsis_Report.pdf)

<sup>29</sup> Rainer Quitzow. 2019. A Sustainable Energy Transition: New Guidelines for Multi-Criteria Evaluation. <https://www.iass-potsdam.de/en/news/energiewende-guidelines-multi-criteria-evaluation>

adequate financing. Compliance describes the degree to which governments follow formal rules and obligations imposed by a higher-level government (also considered a transaction-cost factor). Legitimacy includes the clarity of the rules, the interpreted coherence of the rules and their adherence to the existing hierarchy of rules (e.g., if the current UGS planning in Guangzhou adheres to national environmental agendas such as *Ecological Civilisation*). And then, the interlinkages between institutions also influence the effectiveness of governance, as often several institutions work together to formulate and implement urban plans to ensure effectiveness. Furthermore, adequate financing is important for supporting proper implementation (Fisher et al., 2005).

Third, the European Green Capital Award (EGCA) is an initiative launched by the European Commission aiming to recognise cities leading the way on environmentally friendly urban living. Hence, it is also an adequate reference to complement the MCA, particularly from an urban planning practice and governance perspective.

Fourth, The Guangzhou International Award for Urban Innovation (the Guangzhou Award)<sup>30</sup> is established to recognise innovation in projects, measures or policies in cities and local governments that improve social, economic, and environmental sustainability. The Award is hosted by the City of Guangzhou and co-sponsored by the United Cities and Local Governments (UCLG), the World Association of the Major Metropolises (Metropolis). The criteria applied to the assessment for the Award include 1) innovativeness, 2) effectiveness, 3) replicability and transferability, 4) significance and relevance to the SDGs and the New Urban Agenda (NUA). This reference adds a more context-specific reference on urban governance (Bina, 2008), hence is also supportive for developing the criteria for the MCA in this research.

Lastly, the MCE guideline for analysing ENavi (the Energy Transition Navigation System developed under the German Energiewende national energy transition scheme) is developed by the Potsdam Institute of Advanced Sustainability Studies (IASS) in 2018. This evaluation guideline includes ten criteria divided into three groups highlighting the many different aspects of sustainability. Therefore, this reference is also competent for complementing the MCA in this research.

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<sup>30</sup> The Guangzhou International Award for Urban Innovation. Available at: <http://www.guangzhouaward.org/>

INITIAL & STRUCTURAL REFERENCE	COMPLEMENTARY REFERENCES			
IAD framework	Millennium Ecosystem Assessment	European Green Capital Award	Guangzhou Award for Urban Innovation	ENavi – Energiewende
<p><b>1. Economic efficiency</b></p> <p><b>2. Equity</b></p> <p><b>3. Adaptability, resilience, and robustness</b></p> <p><b>4. Accountability</b></p> <p><b>5. Conformance to general morality</b></p>	<p>1. Compliance</p> <p>2. Legitimacy</p> <p>3. Interlinkages between institutions</p> <p>4. Adequate financing</p>	<p>1. Climate Change Mitigation</p> <p>2. Climate Change Adaptation</p> <p>3. Sustainable Urban Mobility</p> <p>4. Sustainable Land Use</p> <p>5. Nature and Biodiversity</p> <p>6. Air Quality</p> <p>7. Noise</p> <p>8. Waste</p> <p>9. Water</p> <p>10. Green Growth and Eco-innovation</p> <p>11. Energy Performance</p> <p>12. Governance</p>	<p>1. Innovativeness</p> <p>2. Effectiveness</p> <p>3. Replicability and transferability</p> <p>4. Significance and relevance to the SDGs and the NUA</p>	<p><b>Evaluating targets</b></p> <p>1. Effectiveness</p> <p>2. Cost efficiency</p> <p>3. Total costs</p> <p>4. Resilience (as a more broadly defined form of supply security)</p> <p><b>Evaluating “side effects”</b></p> <p>5. Economic predictability and contribution to the common good</p> <p>6. Health and environmental protection and resource conservation</p> <p>7. Fostering social cohesion</p> <p><b>Evaluating compatibility with legal, political, and ethical norms and values</b></p> <p>8. Legitimacy</p> <p>9. Ethical acceptability</p> <p>10. Legality</p>

Table 9: MCA criteria for this research – an overview of references

Building based on the structural reference from the IAD framework and the complementary references, a new set of criteria is developed for the MCA in this research (see Table 10: Evaluative criteria developed for the multi-criteria assessment in this research). The new set of criteria absorbed all the relevant dimensions and indicators from the references above and is defined as the 2<sup>nd</sup> tier criteria. There are altogether 28 criteria covering the 1) economic, 2) technical, 3) ecological, 4) social, and 5) institutional dimensions for the empirical case study in this research.

## Urban Green Space Governance in China - Institutional Analysis

<b>1<sup>ST</sup> TIER &amp; STRUCTURAL CRITERIA</b>	<b>DIMENSIONS</b>	<b>2<sup>ND</sup> TIER CRITERIA</b>
<b>1. Economic efficiency</b>	Economic	1. Financing adequacy 2. Direct cost-benefit efficiency
	Technical	3. Temporal efficiency of planning 4. Temporal efficiency of implementation
	Institutional	5. Interlinkages between institutions
<b>2. Equity</b>	Social	6. Cultivation of social cohesion 7. Inclusion of health and wellbeing benefits 8. Inclusion of rights to access information 9. Inclusion of rights to monitor 10. Inclusion of rights to participate
	Ecological	11. Environmental protection and resource conservation
	Economic	12. Inclusion of economic benefits
<b>3. Adaptability, resilience, and robustness</b>	Technical/ecological	13. Sustainability in land use 14. Environmental quality (air, noise, waste, water) 15. Ecological resilience (ability to stay resilient) 16. Effectiveness in climate change mitigation and adaptation 17. Significance and relevance to the SDGs 18. Technical replicability
	Economic	19. Economic predictability and contribution to the common good 20. Green growth and eco-innovation
	Institutional	21. Innovativeness in governance 22. Institutional adaptability (changes over time) 23. Transferability of practices
<b>4. Accountability</b>	Institutional	24. Compliance with upper-level governments and agendas 25. Administrative accountability within own level
<b>5. Conformance to general morality</b>	Institutional	26. Information transparency
		27. Legitimacy (conformity to the law)
		28. Ethical acceptability

Table 10: Evaluative criteria developed for the multi-criteria assessment in this research

### Evaluating interactions and outcomes

As mentioned in 4.3.1.3 Organising data and coding, the codes (sub-themes) for the categories - ⑥interactions and ⑦outcome are matched with the respective criteria in MCA. The match is presented in Table 11: MCA criteria matched with the ⑥Interactions and ⑦Outcomes of three case studies for evaluation.

## Urban Green Space Governance in China - Institutional Analysis

<b>1<sup>ST</sup> TIER &amp; STRUCTURAL CRITERIA</b>	<b>DIMENSIONS</b>	<b>2<sup>ND</sup> TIER CRITERIA</b>	<b>1<sup>ST</sup> CASE</b>	<b>2<sup>ND</sup> CASE</b>	<b>3<sup>RD</sup> CASE</b>	<b>CORRESPONDING SUB-CODES (SUB-THEMES)</b>	<b>CORRESPONDING CATEGORIES</b>
<b>1. Economic efficiency</b>	Economic	1. Financing adequacy				UGS goals from plans/policies UGS Implementation	⑦Outcome
		2. Direct cost-benefit efficiency					
	Technical	3. Temporal efficiency of planning				UGS goals from plans/policies UGS Implementation	⑦Outcome
4. Temporal efficiency of implementation							
	Institutional	5. Interlinkages between institutions				UGS goals from plans/policies UGS Implementation Urban climate governance	⑦Outcome
<b>2. Equity</b>	Social	6. Cultivation of social cohesion				UGS Implementation Informing/informed Partially participating Substantially participating	⑦Outcome ⑥Interactions
		7. Inclusion of health and wellbeing benefits				Human health and wellbeing	⑦Outcome
		8. Inclusion of rights to access information				UGS Implementation Informing/informed Partially participating Substantially participating	⑦Outcome ⑥Interactions
		9. Inclusion of rights to monitor					
	10. Inclusion of rights to participate						
	Ecological	11. Environmental protection and resource conservation				UGS Implementation Climate resilience	⑦Outcome
Economic	12. Inclusion of economic benefits				UGS goals from plans/policies UGS Implementation	⑦Outcome	
<b>3. Adaptability, resilience, and robustness</b>	Technical/ecological	13. Sustainability in land use				UGS Implementation Climate resilience Human health and wellbeing	⑦Outcome
		14. Environmental quality (air, noise, waste, water)					
		15. Ecological resilience (ability to stay resilient)					
		16. Effectiveness in climate change mitigation and adaptation					
		17. Significance and relevance to the SDGs					
		18. Technical replicability					
	Economic	19. Economic predictability and contribution to the common good				UGS goals from plans/policies	⑦Outcome
		20. Green growth and eco-innovation					
Institutional	21. Innovativeness in governance				UGS goals from plans/policies UGS Implementation Formal changes Informal changes Urban climate governance	⑦Outcome	
	22. Institutional adaptability (changes over time)						
	23. Transferability of practices						
<b>4. Accountability</b>	Institutional	24. Compliance with upper-level governments and agendas				UGS goals from plans/policies UGS Implementation Urban climate governance	⑦Outcome
		25. Administrative accountability within own level				UGS goals from plans/policies UGS Implementation Urban climate governance	⑦Outcome
<b>5. Conformance to general morality</b>	Institutional	26. Information transparency				UGS goals from plans/policies UGS Implementation	⑦Outcome
		27. Legitimacy (conformity to the law)				UGS goals from plans/policies UGS Implementation	⑦Outcome

					Formal changes Informal changes	
		28. Ethical acceptability			UGS goals from plans/policies UGS Implementation Formal changes Informal changes	⑦Outcome

Table 11: MCA criteria matched with the ⑥Interactions and ⑦Outcomes of three case studies for evaluation

A 1-7 scale evaluation scheme is used with respective colours assigned for filling Table 11: MCA criteria matched with the ⑥Interactions and ⑦Outcomes of three case studies for evaluation: 1 - Very clearly negative, 2 - Clearly negative, 3 - Slightly negative, N/A - Not sufficient information to assess, 4 - Neutral / Insignificant, 5 - Slightly positive, 6 - Clearly positive, 7 - Very clearly positive.

1	Very clearly negative	7	Very clearly positive
2	Clearly negative	6	Clearly positive
3	Slightly negative	5	Slightly positive
N/A	Not sufficient information to assess	4	Neutral / Insignificant

Table 12: The 1-7 scale evaluation scheme for the MCA

In summary, this Chapter introduced the research design of this thesis, including how the IAD framework is used to structure the set of variables to be measured, the qualitative and case-study-based approach, how each case study was selected and for how long they have been studied. This Chapter also explained what the targeted data is, how it was collected and analysed, including using the MaxQDA software for a qualitative content analysis and constructing a comprehensive set of evaluative criteria for a multi-criteria analysis (MCA). The next few chapters focus on empirical analysis, in which three UGS governance cases are presented, examined, and crossed with the theories established in Chapter III. The next Chapter follows by confirming the first three exogenous variables: ①*biophysical conditions*, ②*community attributes* and ③*rules-in-use* of the IAD framework.

## CHAPTER V

### EMPIRICAL CONTEXT AND CASE PRESENTATION

This Chapter portrays the first three exogenous and independent variables: ① *biophysical conditions*, ② *community attributes* and ③ *rules-in-use* of the IAD framework (see Section 3.5 Analysing Common-Pool Resource Governance through the IAD Framework, and Figure 9: The IAD framework applied in this research), through 1) contextualising the biophysical conditions of the three case studies, 2) introducing the actors (Section 5.3), as well as 3) outlining the institutional context of the three case studies (Section 5.2). The biophysical conditions (Section 5.1) include the natural, socio-economic conditions and the state-of-art climate change impacts in Guangzhou and in China in general.

#### 5.1 Biophysical Contexts of China and of Guangzhou City

##### 5.1.1 *Natural and socio-economic conditions*

China has the third largest land area globally with about 9.6 million km<sup>2</sup>, stretching 5,000 km from east to west and 5,500 km from north to south with widely varying landscapes, including mountains, high plateaus, sandy deserts, dense forests, coastal wetlands, plain fertile agricultural fields, and more. The country is located on the west coast of the Pacific Ocean with a continental coastline of more than 18,000 km and a complex and diverse range of climates characterised by monsoon with high temperature and rain in summers, cold and little rain in winters. The high-temperature periods are often consistent with the rainy period.

In addition, China is currently the most populous country with 1.39 billion population and four of the ten largest metropolitan cities globally each hosting well over 20 million people. Meanwhile, the country has the second largest economy distributed primarily along the eastern coastline, particularly in the Yellow River Delta (YRD) and the Pearl River Delta (PRD). The drastic divide between the eastern and western sides of the country both in biophysical and socio-economic conditions is often marked by the reference of the Heihe-Tengchong Line (see Figure 10: The Heihe-Tengchong Linean imaginary northeast-southwest line proposed by Chinese geographer Hu Huanyong as a geo-demographic demarcation line. This line reveals that the eastern side of China contains about 36% of China's total land and is semi-humid but supports around 96% of the total population. Whilst the western side of China marked this line

contains up to 64% of total land and is semi-arid, but only supports 4% of the population (Pan, 2015). Considering such a high population density on the eastern side of the country, the socio-economic needs are pushing the ecological capacity of the eastern side to the limit. According to the *Report on China's Ecological Footprint* co-released by the World Wildlife Fund (WWF) and the China Council for International Cooperation on Environment and Development (CCICED) in 2012, provinces in China that have ecological deficits (when the footprint of a population exceeds the biocapacity of the area available to that population) grew from 19 to 26 between 1980-2000. The speed of change drastically outpaced world average, primarily due to the rapid increase in both intensive agricultural production and fossil fuel consumption (Cheng et al., 2012).

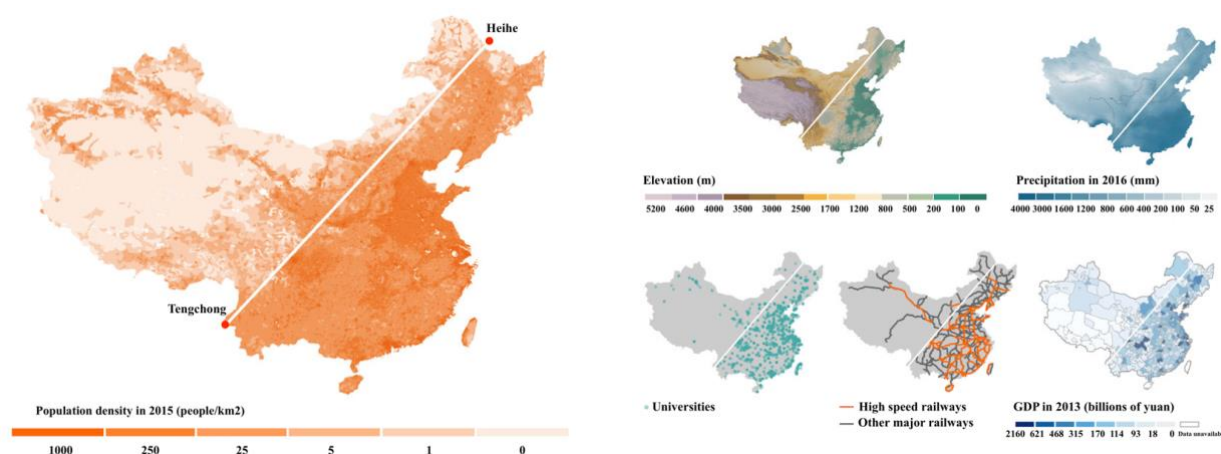


Figure 10: The Heihe-Tengchong Line

Source: Murphy 2017

Guangzhou is the third-largest metropolis in China and the economic, political, and cultural centre of Guangdong Province located in the southeast close to the low-laying composite Pearl River Delta 0.3 - 0.4 m below mean sea level (MSL) (Tracy et al., 2007) (see Figure 11 and Figure 13). Guangzhou has a total urban territory of 7,434 km<sup>2</sup> between 112.57~114.3° E and 22.26~23.56° N and a subtropical oceanic monsoon climate<sup>31</sup> characterised by hot summers

<sup>31</sup> Chinese National Bureau of Technical Supervision.1994. Standard for climatic regionalization for architecture (in Chinese: 建筑气候区划标准 GB50178-93).

and warm winters. The city receives abundant rainfall of about 150 days a year and average annual precipitation of more than 1,800 mm, most of which during the flood season beginning in April and peaks in June. Tropical cyclones tend to visit in summers (June-August), bringing abundant precipitation. The hottest month of the year usually is July.<sup>32</sup>

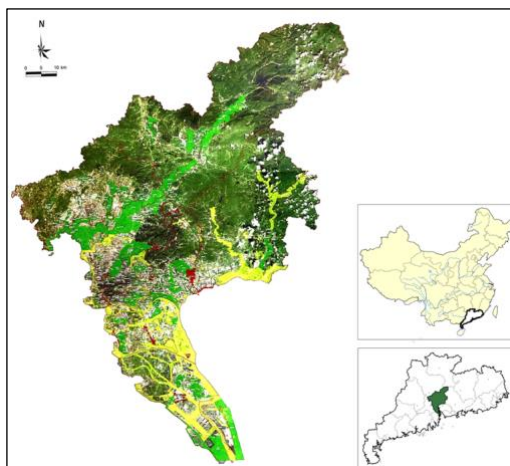


Figure 11: Geographic location of Guangzhou

### **Rapid urbanisation and land use change**

Since the national economic reform in the early 1980s, the total built area in Guangzhou at least tripled by 2010 (Zhou, 2010) (For a transformative example, see Figure 14). Before 2000, Guangzhou's urban area only contained five districts: Yuexiu, **Haizhu**, Liwan, **Tianhe**, and Baiyun (see Figure 12, marked in red letters). The other six districts: Huangpu, Huadu, Panyu, Nansha, Conghua, and Zengcheng, were all established or merged into Guangzhou after 2000. **Panyu** and Huadu were merged into Guangzhou as individual districts in 2000. The District of Nansha was established in 2005. Conghua and Zengcheng were merged into Guangzhou as individual districts in 2014, and Luogang District was merged into Huangpu District to become the new Huangpu District in the same year. Today, Guangzhou's jurisdictional boundary embraces 11 districts, including Yuexiu, **Haizhu**, Liwan, **Tianhe**, Baiyun, Huangpu, Huadu, **Panyu**, Nansha, Conghua, and Zengcheng occupying a total land area of 7,434.4 km<sup>2</sup> (see Figure 12).

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<sup>32</sup> Homepage of the Municipal Government of Guangzhou > City Information > Overview of Guangzhou > Natural Geography. Available at: [http://www.gz.gov.cn/gzgov/s2769/sq\\_tt.shtml](http://www.gz.gov.cn/gzgov/s2769/sq_tt.shtml)



Figure 12: The current administrative districts and their distribution of Guangzhou

Note: The red texts indicate the administrative districts established in or before 2000, and the black letters indicate the districts established or merged after 2000

The rapid and extensive industrialisation and urbanisation Pearl River Delta area experienced following the economic reform in the early 1980s plus the historically lagged land property rights confirmation work resulted in the overall low land-use efficiency and evident urban land scarcity by the New Millennium. For example, by 1989, five years into the implementation of the 14th Urban Master Plan of Guangzhou (1984-2000), the city had almost used all of the urban land quotas for the planned period (Dai & Duan, 2003). The appeal for urban land expansion was extremely evident during the subsequent planning work for the 15<sup>th</sup> edition of the Urban Master Plan of Guangzhou (Deng et al., 2017). The increasing urban land scarcity and land needs in the vibrant economic development prompted the city to expand by merging neighbour districts or cities. The landscape of Guangzhou experienced great changes between 1990 and 2014 with the tendency likely to continue (Gong et al., 2018). In 2018, the central government proposed to integrate Hong Kong, Macau and nine southern mainland cities into one huge megacity, the largest megacity hub that the world has seen, alias the Guangdong-Hong Kong-Macau Greater Bay Area (GD-HK-MO GBA), with the vision of turning a leading hub for innovation and economic growth.

## Urban Green Space Governance in China - Institutional Analysis



Figure 13: Pearl River Delta in 1979 (left) and in 2000 (right)

Comparing to the previous image, vast swathes of farmland have turned from green to grey, and huge new areas of land reclaimed from the sea. *Satellite image 1979 and 2000*

©Landsat/Nasa/UIG/Getty Images



Figure 14: Guangzhou South Avenue looking towards the river in 1991 and 2015

Left: 1991 ©Zeng Zhi; right: 2015 ©Alex Hofford

### Population and urbanisation in Guangzhou

Guangzhou's residential population grew from 5.9 million in 1990 to 14 million in 2016, and the urban population accounts for 86%. Urban population is the number of residents who are registered as urban households. The urban and rural household registrations are a unique system in China which are invented initially to mediate population movements across the country. To do so, the household registration systems connect urban and rural population to

different sets of public service resources within their administrative region, including healthcare, education, and housing, The Pearl River Delta, where Guangzhou is located, has the largest urban agglomeration globally based on the total residential population (UN Habitat, 2016). The city's gross domestic product (GDP) increased 56 folds, from approximately 32 billion (CNY, ~4 billion Euro) in 1990 to 1 trillion and 810 billion (CNY, ~226 billion Euro) in 2015. All three districts selected for this study: Haizhu, Tianhe, and Panyu, became Guangzhou's administrative districts by 2000. Urban development land availability decreased drastically in these districts over the last few decades. Among them, Haizhu and Tianhe districts are significantly smaller in land area and their residential population density is significantly larger than other districts (also see Table 13). These two indicators are of great significance from an urban land economy perspective. While Panyu District has mostly industrial land even though the land area is relatively large. Since UGS is regarded as a part of urban development land in the Chinese land use system, the total amount of usable urban land and how it is being used are of great significance to UGS planning and governance.

	PANYU	HAIZHU	TIANHE	GUANGZHOU TOTAL
Land Area (Km <sup>2</sup> )	529.94	90.40	96.33	<b>7434.40</b>
Residential Population (Million)	1,641.1	1,637.9	1,631.0	<b>14,043.5</b>
Population Registered as Urban Households (Million)	0,886.5	1,022.6	0,867.7	<b>8,704.9</b>
Density of Residential Population (Per Km <sup>2</sup> )	3097	18118	16931	<b>1889</b>
Density Of Population Registered as Urban Households (Per km <sup>2</sup> )	1673	11312	9008	<b>1171</b>
Size of UGS (Hectares)	1731.84	342.96	2605	<b>15750.93</b>
Size of UGS Per Capita (m <sup>2</sup> )/Residential Population	10.55	11.06	15.97	<b>16.5</b>

Table 13: Land area, population density and UGS size of each district in Guangzhou in 2016

Data source: Guangzhou Municipal Bureau of Statistics and Bureau of Forestry and Landscaping

### *5.1.2 Climate change impacts*

China's geographic and climatic conditions as well as population distribution determine that the country is highly susceptible to climate change impacts. Although China's climate is conducive to the cultivation of agricultural products, the disadvantage is that the country has frequent disastrous weathers, among which droughts, floods, cold waves, and typhoons are the main hazards that cast negative impacts on the population often. Summer and autumn seasons are when tropical cyclones or typhoons frequently hit the southeast coast of China. During the autumn and winter seasons in China, cold air from Mongolia and Siberia sweeps southward, sharply decreasing the temperature and forming cold waves, frosts, and strong winds, which impact human health negatively and can jeopardise agricultural production.<sup>33</sup>

Climate change is evident in China. From 1901 to 2017, the average surface temperature in China has become 1.21° higher than the pre-industrial level, compared to the global average of about 1.1°C (National Climate Centre, 2018). The sea level in coastal China rose around 122 mm from 1980 to 2017 (China Meteorological Administration, 2018). Looking forward, the probabilities of continued sea level rise and the consequential extreme events, such as tropical cyclones, storm surge, and coastal erosion, are very likely to increase significantly over the 21<sup>st</sup> century and the coasts of China is among the highly vulnerable coastal regions (Feng and Tsimplis, 2014; Hallegatte et al., 2013b; Yang et al., 2017). Climate change has caused the 400 mm isoline of mean annual precipitation to shift around, but more importantly, has made extreme climate events such as typhoons, storms, and floods, more intense and more frequent in the east side of the Heihe-Tengchong Line (see Figure 10). Notably, one recent study projects that 37 million people in China will be exposed to sea level rise and related consequences, accounting for 53% of the global exposure (Muis et al., 2016). So far, climatic hazards have costed an average \$76 billion US dollars in China and affected around one third of agricultural land (Asian Development Bank, 2015). While poverty rate has been drastically reduced over the last few decades (Hu et al., 2003), many urban areas in China are not decently equipped for natural hazards due to infrastructural creation failing to catch up with the speed of urbanisation (Xiao et al., 2018; Zuo, 2014).

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<sup>33</sup> State Council of China Homepage > Basic conditions of the country (in Chinese: 首页>国情). Available at: <http://www.gov.cn/guoqing/index.htm>

Guangzhou, as a low-lying coastal city in the Pearl River Delta, is easily affected by rising sea levels. Its unique Asian subtropical monsoon climate also means that millions of people in the city increasingly need to withstand the direct threats of tropical cyclones, heavy rainfall, floods, high temperature and heatwaves, haze, thunder and lightning, and sea-level rise. Regular heatwaves throughout the summers in Guangzhou have intensified in the last 60 years, both in the number and the duration of heatwaves (see Figure 15). Since the New Millennium, the threat of intensified heatwaves on the city became particularly evident. In the 2001-2010 period, the number and duration of heatwaves in Guangzhou dramatically increased. Such is the result of climate change and increasing heat-island effect, inducing great health impacts ranging from insomnia, fatigue, clinical exacerbation to increasing transmission potential of malaria to death from heatstroke (Du et al., 2013).

The China-UK Global Health Support Program’s research on Guangzhou finds that the higher intensity and time length a heatwave possesses, the higher the mortality risks become. According to the Guangdong Provincial Centre for Disease Control and Prevention (GPCDCP), each degree of temperature rise in Guangzhou has increased 3.7% mortality rate for the elderly ( $\geq 65$  years old) (Liu 2020). Furthermore, dengue fever is a common concern in post-typhoon periods due to the stagnant groundwater and hot and humid weather. Climate change with its intensification effect on the length and intensity of typhoons, as well as rainfalls, has demonstrated significant impacts on dengue in Guangzhou (Xiang et al., 2017).

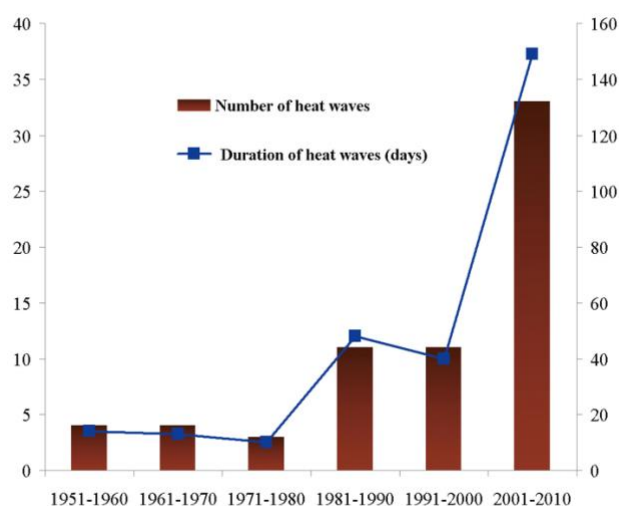


Figure 15: Decade trend of heat wave during the last 60 years in Guangzhou

Source: The Adapting to Climate Change in China Project (ACCC 2012)

Besides, tropical cyclones affecting the PRD Region in the last decade became more intensive and brought heavier rainfalls (see Figure 16). The intensity of typhoons generated on the western North Pacific and the consequential storm surges have increased due to warmer ocean surface temperature and decreased salinity (Balaguru et al., 2016; IPCC 2014; Nakamura et al., 2016). The typhoons which demonstrated destructive power in Guangzhou and the neighbouring provinces between 2013-2017 have caused an estimated 2000 deaths in total (State Council of China ,2014a). In addition, the increased intensities of the strongest tropical cyclones and the rising sea levels globally are continuously impacting on the social, economic and environmental determinants of mental health (Elsner et al., 2008b; Fritze et al., 2008; Walsh et al., 2014). These extreme events may be leading to serious mental health problems, such as fear and stress over exposure to greater disaster risks and post-disaster trauma-related mental illness, possibly even including increased suicide mortality (Berry et al., 2010). The impacts of climate change on mental health merit further investigation.

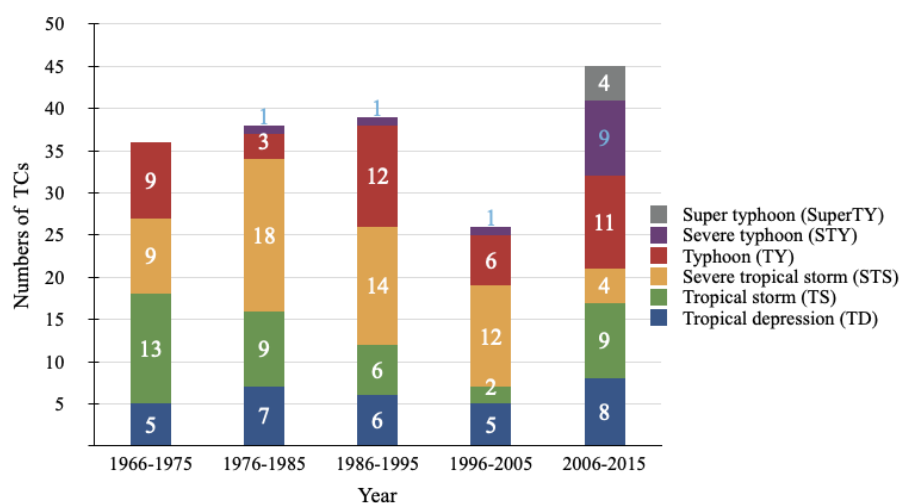


Figure 16: Numbers of landfalling Tropical Cyclones affecting the Pearl River Delta region from 1966-2015

Data source: HKO's Tropical Cyclone dataset, 2016

Guangzhou has long been ranked as one of the most vulnerable cities in the world facing climate change as shown in various climate modelling results. The city was ranked as the second most vulnerable cities among the top ten, only after Mumbai, in terms of exposed population

(including all environmental and socioeconomic factors) for present-day conditions (2005). The impacts of climate change on human health and wellbeing are concrete, complex, and intricate. These impacts tend to bring forth greater damages for physically vulnerable groups. Vulnerable urban populations, e.g., rural migrants who are provided with very basic housing conditions such as pre-gentrified urban villages and peri-urban areas and the urban poor who possess weaker financial means, are especially vulnerable to the adverse health impacts from climate change. The fact that climate change related mortality is on the rise could be an indication of a lack of knowledge on how exactly climate change impacts health and which actions can be taken to mitigate the impact.

Two thirds of the world's largest cities are in coastal deltas; Guangzhou is one of them. Due to the low-laying geographical feature, these cities are particularly vulnerable facing climate change impacts such as sea level rise. A global chemistry-climate model projected that, under the high greenhouse gas scenario RCP8.5, premature mortality from climate change-attributed air pollution rises in all regions, with the most significant rise in India and East Asia, which includes Guangzhou (Silva et al., 2017; Du et al., 2013). Research on vulnerability variation from coastal regions to inland in Guangzhou indicated that climate change is likely to bring stronger heatwaves in the future, thereby increasing heatwave-related illnesses and deaths (Du et al., 2013; Liu et al., 2013; Zhu et al., 2014). The same China-UK research also finds that heatwaves affect health more strongly in these Chinese urban areas where air-conditioners are less commonly seen, and per capita disposable income is lower. In addition, recent research also points to the intensification of cold spells due to climate change and that the cold spells related non-accidental deaths in Guangzhou will increase in the future (Sun et al., 2018). By the 2070s, Guangzhou is projected to still be amongst the top 10 most vulnerable cities in the world, irrespective of the changes, and the social and economic loss could be catastrophic (C40 Cities Climate Leadership Group, n.d.; Nicholls et al., 2007).

## **5.2 Institutional Contexts of China**

This Section introduces the institutional contexts of China, including the contemporary development philosophy (the most prominent and recent one being *Ecological Civilisation*), history of environmental protection, important national-level plans on environmental health and climate change and the multi-level, nested hierarchical system of land-use and spatial planning. These institutional settings together compose the third independent variable ③rules-

*in-use* (of the IAD framework) for understanding the three UGS governance cases in Guangzhou.

### **5.2.1 Contemporary development philosophy before Ecological Civilisation**

#### 5.2.1.1 Socialist market economy with Chinese characteristics

Scholars consider the period between the founding of the Chinese socialist state in 1949 and the economic reform in 1979 as the modern political period characterised by the communist identity, state-controlled resource allocation, and the ethical norm of prioritising the common good over individual good (Dallmayr et al., 2012; Li 2018). The period since the economic reform is generally considered the contemporary political period marked by the state-oriented market economy, or, as formally named, socialist market economy with Chinese characteristics (in Chinese: 中国特色社会主义市场经济 *zhōng guó tè sè shè huì zhǔ yì shì chǎng jīng jì*) (Cheng and Chen 2018). With the economic Reform and Opening Up since 1979, particularly since the early 1990s, China underwent a rapid process of marketisation of goods and services by privatising property rights orchestrated by the state. The process is accompanied by the transition of governance and regulation based primarily on political means (or ideological regulation) to legal means and economic means. State intervention in society, in general, saw a decrease. The goal of the transition in the Chinese political and economic transition is to develop a civil society through economic development, industrialisation, and urbanisation, while keeping the emphasis on social harmony and the performance of social roles that the leadership promotes within the country's contemporary social, economic, historical and cultural context (Li 2018).

The lack of former references and experience challenged the central government in leading the path to marketisation and industrialisation followed by the local governments. Problems frequently arose, for example, the privatisation process, especially when conducted by local governments, was not standardised, resulting in the devaluation and sometimes even corruption of state assets. Besides, the central government's vision and agendas often did not align well with the needs or interests of the local developments, resulting in coordination problems. Furthermore, the economic dynamics fostered in contemporary Chinese society determine that all levels of government not only provide policy support but also gain economic benefits. Local governments have increasingly valued economic benefits, gradually prioritising projects with high and fast economic benefits. On this basis, the state has gradually given priority to

economic efficacy over distributive justice, not only economic justice but also social and environmental justice.

#### 5.2.1.2 Scientific Outlook on Development

After summarising the above problems and experience in the Reform and Opening up, in 2003, the former president Hu Jintao stated at the 16th Party Central Committee Session that it is necessary to "adhere to a *people-centred principle* and establish a comprehensive, coordinated and sustainable development concept." In 2007, the 17th National Congress defined *Scientific Outlook on Development* (科学发展观, kē xué fā zhǎn guān) as *sustainable development* that is *people-centred*. This was the first time the term *people-centred* was made formally associated with the notion of *sustainable development*. The goal is to address the high cost of the "pollute first, control later" approach taken since the Reform and Opening up, and to achieve comprehensive, coordinated, and sustainable development through coordinated and comprehensive planning. The objective is to "pursue comprehensive progress both at individual and societal levels based on economic development, develop socialist economic, political, and spiritual civilisation through coordinated means, and insist on achieving human-nature harmony in natural resources consumption, ultimately achieve sustainable economic and social development." (Literature Research Office of the Central Committee of the Communist Party of China, 2005: 483). Furthermore, in 2006, the national government made it a strategic task to build a "resource-conserving, environment-friendly society" in medium- to long-term socio-economic planning.

#### **5.2.2 Ecological Civilisation**

This section introduces *Ecological Civilisation*, China's current most ambitious national environmental governance framework, in four parts: 1) emergence of the concept, 2) the integrated reform plan of a more comprehensive environmental governance system, 3) experiments and development of novel concepts including Gross Ecosystem Product (GEP) and Ecological Asset (EA) for fundamental value change, 4) *Ecological Civilisation* operationalised as *people-centred development* in the urban context, and 5) challenges of insufficient understanding of the current institutional reform.

### 1) China's emerging national environmental governance framework

In 2007, the concept of *Ecological Civilisation* (生态文明 sheng tài wén míng) was introduced into the National Party Congress Report as “a **future-oriented guiding principle** based on the perception of the extremely high price we have paid for our economic miracle” and as a strategic goal to establish a more comprehensive environmental governance institutional framework (China Daily, 2007). The concept was proposed as a core national development strategy in 2012 (Pan, 2015). *Ecological Civilisation*, according to senior Chinese development officials, emphasises respect for nature and protection of people's rights, and aims to achieve ecological and social justice, improve efficiency in economic production and balance of regional differences, and secure quality life for the people (Pan, 2015).

The concept of *Ecological Civilisation* builds upon the realisation that gradually came through about the high ecological footprint and unsustainability of the Western Industrialisation development pathway, after following this model for more than three decades. China has achieved great economic success but, in the meantime, experienced severe environment deterioration, increasing inequality, and loss of critical ecological assets. The Western development model since the Industrial Revolution has been increasingly referred to by scholars as the “develop (the economy) first and treat (the environment) later” model (先发展后治理 xiān fā zhǎn hòu zhì lǐ). In fact, as early as in the 1920s, British historian Bertrand Russell (2009) argued that industrialism is a threat to human freedom, especially mental freedom because of its fundamentally exclusive nature (private property), uninspiring form (mechanistic outlook), and egoistic political purpose (nationalism). Entering the 1960s, a series of environmental incidents prompt a broad societal reflection on economic growth and environmental movement. Rachel Carson (2000) described a world possibly without birds, bees and butterflies due to the extensive use of pesticides and artificial fertilizers. Donella Meadows (1972) inquired about the quantitative constraint of global resources and the system of production on human socio-economic activities and emphasised the criticality of redirecting society toward global economic and ecological equilibrium instead of growth.

In addition, the Chinese traditional thoughts of Nature, such as the “human-nature oneness” from Taoism (also see Chapter 2.1.2 Ecological notion and Governance philosophy in China), has gradually become the philosophical foundation which formed the principle of *Ecological Civilisation*. In China, agricultural economist Ye Qianji first introduced the concept from the

former Soviet Union in 1987 and further conceptualised it based on the traditional Taoist thinking on the human-nature relationship (Xu, 2009). For instance, the Chinese sage Laozi wrote in the *Tao Te Ching*, the 6th-century BC Chinese classical text: “*Humans produce and reproduce according to (the ability of) land, land produces according to the weather, the weather serves the land according to Tao, and Tao is subjected to Nature’s grace* (in Chinese: 人法地，地法天，天法道，道法自然; rén fǎ de, dì fǎ tiān, tiān fǎ dào, dào fǎ zìrán)” ‘*Tao* (道)’ in Chinese has the literal meaning of ‘way, methods, or principle’. The concept of *Ecological Civilisation* is built upon the idea that human behaviours need to follow and respect nature’s capacity (Pan, 2015).

In short, the concept of *Ecological Civilisation* contains explicit value prospects and institutional goals necessary for building a new political philosophy in China that defines a development paradigm highlighting fairness, efficiency, harmony and human development (Pan, 2015). On value, the phrase “*lucid waters and lush mountains are invaluable assets*” (in Chinese: 绿水青山就是金山银山, lǜ shuǐ qīng shān jiù shì jīn shān yín shān) proposed by the current President Xi Jinping has been widely promoted as an interpretation of *Ecological Civilisation* - a value of respect for nature, co-existence and co-prosperity with nature. On institutions, it seeks to establish a system based on regulations, rules, and economic incentives to improve nature conservation and protection, production of higher efficiency and distribution of goods and services of better fairness.

## **2) An integrated reform plan of a more comprehensive environmental governance system**

Initially, the concept of *Ecological Civilisation* was criticised as vague and little operationalisable (Marinelli, 2018). After defining the mission and main task of the future-oriented guiding principle *Ecological Civilisation*, the State Council issued the ***Integrated Reform Plan for Promoting Ecological Progress*** (in Chinese: 生态文明体制改革总体方案; shēng tài wén míng tǐ zhì gǎi gé zǒng tǐ fāng àn) in 2015 to put forward a more systematic, comprehensive and better-coordinated institutional framework. As showcased in Table 14, this Integrated Reform Plan established explicitly eight major working areas consisting of 47 working items of environmental governance (State Council of China, 2015).

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<b>Major working areas and working items listed in the <i>Integrated Reform Plan for Promoting Ecological Progress</i></b>		
	<b>Working areas</b>	<b>Working items</b>
1	Property rights of natural resources	<ol style="list-style-type: none"> <li>1. Establish a unified system for determining and registering property ownership rights</li> <li>2. Establish a system of property rights for natural resources with defined rights and responsibilities</li> <li>3. Improve the state natural resource assets management system</li> <li>4. Establish a system for exercising property ownership rights at different administrative levels</li> <li>5. Launch demonstration projects for determining and registering watershed and wetland ownership rights</li> </ol>
2	Land space development and protection	<ol style="list-style-type: none"> <li>6. Improve the zoning system of functional zones</li> <li>7. Improve the regulatory system of land space use</li> <li>8. Establish a national park system</li> <li>9. Improve the system of natural resources regulation</li> </ol>
3	Spatial planning	<ol style="list-style-type: none"> <li>10. Formulate spatial plans</li> <li>11. Promote integrated planning at municipal- and county-levels</li> <li>12. Develop new approaches for formulating spatial plans at municipal- and county-levels</li> </ol>
4	Total resource management and conservation	<ol style="list-style-type: none"> <li>13. Reinforce systems for farmland protection and sustainable land-use</li> <li>14. Strengthen a system for water resources management</li> <li>15. Establish a system for total energy consumption management and conservation</li> <li>16. Establish a system for old-growth forest protection</li> <li>17. Establish a system for grassland protection</li> <li>18. Establish a system for wetland protection</li> <li>19. Establish a system for deserted land close-off and protection</li> <li>20. Improve the system of marine resources development and protection</li> <li>21. Improve the system of mineral resources development and utilisation</li> <li>22. Improve the system of resource recycling</li> </ol>
5	Payment-based natural resource consumption and ecological compensation	<ol style="list-style-type: none"> <li>23. Accelerate the reform for natural resource products pricing</li> <li>24. Improve the payment-based system for land use</li> <li>25. Improve the payment-based system for mineral resource use</li> <li>26. Improve the payment-based system for use of oceanic spaces and offshore islands</li> <li>27. Accelerate the reform of resource and environmental taxes and fees</li> <li>28. Improve the ecological compensation system</li> <li>29. Improve the mechanism for utilising ecological protection and restoration funds</li> <li>30. Create a system for farmland, grasslands, rivers, and lakes recuperation</li> </ol>
6	Environmental governance system	<ol style="list-style-type: none"> <li>31. Improve the pollutant emissions permit system</li> <li>32. Establish a mechanism for regional cooperation in pollution prevention and control</li> <li>33. Establish systems and mechanisms for rural environmental governance</li> <li>34. Improve the systems of environmental information public disclosure</li> <li>35. Strengthen the implementation of ecological and environmental damage compensation systems</li> <li>36. Improve the environmental protection management system</li> </ol>
7	Market system for environmental governance and ecological conservation	<ol style="list-style-type: none"> <li>37. Foster market entities for environmental governance and ecological conservation</li> <li>38. Promote the energy-use and carbon emission permits trading systems</li> <li>39. Promote the pollution permit trading system</li> <li>40. Promoting the water rights trading system</li> <li>41. Establish a green finance system</li> </ol>

		42. Establish a unified system for green products
8	Environmental governance performance evaluation and accountability system	43. Establish an Ecological Civilisation targets system 44. Establish monitoring and early-warning mechanisms for environmental and resource carrying capacity 45. Create natural resource assets balance sheets 46. Audit outgoing officials' management of natural resource assets 47. Establish a lifelong accountability system for ecological and environmental damage

Table 14: Major working areas and working items listed in the Integrated Reform Plan for Promoting Ecological Progress

Data source: State Council of China 2015

These working areas and items proposed above were deemed innovative, visionary, and ambitious (Li [ed.], 2018), therefore required a suitable and effective government system for implementation. At that time, three main problems were identified in a national government performance evaluation: 1) disarrangement of positions, powers and responsibilities of some government agencies including central and local ones, leading to 2) inefficient performances, and 3) the lack of effective power checking, monitoring and supervision mechanism (Wei, 2018). To improve the government system's suitability and effectiveness and establish the above-mentioned *Ecological Civilisation* institutional framework, the State Council issued the *Decision of the Central Committee of the Communist Party of China on Some Major Issues Concerning Comprehensively Deepening the Reform* (in Chinese: 中共中央关于深化党和国家机构改革的决定; zhōng gòng zhōng yāng guān yú shēn huà dǎng hé guó jiā jī gòu gǎi gé de jué dìng) in 2018. The *Decision* gave instructions on how to **provide institutional guarantee for building *Ecological Civilisation*, namely, by “reforming the management and protection systems of natural resources and ecological environments, and building an environmental governance system led by state, primarily participated by market, and co-participated by societal organisations and the public”** (State Council of China, 2018). An immediate subsequent action of this *Decision* was the creation of two brand new ministries: the Ministry of Ecology and Environment, and the Ministry of Natural Resources, concentrating the scattered responsibilities of different government departments on environmental governance (see Figure 17).

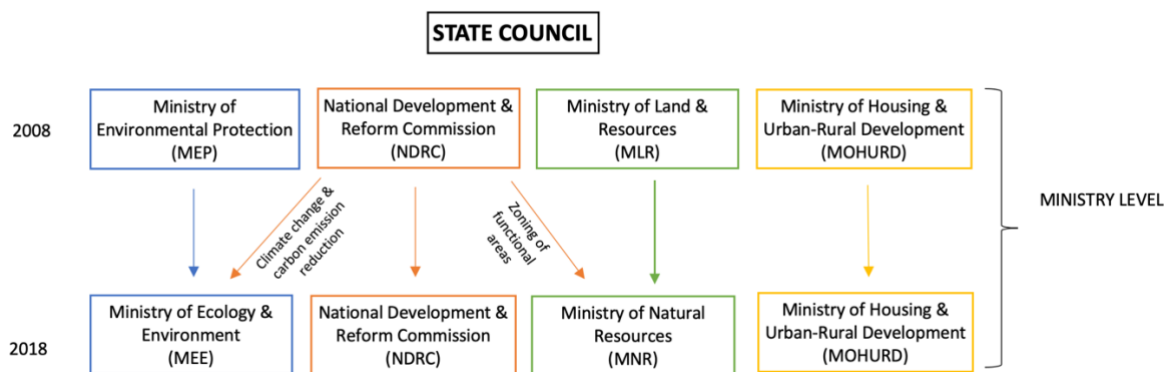


Figure 17: Institutional reform at the national level in the Chinese Central Government in 2018

### 3) Examples of experiments and development of novel concepts: Gross Ecosystem Product (GEP) and Ecological Asset (EA) for fundamental value change

Human societies and the ecological environment on which they depend for survival and development constitute complex social-ecological systems. Environmental and especially ecological economists have long advocated for accounting ecosystem services that human societies and economic development have benefited, with the support of less economy-centric references such as the Human Development Index (HDI) and Gross National Happiness (GNH). The *Integrated Reform Plan* introduced above proposed establishing diverse mechanisms for assessing the ecological dependence, for ecological compensation, restoration, and conservation based on quantitative evidence (Ouyang et al., 2018). Gross Ecosystem Product (GEP) is defined as the total economic values of ecosystem products and services for human welfare and sustainable development in a geographical area with one year as a time unit for analysis (Ouyang et al., 2013). Ecological Asset (EA) refers to various types of ecosystems that produce and provide ecosystem products and services, including natural and artificial ecosystems based on natural ecological processes such as urban green spaces. The GEP and EA accounting methods and experiments are also expected to lead to the development of other ecological governance tools such as the ecological assets balance sheets and the auditing system for outgoing officials' performance on natural resource management.

The work of establishing the GEP accounting system under *Ecological Civilisation* in China has been based on many concluded or ongoing international ecological environment protection work, including the UN-led Millennium Ecosystem Assessment, the Intergovernmental

Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), the UN System of Environmental-Economic Accounting (SEEA) integrated economic and environmental data framework, the Economics of Ecosystems and Biodiversity (TEEB) initiative, and the World Bank Wealth Accounting and the Valuation of Ecosystem Services (WAVES) global partnership program.

GEP accounting includes the total direct- and indirect-use values of ecosystem goods and services, including ecosystem provision value (EPV), ecological regulation services value (ERV) and ecological culture services value (ECV) (see Table 15). The math of GEP accounting is expressed as:  $GEP = EPV + ERV + ECV$ .

Types of values of ecosystem goods and services considered in the GEP accounting	
Types of values	Examples
Ecosystem provision value (EPV)	e.g., agricultural, forestry, livestock, and fisheries products, water resources, energy and other tangible products that enter the market
Ecological regulation services value (ERV)	e.g., water and soil conservation, water purification, flood storage, sand fixation, air purification, carbon sequestration, and climate regulation
Ecological culture services value (ECV)	e.g., recreation, mental and physical health, tourism, aesthetic appreciation and inspiration for culture, art and design, spiritual experience, and sense of place

Table 15: Types of values of ecosystem goods and services considered in the GEP accounting

Source: Ouyang et al., 2013 & 2018, the Economics of Ecosystems and Biodiversity (TEEB)

**The relation between GEP and GDP:** In theory, the GEP of the planet Earth must be greater than the global GDP to account for the social and environmental externalities that the concept of GDP failed to. The GEP of a country should also be defined as greater than the GDP through institutional means for a country to be sustainable in the long-term (Zhu, 2017). However, for smaller administrative units, GEP may also be smaller than GDP. This is often the case for cities with a service-based economy and high population density (e.g., Shanghai, London, and New York), which depend on imports of ecological resources.

**4) *Ecological Civilisation operationalised as people-centred development in urban context***

Today, *Ecological Civilisation* has evolved into a comprehensive institutional framework encompassing guidelines, indicators, assessment methods, standards that orientate China's environmental policymaking and governance from central to local levels across land-use, natural resource conservation, ecological protection and restoration, urban planning, pollution emission control and many more. One of the main concepts of *Ecological Civilisation* is "people-centred development." As proposed by former president Hu Jintao, adhering to people-centred development means "to achieve the goal of comprehensive development of people, to seek and promote development from the fundamental interests of the people, to continuously meet the growing material and cultural needs and to effectively protect the economic, political and cultural rights and interests of the people" (People's Daily, 2008). The people-centred development principle emphasises economic growth to achieve the end goal of fulfilling the material and cultural needs of people (People's Daily, 2008).

The people-centred development principle is applied in the National New Urbanisation Plan (2014–2020) to address the country's widespread urban problems, including the marginalisation of urban migrants and environmental pollution, and to transform its land-centred urbanisation practices (Chen et al., 2016). This New Urbanisation Plan elaborated measures on integrating rural to urban household registrations, improving public transport, housing, utility infrastructure, health care and education services, institutionalising ecological and environmental protection, and strengthening and developing new approaches to social governance (State Council of China, 2014c).

**5) *Insufficient understanding of the current institutional reform under Ecological Civilisation***

Despite the strong political determination of the Chinese central government to conduct institutional reform and create a new environmental governance framework, the process has not always been smooth. A recent large-scale survey conducted by the National Development Research Centre for local government officials and policy experts shows mediocre knowledge rates on the content of the *Integrated Reform Plan*. Only about half of the survey participants knew all the eight major working areas, and few recognised all the 47 working items. In general, local policymakers tend to have better knowledge of the more coercive working items and the ones with higher economic sensitivities, such as the auditing system for outgoing officials'

natural resource management performance and the lifelong accountability system for ecological and environmental damage, and the ecological compensation system.

### ***5.2.2 History of environmental protection in China***

Regardless of political philosophy, the development and modernisation of a society require political ambitions and strategies to organise resource distribution properly. Development and modernisation across different societies share the common elements of sovereign responsibility, resource distribution, and a range of political means and ends. The Chinese government has followed the international environmental agendas since attending the first UN Conference on the Human Environment in Stockholm in 1972. Since then, the central government has undertaken major reforms in the national environmental governance system, all towards strengthening the structure and position of the national environmental agency and building a more comprehensive institutional framework combining regulatory and economic instruments. For example, the State Council passed the *Environmental Protection Law*, the *Law on the Prevention and Control of Atmospheric Pollution*, and the *Environmental Impact Assessment law* in 1979, in 1987 and in 2002 respectively. These laws contained regulatory instruments such as environmental quality and emission standards, discharge permit system, as well as economic instruments such as pollution charges specific to both the types and volume of pollutants (OECD, 2006). Central government's determination for environmental regulation was particularly evident between the mid-1990s and the New Millennium, explicating environmental governance goals through various action plans and enacting new environmental laws frequently, including the Five-Year Social and Economic Development Plans (FYPs) and the correspondent Environmental Plans with industry-specific, time-bound targets. The State Council launched *China's Agenda 21* in 1994 (State Council of China, 1994), the first white paper focusing on the nexus between its population growth, environment potential, and visions of development in the 21<sup>st</sup> century. In 1996, *Sustainable Development* was elevated as a national strategy to guide the large-scale, rapid urbanisation process of the country. In 2003, the former president Hu Jintao proposed the *Scientific Outlook on Development* (科学发展观 *kē xué fā zhǎn guān*) which can be summarised succinctly as people-centred, comprehensive, coordinated, and sustainable development, or *people-centred sustainable development* (Pan, 2015) (also see Section 5.2.1 Contemporary development philosophy before *Ecological Civilisation*). In 2003, the central government adopted a form of *Strategic Environmental Assessment (SEA)* in order to insert more valuable notions of sustainable development into the

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country's macro socio-economic development plans (Zhu & Ru, 2008). The central government further proposed environmentally relevant concepts such as the “Resource-Conserving, Environment-Friendly Society” in 2006 and formalised it as a strategic task in medium- to long-term socio-economic planning. Major institutional reforms of China's environmental governance system led by the state prior to *Ecological Civilisation* are shown in Figure 18.

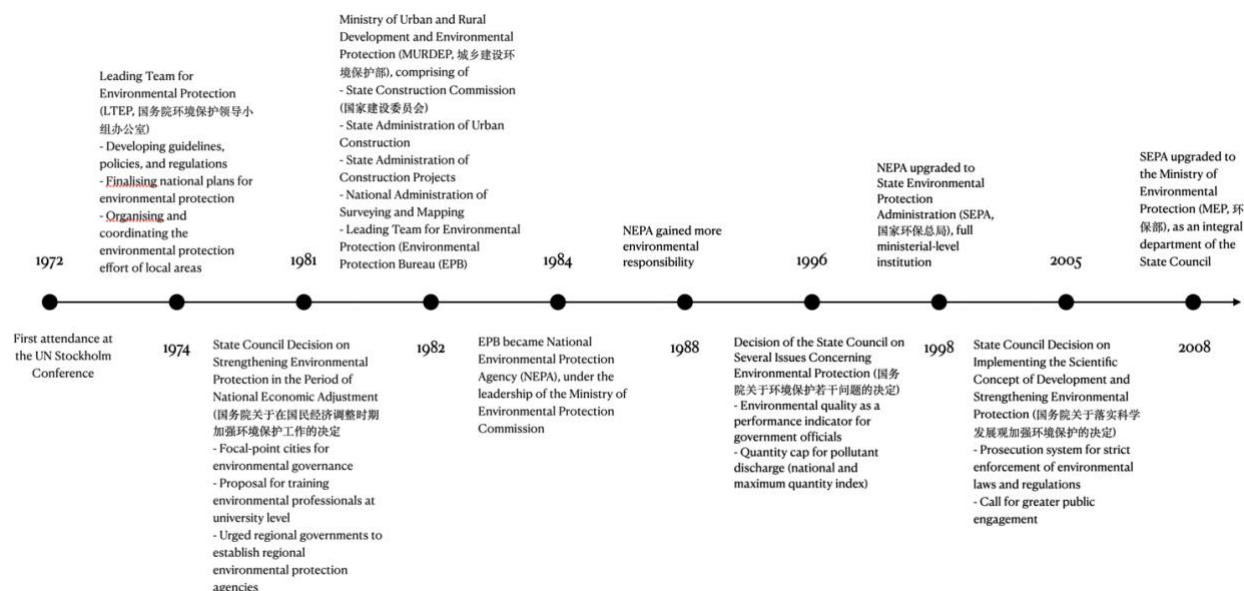


Figure 18: Major institutional reforms of China's environmental governance system led by the State prior to *Ecological Civilisation*

Data source: Wang 2019; MEE; OECD 2006; State Council 1996, 2005 & 2011

Prior to the State Environmental Protection Agency (SEPA) being upgraded to the Ministry of Environmental Protection (MEP) in 2008, China's environmental management system had limited authority and capacity to be effective and efficient in policy implementation (OECD, 2006). That was due to the provincial and local branches of the SEPA being coordinated and directed more so by local governments than by the SEPA hierarchically from Beijing. While SEPA led a strong environmental agenda at the central level, local governments often still had alternative priorities (e.g., economic development), leading to weak financial and institutional support for implementing environmental policies at local levels.

For this reason, the State Council has gradually made it a work focus to improve the institutions for better local environmental governance, so that environmental agendas set at the central level could be implemented properly. In 2011, the State Council issued the *State Council Opinion Regarding Strengthening Key Environmental Protection Work* (in Chinese: 国务院关于加强环境保护重点工作的意见; guó wù yuàn guān yú jiā qiáng huán jìng bǎo hù zhòng diǎn gōng zuò de yì jiàn), urging for 1) improving the level of supervision and management in environmental protection, 2) focusing on resolving prominent environmental problems that jeopardise public health, and 3) reforming and innovating the institutional framework and mechanism of environmental protection. Furthermore, the *Integrated Reform Plan for Promoting Ecological Progress* (in Chinese: 生态文明体制改革总体方案; shēng tài wén míng tǐ zhì gǎi gé zǒng tǐ fāng àn) (introduced in Section 5.2.2 *Ecological Civilisation*) outlined more actions to establish a more systematic, holistic and better-coordinated systems for environmental governance, including the creation of two brand new ministries exclusively dedicated to environmental and natural resource governance.

### **Problems in China's environmental governance history**

The achievements of China's environmental governance in the past few decades are applaudable, but were not without problems, which are summarised in this section. The first is ambitious planning, which is a characteristic of the centralised planning system, as well as due to insufficient understanding of the complexity of environmental problems, and knowledge gap among local governments. The second issue is the stickiness to current development norms. The performance of local government officials has been linked to their tasks of promoting economic development and GDP growth in the last few decades. This stickiness of development norms is also reflected by the weak political determination to implement and monitor current environmental governance plans and progresses at local levels. The third issue is the lack of good quality assessments on policy impacts and implementation outcome, which are critical for providing lessons learned. Current assessments are often individual project-based, result-oriented, and evaluated by institutions affiliated with the government, whose objectivity is often questioned (Li, 2016). More comprehensive assessments such as the degree of public participation, transparency and legitimacy are needed to provide lessons learned for more effective governance. The fourth problem is insufficient public participation. Citizens have not been fully mobilised to participate in environmental governance in China in the last few decades. In many projects, even when citizens were encouraged to participate, they were

limited to participate in monitoring and reporting and did not reach the level of collective planning and co-implementation. Having relied primarily on limited government resources without sufficient public participation might have been another reason why environmental governance in China still has room for improvement.

### **5.2.3 Important plans on environmental health and climate change**

This section introduces six major national plans on environmental health and climate change: 1) the *National Environmental Health Action Plan (2007–2015)*, 2) the *National Strategy for Climate Change Adaptation*, 3) the *Action Plan on Prevention and Control of Air Pollution 2013*, 4) *National Plan on Climate Change (2014–2020)*, 5) *Action Plan for Urban Climate Change Adaptation*, and 6) *Healthy China 2030*. These national plans have direct and explicit reasonings for the significance of UGS and commands for planning UGS as actions for respective environmental health and climate change adaptation purposes.

**1) The *National Environmental Health Action Plan (2007–2015)*** serves as the first national guiding principle addressing the environment-health nexus and calling for actions. It is coordinated by the Ministry of Health and sixteen other ministerial agencies. The Plan noted that environmental degradation, the destruction of ecological balance, and harm to human health has “increasingly become the key factors constraining economic growth and affecting the harmonious development of society. The Plan strives to solve major environmental problems that endanger people’s health and to further promote sustainable socio-economic development. It has defined it as both a ‘basic requirement and an important task’ for establishing the ‘people-oriented governance’ and building a ‘harmonious socialist society (State Council of China, 2007: 3).’ This Plan highlighted the significance of resolving major environmental health problems through environmental health assessments – namely, the impacts of climate change on human health and coping strategies. The effects of climate change on human health referred to in this Plan include the impacts of extreme weather and climate events such as heatwaves, storm floods, dust storms, droughts, floods, and other climate change-induced or intensified diseases. Besides, the Plan also emphasised the importance of establishing early warning systems, emergency response plans, related methods and technologies, and effectiveness evaluations of these interventions.

**2) The *National Strategy for Climate Change Adaptation*** debuted during COP19 in Warsaw in 2013. The Strategy was the first and one of the most critical sets of climate change adaptation policies of the country. It outlines a systematic transition framework of work focus from climate change assessment to adaptation policymaking, and it serves as guidance for cities to make climate change adaptation plans at their respective level (State Council, 2013). Specifically, the Strategy highlights human health as one of the seven important tasks to be implemented by 2020. This includes: 1) establishing climate change-health monitoring, assessment, early warning systems; 2) improving the control system of infectious diseases; 3) wide spreading the knowledge and skills of health protection facing climate change, and 4) enhancing health supervision and law enforcement. The Strategy defined the goal to protect health from increasing risks of occurrence and spread of many diseases, especially temperature-sensitive illnesses, and post-disaster infectious diseases. Climate change researchers also back the necessity of establishing early warning and monitoring systems (Du et al., 2013).

**3) The *Action Plan on Prevention and Control of Air Pollution 2013*** is an outcome of the 7th National Conference on Environmental Protection in 2011. The conference framed decent environmental quality as a public good that governments ought to provide, which requires resolving major environmental problems that jeopardise human health and development. The action plan, thus, sets human health as both the entry point and fundamental interest, and has laid out ambitious, specific targets from the national level to reduce ambient air pollution and to improve air quality nationwide by the end of 2017. It aimed to reduce PM10 by at least 10 percent relative to 2013 levels across all urban areas. The most heavily polluted and most densely populated urban areas in the country: Beijing-Tianjin-Hebei, Pearl River Delta, and Yangtze River Delta, received specific targets to reduce PM2.5 by 25%, 20%, and 15% respectively. For Beijing, the target was to reduce PM2.5 by 34% from the 2013 level.

**4) *National Plan on Climate Change (2014–2020)*.** Several incidents prompted China's increasingly affirmative gesture on environmental and climate change governance. China overtook the U.S. and became the biggest CO2 emitter in 2007 and gained international exposure from hosting the International Olympic Games in 2008. Air pollution has become a genuine concern of citizens as more evidence surfaced, indicating negative health consequences. There is an evident change in the central government's political gesture towards

the challenges of climate change impacts. As shown in the *National Plan on Climate Change (2014–2020)*, climate change was deemed as ‘crucial’ in influencing the overall socio-economic development, the security of energy, food, ecological environment, and human health. Besides, the Plan frames ‘actively responding to climate change’ as both an inherent requirement for achieving *Ecological Civilisation*, as well as a significant opportunity for transforming the current economic development model. The Plan further frames it as an ‘international obligation’ of the country as a ‘responsible powerful nation.’

**5) The Action Plan for Urban Climate Change Adaptation** places a primary focus on the role of cities in climate change adaptation, as cities host a significant quantity of social and economic activities. The urban population in Guangzhou is exposed to high risks of severe climate change impacts, mainly due to its high density. The *Action Plan for Urban Adaptation to Climate Change* (State Council of China, 2016b) was co-carried out by the National Development and Reform Commission (NDRC) and the Ministry of Housing and Urban-Rural Development (MOHURD) in 2014. The Action Plan sets the stage that ‘urban adaptation to climate change is about the vital interests of the people.’ Besides, it supports cities to ‘actively promote’ climate change adaptation by addressing public health, among other aspects (depending on each city’s specific climate change challenges), in their pilot work programs. The Plan emphasises that cities take action to adapt to climate change is an essential contribution to achieving *Ecological Civilisation*. The Action Plan requires cities to make ‘more comprehensive and forward-thinking’ policies for climate change adaptation. For Guangzhou, this implies making policies that incorporate updated scientific evidence to manage the impacts of storms and floods more effectively.

**6) Healthy China 2030.** The State Council endorsed the Healthy China 2030 Plan in 2015, which entered in effect in 2016. This is China’s first national medium- to long-term action plan strategically focusing on health. It aims to promote healthy lifestyles, improve health services and the health industry. Besides, the Plan outlines the vision of a sustainable health system to provide essential health services to every citizen by 2020. The Plan defines health as a ‘basic condition for socio-economic development.’ It states that improvement in national health governance is a ‘proactive contribution to global health governance and fulfilment to the commitment of 2030 Sustainable Development Agenda’ (State Council of China, 2016a). To achieve these aims and visions, the Healthy China 2030 Plan puts forward five strategies:

popularising a healthy life, optimising the health service, improving health protection, building a healthy environment, and developing a healthy industry. In actionable terms, the Plan seeks to resonate with the WHO's Health in All Policies (HiAP) approach and to reach the primary health indicators of high-income countries by 2030.

#### ***5.2.4 A multi-level, nested hierarchical system of land-use and spatial planning***

This section introduces the Chinese system of land-use and spatial planning in three parts: 1) the five-level administrative system and processes for land-use and spatial planning, 2) the typology of land and spatial plans, and 3) the definition and standards of urban green spaces in China.

##### ***5.2.4.1 Five-level administrative system and processes for land-use and spatial planning***

In this section, the Chinese land-use and spatial planning systems are introduced together as they interact closely within the nested five levels of governments. China's land-use and spatial planning system are composed of five levels of administrative departments at the national, provincial, city, county, and township levels. After the national government institutional reform in 2018, at the national level, the Ministry of Natural Resources and the Ministry of Housing and Urban-Rural Development coordinate land-use and spatial planning (see Figure 17). At the provincial level, the Bureau of Natural Resources, and the Bureau of Housing and Urban-Rural Development coordinate. The city level (municipality and autonomous region) is coordinated by the Bureau of Planning and Natural Resources and the Bureau of Housing and Urban-Rural Development. Similarly, the district/county level is coordinated by the Division of Natural Resources and Planning and the division of Housing and Urban-Rural Development. There are no offices set expressly for managing natural resources and spatial planning at the township level; instead, the work is shared between the Economic Development Office and the Urban-Rural Development Office at this level. In this five-level administrative system, the agencies at superior levels provide professional guidance and supervision to the lower levels. The process of land-use and spatial planning include planning, approval, implementation, supervision, and inspection/assessment. The process involves institutions of technical planning, administrative as well as specialist approval according to policies and a set of technical standards, implementation supervision, and regulations.

For forestry and landscaping, the Forestry and Grassland Bureau, subordinate to the Ministry of Natural Resources at the national level, is responsible for the development and conservation of forest and grassland resources. Similarly, a Bureau of Forestry is established at the provincial level under the Bureau of Natural Resources and Planning to manage forestry production and conservation. At the city level, a Municipal Bureau of Forestry and Landscaping is set up, independently from the Bureau of Natural Resources and Planning, to manage forestry production, conservation and UGS management. At present, no departments are set up specifically for forestry and landscaping at the district and township levels. At the district level, forestry and landscaping related work is directed by the Municipal Bureau of Forestry and Landscaping. At the township level, forestry related work is handled by the Office of Economic Development, while township greening and landscaping related work is handled by the Office of Urban and Rural Development instead.

Before 2018, the work on environmental protection was be coordinated from central to local levels by the Ministry of Environmental Protection. Since the national government institutional reform in 2018, the Ministry of Environmental Protection has been renamed the Ministry of Ecology and Environment, and the subordinate levels have also been renamed, assuming similar functions within their respective administrative areas. Similar to the work on urban greening and landscaping, at the township level, for the time being, no departments are set up specifically for environmental protection / ecological conservation, instead, the work is shared between the Office of Economic Development and the Office of Urban and Rural Development.

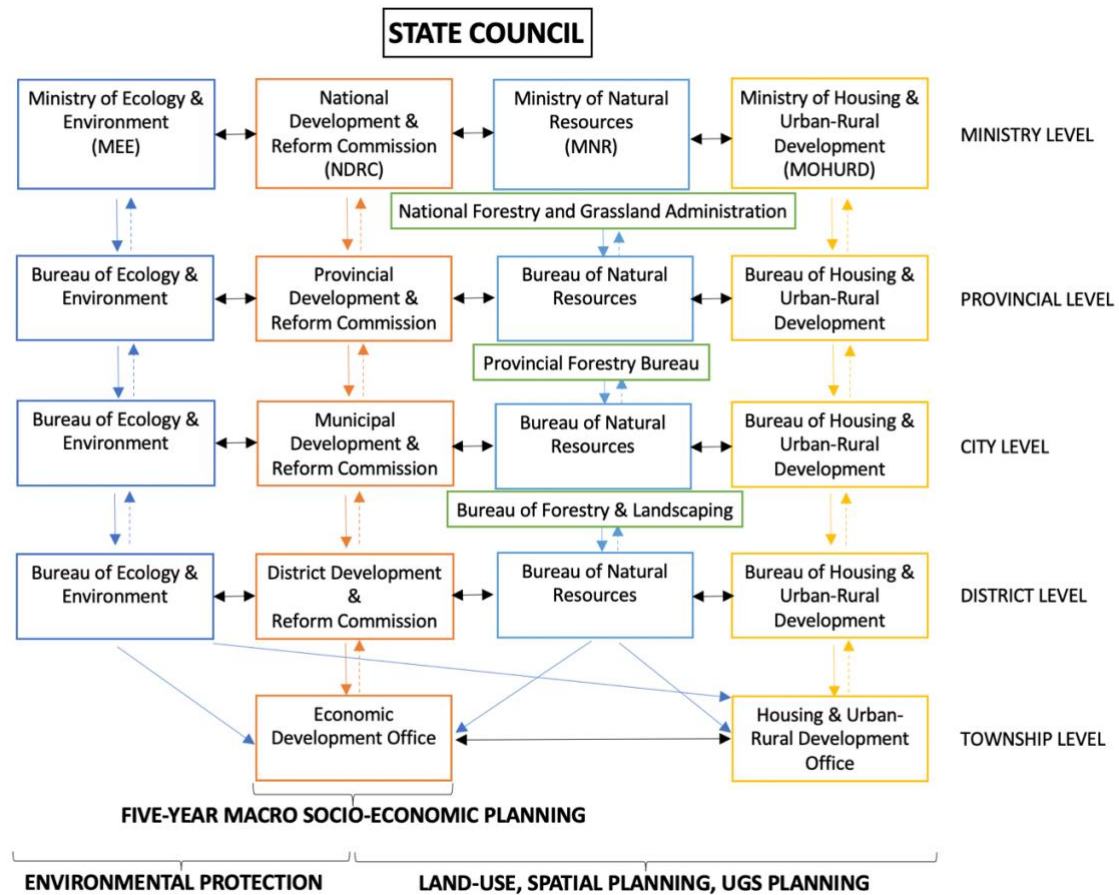


Figure 19: The current five-level administrative system of environmental protection, land-use and spatial (and UGS) planning

5.2.4.2 Typology of land and spatial plans in China

There are three types of land by the use status classified in the Chinese national standard *Current Land-Use Classification* (ref. GB/T21010-2017, in Chinese: 土地利用现状分类; tǔ dì lì yòng xiàn zhuàng fēn lèi): 1) farming land, such as paddy fields and orchards; 2) development land, such as commercial land, residential land, parks and green spaces; 3) non-development land, such as river surface, marshland, and glacier. This classification indicates that parks and green spaces are of a public service nature. Secondly, within the jurisdiction of a city, urban land is divided into development land and non-development land according to the current land classification standard *Urban Land Classification and Standards of Planning and Construction* (ref. GB50137-2017, in Chinese: 城市用地分类与规划建设用地标准; chéng shì yòng dì fēn lèi yǔ guī huà jiàn shè yòng dì biāo zhǔn). Urban development land includes

land for residential, administration and public services, commercial and business facilities, industrial and manufacturing, logistics and warehouse, road, street and transport, municipal utilities, green space and square, and land to be defined. Urban non-development land includes water areas, farming and forestry areas and other non-development lands. Again, UGS is considered a type of urban development land in China (see Table 16).

URBAN LAND	URBAN DEVELOPMENT LAND	URBAN NON-DEVELOPMENT LAND
<b>CLASSIFICATION BY FUNCTION</b>	1. Residential, Administration and public services	1. Water area (excluding water bodies within urban green spaces and squares)
	2. Commercial and business facilities	
	3. Industrial and manufacturing	
	4. Logistics and warehouse	
	5. Road, street and transport	2. Farming and forestry area
	6. Municipal utilities	3. Other area
	7. Green spaces and squares including <b>Urban parks, green buffers</b> , and public squares	
	8. Lands to be defined	

Table 16: Types of urban land and classification by function in China

There are several types of spatial plans in the Chinese planning system, including plans of primary functional areas, land use plans, and urban and rural development plans. Urban and rural development plans then also include several types: city system plans (macro-level), master plans (city-level), district plans (for big cities only), detailed plans (detailed development control plans), detailed construction plans, and special plans. Under the new government institutional framework, the Ministry of Housing and Urban-Rural Development, together with the Ministry of Natural Resources and the National Development and Reform Commission, prepares the national city system plans for planning at the subordinate levels. Provincial governments compile provincial urban system plans. Governments at the city, district/county, and township levels prepare master plans for their administrative areas, respectively. In addition to master plans, governments at the city, county/district, and township levels also compile the detailed development control plans per the requirements of the master plan within their respective administrative areas. The plans mentioned above are all statutory. Conceptual planning as a new type of urban plans has emerged in recent years as a more forward-looking plan incorporating new concepts which do not contain legal effects but serve as a reference of urban development and planning tendencies for planning professionals and policymakers.

5.2.4.3 Definition and standards of urban green spaces in China

As briefly mentioned above, the current Chinese land classification standard *Urban Land Classification and Standards of Planning and Construction* (ref. GB50137-2017) defines UGS as components of urban development land. In comparison to an older version (ref. GBJ137-90) of the same land classification standard, there are changes both in the terminology of UGS in relation to the population as well as in the minimal standards (see Table 17). Two things to note: first, there is an improvement in inclusiveness from measuring UGS only for the population residing in the city's central area (2011) to measuring it for the residents within the boundary of the development land of the city (2017). However, permanent residents in the Chinese policy documents refer to residents associated with an urban household registration. Those who are associated with a rural household registration instead are considered temporary residents, which are not included in UGS size per capita measurements.

<i>Urban Land Classification and Standards of Planning and Construction</i>	
Version 2011, ref. GBJ137-90	Version 2017, ref. GB50137-2017
<b>Green space per capita:</b> the total green area in a city divided by the number of permanent residents in <b>the central area of the city</b> , in m <sup>2</sup> per capita.	<b>Green space and public square area per capita:</b> the total green area and public squares in a city divided by the number of permanent residents <b>within the boundary of development land of the city</b> , in m <sup>2</sup> per capita.
<b>Park green area per capita:</b> the total green area of parks in a city divided by the number of permanent residents in <b>the central area of the city</b> , in m <sup>2</sup> per capita.	<b>Park green area per capita:</b> the total green area of parks in a city divided by the number of permanent residents <b>within the boundary of development land of the city</b> , in m <sup>2</sup> per capita.
Minimum required: Park green area per capita should be at least 8.0 m <sup>2</sup>	Minimum required: Park green area per capita should be at least 10.0 m <sup>2</sup>

Table 17: Comparison of green space per capita requirements in earlier and current versions of *Urban Land Classification and Standards*

As for per capita park green area, different city development schemes hold different standards. These schemes function on a voluntary base in which cities apply depending on their development preferences. For example, for urban green area development, there are three schemes: *Garden City*, *Ecological Garden City* and *Ecological City*, the standards of which increase in turn (see. In comparison, for example, the European Common Indicator of local public open areas, does not set a target and is not explicitly focused on green space but is based on two criteria: 1) the percentage of citizens living within 300 metres from a public open area

of minimum size 0.5 hectares, and 2) a distance that represents accessibility - approximate a 15-minute walk.<sup>34</sup>

Chinese cities	National Garden City Standards (in Chinese: 国家园林城市系列标准)	Park green area per capita <b>no less than 9m<sup>2</sup></b> for cities with average development land per capita larger than 105m <sup>2</sup> (alias the case of Guangzhou)
	National Ecological Garden City Standards (in Chinese: 国家生态园林城市标准)	Park green area per capita <b>no less than 12m<sup>2</sup></b> for cities with average development land per capita larger than 105m <sup>2</sup>
	National Urban Ecological Protection and Construction Plan (2015-2020) (in Chinese: 全国生态城市保护与建设规划 2015-2020 年)	Park green area per capita <b>no less than 14.6m<sup>2</sup></b>
	Urban development goals for Ecological Civilisation in 2020 and 2030	Park green area per capita <b>no less than 17m<sup>2</sup> and 20m<sup>2</sup></b> respectively
European cities	Distribution: The percentage of citizens living within 300 m from a public open area of minimum size 0.5 hectares Accessibility: approximate a 15-minute walk	

Table 18: Size related standards for UGS planning in China and in Europe

### 5.3 Three Urban Green Spaces Governance Cases in Guangzhou

This Section introduces the three UGS governance cases in Guangzhou. It includes an overview and the three respective cases, each containing the urban planning backgrounds, reasoning for intervention, the interventions, the results, the actors, the timelines, and their respective relevance as a case study.

Overall speaking, Guangzhou has a basic UGS structure that contains three main types UGS resources. The first type is a network of seven major ecological corridors distributed across the city. The second type is the major ecological hotspots, such as the Yuexiu Park, Baiyun Park, and the Haizhu Wetland Park – the latter two are also referred to as the "Northern Lung" and the "Southern Lung" of the city, respectively. The third type includes the small pieces of green spaces scattered in between other urban infrastructures. Having had a basic UGS structure in

<sup>34</sup> Aambiente Italia Research Institute. 2003. European Common Indicators: Towards a Local Sustainability Profile. Final Report. Milano, Italy. Available at: [http://www.cityindicators.org/Deliverables/eci\\_final\\_report\\_12-4-2007-1024955.pdf](http://www.cityindicators.org/Deliverables/eci_final_report_12-4-2007-1024955.pdf) (accessed on 19 May 2016).

place, recent research points out many nuanced problems associated with the ecosystem performance and spatial distribution. These problems could serve as an opportunity window if appropriate institutional arrangements are applied. The vegetation landscape in Guangzhou's old urban areas was characterised by small patches, heavy fragmentation, and random distribution. In contrast, in the new urban areas, it was characterised by big patches and even distribution. Compared to natural forests, these UGS in Guangzhou also have lower species diversity and lower organic matter content (Guan and Chen, 2003; Li, et al., 2000). For effective climate change adaptation, biodiversity, primary production, and ecological function of these urban green resources need to be increased.

### *5.3.1 Overview of the three case studies*

The three UGS governance cases in Guangzhou are: 1) Panyu Ecological Corridor (PEC), 2) Haizhu Wetland Park (HWP), and 3) Tianhe Sponge City Demonstration Site (TSCD) (see Figure 20). showcases the location of these three cases in Guangzhou city. These three cases occurred across the span of the last twenty years, each representing different institutional settings, namely, different combination of preferences, formal and informal, in urban development, property rights bundles, and governance arrangements. The basic characteristics of these three cases are presented in Table 19.

1. **Panyu Ecological Corridor (PEC)** case presents a conflict of interest between municipal and district governments. In this case, the Municipal Government of Guangzhou (GZ) aimed to promote a city-wide ecological corridor system, contradicting the economic development interest of the district government of Panyu (PY) which would require the land nearby or even within the PEC system.
2. **Haizhu Wetland Park (HWP)** case represents a conflict of interest between GZ, farmers (land- and homeowners), and urban migrants (tenants). The land property transfers only benefited the farmers but not the urban migrants due to the restriction imposed by the dual urban-rural household registration system, leaving urban migrants' quality of life poorly attended.
3. **Tianhe Sponge City Demonstration Site (TSCD)** case represents a conflict of interest between different branches within the municipal government, e.g., between the Bureau of Water Affairs and the Administration of Forestry and Gardening. In addition, for the private equipment and service suppliers with established connections to the conventional engineering solutions through public infrastructure construction projects, their vested

## Urban Green Space Governance in China - Institutional Analysis

interests are challenged by the Sponge City Initiative as it is a nature-based rather than engineering-based solution.

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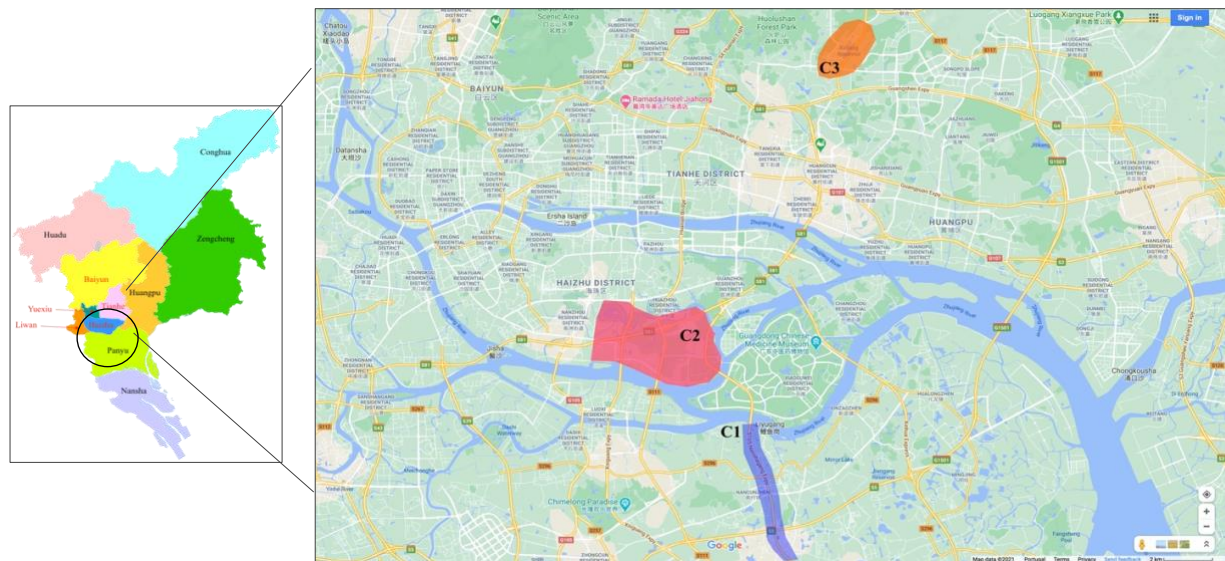


Figure 20: Location of the three urban green space governance cases in Guangzhou

C1 = Case 1. Panyu Ecological Corridor, C2 = Case 2. Haizhu Wetland Park, C3 = Case 3.

Tianhe Sponge City demo site. Source: based on Google Map

Characteristics \ Cases	C1: Panyu Eco-Corridor	C2: Haizhu Wetland Park	C3: Tianhe Sponge City demo-site
<b>Period</b>	2000-2006	2012-2015	2015-2017
<b>Size (km<sup>2</sup>)</b>	No data	3.67 km <sup>2</sup>	3.57km <sup>2</sup>
<b>Administrative body</b>	Guangzhou Municipal Government		
	Panyu District government	Haizhu District government	Tianhe District government
<b>Actors involved or influenced</b>	Panyu district government Business/individuals with interests in land Residents in neighboring area	Haizhu district government Villagers/orchard land collective owners Urban migrant workers	Tianhe district government Other departments in the municipal government Residents in neighboring area
<b>Method</b>	landscape	land property right acquisition	landscape adjustment/conversion

	adjustment/conversion	landscape adjustment/conversion	
<b>Urban planning basis</b>	Guangzhou Ecological Conceptual Plan	Guangzhou Master Plan	National Sponge City Initiative (under <i>Ecological Civilisation</i> )

Table 19: Characteristics of the three UGS planning and governance cases in Guangzhou

### 5.3.2 Panyu Ecological Corridor

**The urban planning background:** Due to the rapid expansion, land consumption in Chinese cities often outpaces the planned land use indicators defined in master plans, invalidating them before the planning periods end. In this context, the planning of urban green spaces is often in a relatively weak position that often gets compromised by the urgent land needs for other types of infrastructures for economic development. Such is the case for the Panyu District Ecological Corridor in Guangzhou. Panyu was a county, a sub-level unit of cities by administrative category and was independent of Guangzhou City before the New Millennium. Considering the rapid urbanisation rate and land needs for future economic development, Guangzhou City merged with the former Panyu County in 2000, making Panyu a district of Guangzhou. Panyu District is in southern Guangzhou and the estuary of the Pearl River with a flat, alluvial landform ideal for urban sprawl. The district was therefore at risk of losing land resources with particularly critical ecological functions.

**The reasoning for intervention:** From an ecologist's perspective, urban ecological corridors as essential components of urban green spaces not only because they perform the function of ecological evolution in nature but also play a supporting role for urban development by providing essential ecosystem services such as air, water and soil purification, noise-cancellation, soil fixation, food production, education, recreation and many more. Therefore, the principle of planning ecological corridors needs to respect and align with the spatial structure of urban construction areas to optimise their potential to provide ecosystem services.

**The intervention:** The Panyu Ecological Corridor, one of the seven major ecological corridors in Guangzhou (see Figure 21), was laid out on a 'conceptual plan' based on this principle. In 2000, Guangzhou's municipal government established a 'strategic plan' for more sustainable urban development through planning, constructing, and conserving a city-wide ecological

corridor network, alias the "Ecological City" plan (Xinhua News Agency, 2018). In the Chinese urban planning system, both terms - 'conceptual plan' and 'strategic plan' - refer to planning that has a suggestive and non-legally binding nature and that they would be considered in more specific land use plan-making. Conceptual and strategic plans are macroscale, long-term plans in which future projections of population growth, social and economic activities are considered. The conceptual plan of the ecological corridor network in Guangzhou (see Figure 21) is composed of four horizontal (east-west) and three vertical (north-south) ecological corridors based on the major natural characteristics of the existing urban landscape. The three vertical (north-south) ecological corridors were planned to go through Panyu district. The one referred to as the Panyu Ecological Corridor in this research is the one planned alongside the S105 Nanshagang Expressway (S105 南沙港快速公路; Nán shā gǎng kuài sù gōng lù).

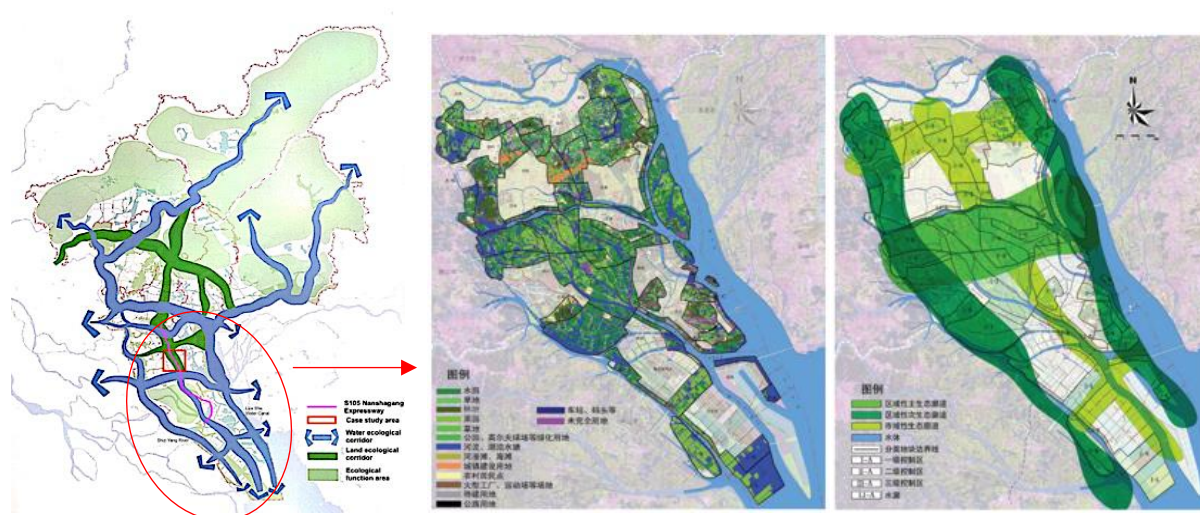


Figure 21: Map of Panyu Ecological Corridor

*Left:* Structural map of the Ecological Corridor Network in Guangzhou. *Middle:* Current status of land use of Panyu District. *Right:* Planned ecological functional structure of Panyu District.

Source: 1. *Master Plan, Planning and Construction Guideline of the Guangzhou Ecological Corridors*, 2016 (in Chinese: 广州市生态廊道总体规划与生态廊道规划建设指引); Guǎngzhōu shì sheng tài láng dào zǒng tǐ guī huà yǔ sheng tài láng dào guī huà jiàn shè zhǐ yǐn). 2. *Conceptual Plan of Panyu District Ecological Corridor* (Qiao and Yang 2013).

**The result:** The third ecological corridor alongside the S105 Expressway (see Figure 22) had gone through constant erosion. This part of the ecological corridor was initially designed with a 500-meter-wide green space on each side of the S105 Expressway. As planned without

having any critical natural feature basis such as mountains or waterways, but only based on a major concrete highway, the green spaces in this area were particularly exposed to the risk of erosion by the growing land demand for urban economic development. The fact that the conceptual plan was not legally-binding meant the cost for contradicting other land interests and implementing the plan was high. Consequently, various private construction proposals near the S105 Expressway were either formally or informally approved, gradually eroding the green space along the S105 Expressway. As a result, the initially designed 500m wide green space on each side was reduced less than to 100m wide (see Figure 22). The intended Panyu Ecological Eorridor was eventually downgraded to the Nanshagang Expressway Green Belt, as referenced in recent policy documents (“南沙港快速路隔离绿带”) (Guangzhou Forestry and Gardening Bureau, 2012).

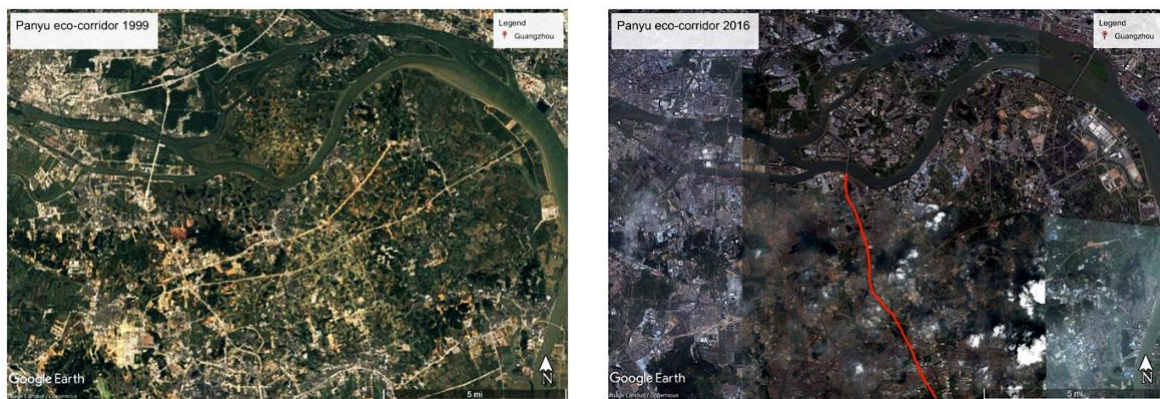


Figure 22: Satellite image of the Panyu Ecological Corridor area prior and after planning

*Left:* prior to planning and construction of the S105 Expressway in 1999. *Right:* after planning and construction of the S105 Expressway in 2016. The S105 Expressway shown by the red line. ©Google Earth

**The actors:** The actors and roles involved in this case study include:

- 1) The Municipal Government of Guangzhou, which had the conflictual interests both to pursue economic progress as in macro, long-term development planning as well as to pursue the concept of “ecological city” by establishing an ecological corridor network throughout the city
- 2) The District Government of Panyu, which holds a primary interest in pursuing economic development opportunities

- 3) The private business initiatives which desire to acquire land nearby the ecological corridor for economic activities

Since the conceptual plan had no legal rigidity, the low costs to disrespect the conceptual plan became a de-facto incentive for the private sector or the citizens to erode the green spaces around the S105 Expressway and conduct economic activities.

### **The timeline**

2000: Panyu became a district of Guangzhou; the Ecological Corridor Network Conceptual Plan of Guangzhou was proposed. A size standard proposed for ecological corridors is: 200-1000m by width.

2009: A detailed development control plan<sup>35</sup> was made to reinforce the implementation of the parts of the ecological corridor network in Panyu district.

2015: A Conceptual Plan for eastern part of the Ecological Corridor Network of Guangzhou was approved, specifying the controlled area of the S105 Expressway ecological corridor.

2018: An Implementation Assessment Report indicating that 10 out of 11 in total ecological corridors in the Ecological Corridor Network Conceptual Plan of Guangzhou were inadequately implemented, including the one alongside the S105 Expressway. The wording 'S105 Expressway ecological corridor' was changed to 'S105 Expressway isolation green belt.'

**Relevance as a case study:** In this case study, the ecological corridor plan's implementation had often been compromised for urban economic development practices for several reasons. First, placing economic development as the primary goal for the country has been consistent in China's governance history as a state since founded in 1949. The country aligns central-local efforts to economic development in a top-down administration system and a concentration of power. Second, Guangzhou's ecological corridor plan is conceptual, meaning that it does not have the same legal rigidity as municipal master plans or regulatory plans, which are legally binding. In other words, as a conceptual plan, it was subjected to modification depending on the emerging needs or priorities in context. Therefore, the ecological corridor plan's implementation costs, namely, the designed 500-meter-wide greenspace on each side of the S105 Expressway, were higher due to the often need for conflict resolution. Third, the ecological corridor plan's technical aspects – meaning the biodiversity and ecosystem services

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<sup>35</sup> Notice on the Controlled Detailed Plan of the Greening Corridors along the Four Expressways in Panyu District (in Chinese: 番禺区四条快速路绿化廊道控制性详细规划通告).

of the corridor – were not given sufficient attention or consideration. This was reflected by the lack of ecology experts in the planning and implementation processes, especially when conflicts of interest rose. Lack of political priority, legal formality, and technical expertise together constituted high costs for the Municipal Government of Guangzhou to complete the ecological corridor plan, especially for the one alongside the S105 Expressway.

### ***5.3.3 Haizhu Wetland Park***

**The urban planning background:** The Haizhu Wetland Park was initially an area of orchards referred to as the Guangzhou Wan Mu Orchard<sup>36</sup> run by farmers in the neighbour villages (see Figure 23). The Guangzhou Wan Mu Orchard area is situated southeast Haizhu district, covering about 8 km<sup>2</sup>. As an urban wetland located in the centre of the city, the Wan Mu Orchard is an essential component of the city’s ecological system. Therefore, the Orchard is also referred to as the “Southern Lung” of Guangzhou, to the “Northern Lung” – the largest urban park in the northern area of the city – the Baiyun Park. Traditionally the Wan Mu Orchard had served as a major agricultural field for the neighbouring villages, which are now surrounded by the expanding urban construction and high-rise buildings in Guangzhou as the city is going through a rapid urbanisation process. These villages, therefore, are also referred to as urban villages.<sup>37</sup> In the Haizhu Wetland Park case, the provision of benefits from establishing urban green spaces goes hand in hand with the living conditions of urban migrants. The land transformed from farming land into a wetland park was acquired from farmers of the nearby villages. Despite that financial compensation was made to villagers for their loss of agricultural income and that some land was preserved for farmers to explore future economic opportunities, appropriate planning and infrastructure remain lacking in these villages as they remain collectively owned by villagers and are not converted into urban development land, which the local governments hesitate to develop. Also, informal housing continues to emerge

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<sup>36</sup> The words Wan Mu literally means “ten thousand Mu”, with Mu as a traditional Chinese standard unit for land area measurement: 1 Mu  $\cong$  666.67 m<sup>2</sup>.

<sup>37</sup> In China, urban villages refer to a particular community form resulting from villages being surrounded rapidly by the expanding urban construction and high-rise buildings (Lan, 2005; Liu and Gatzweiler, 2020) Although located within cities, the land of urban villages is collectively owned by villagers and is not urban development land. Therefore, the costs to build houses in urban villages are much lower than on what is legally defined as urban development land. For this reason, housing costs, in general, are much lower, forming a primary factor attracting urban migrants to inhabit those villages.

in these villages, responding to a growing demand for affordable housing by urban migrants, who have overtaken the farmers and became the major inhabitants. Despite becoming *de-facto* residents of Guangzhou, most of these migrants do not have access to the public services such as free health care and education in Guangzhou which their urban peers have, since the rights to such services for these urban migrants are tied to their rural household registration of their places of origin. In this sense, the local governments have marginalised urban migrants residing in informal housings in the Haizhu wetland area.

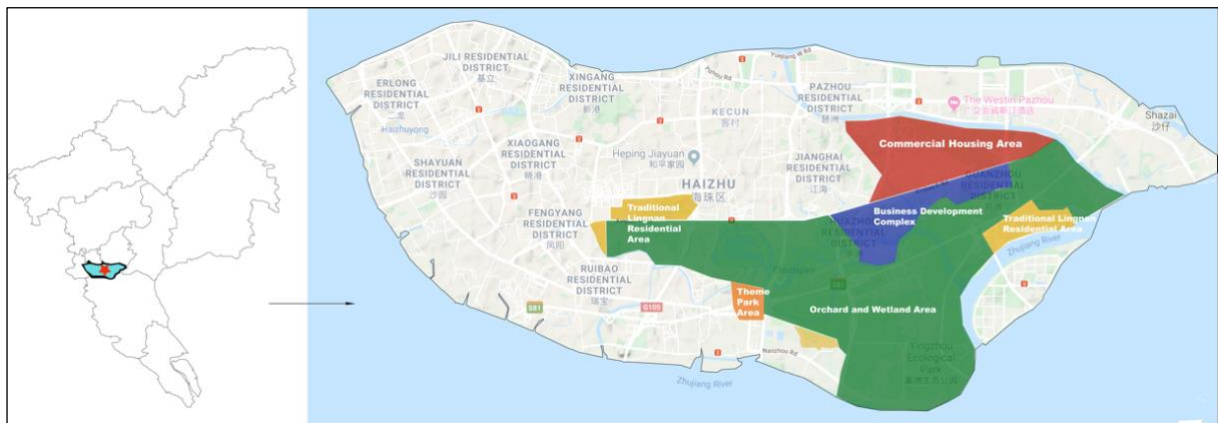


Figure 23: Location and planning map of the Guangzhou Wan Mu Orchard Wetland Park

**The reasoning for intervention:** The above situation has generated several consequences. First, the Orchard has been eroded by urban infrastructures as the neighbouring land demand has been rising. The farmers made many temporary housing arrangements to meet the demand of the growing number of urban migrants. Urban migrants gather in these urban villages as these housing options tend to be more affordable. Although located within Guangzhou, the land of these urban villages and the Orchard is collectively owned by villagers and is not urban development land, which urban governments normally would have had the right and intention to develop. Second, the Orchard area has been polluted due to the growing number of industrial factories as well as urban migrants residing in the area without systematically planned grey infrastructure. Third, the temporary housing arrangements provided greater benefits for the farmers than traditional agricultural practices, which further accelerated the Orchard area's ecological deterioration.

**The intervention:** To address the environmental degradation problem and preserve the Orchard area as a key urban ecological hotspot, the Municipal Government of Guangzhou acquired the land ownership right of 90% of the Orchard from the villagers, changing it into state/public ownership, alias the new Haizhu Wetland Park, but keeping the farming land function to conserve the ecological potentials. The newly Haizhu Wetland Park is designed to be a semi-natural wetland-orchard hybrid ecosystem with a total size of 367 hectares (or 3.67 km<sup>2</sup>, see Figure 23). As a result of the 90% land property right transfer, the villagers/farmers were compensated financially with a total sum of 4.585 billion RMB (~ 6 million Euro, Municipal Government of Guangzhou, 2018) and the right to develop the remaining 10% collective land. The Wetland Park project has received 16 million RMB from the central government as subsidies for wetland protection and conservation. Till 2018, the Wetland Park project has costed the Municipal Government of Guangzhou and the District Government of Haizhu 6.3 billion RMB for the land property transfer, construction, and maintenance (Municipal Government of Guangzhou, 2019a).

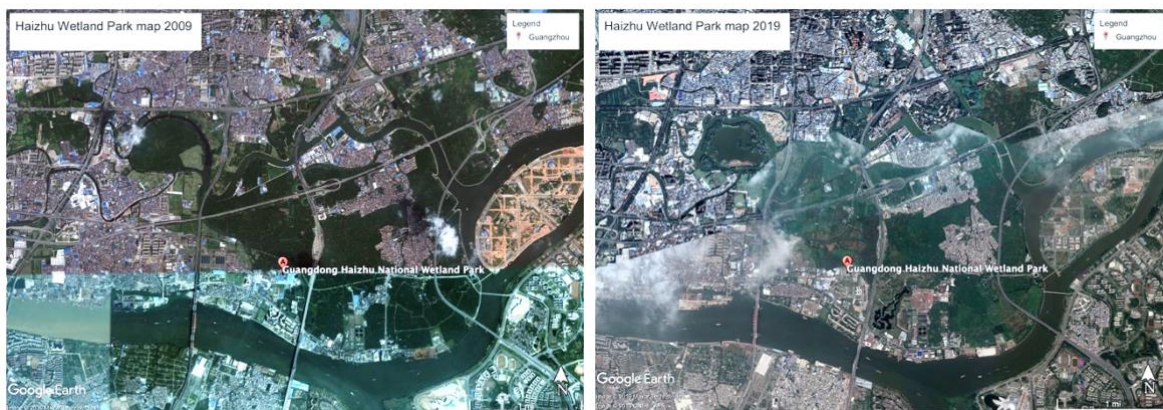


Figure 24: Satellite image of the Haizhu Wetland Park area prior and after conversion

*Left:* prior to conversion in 2009. *Right:* after land transfer and conversion in 2019. ©Google Earth

**The institutions:** Besides existing government institutions, new institutions were also created to improve the governance of the Haizhu Wetland Park. The Haizhu Wetland Park project was coordinated by the Haizhu District Government, the land acquisition, planning, and construction were mainly conducted by the Haizhu District Housing and Construction Bureau, and the Water Authority, and collaborated by the Bureau of Landscape and Gardening. An

administrative body named the Haizhu Wetland Management Office was explicitly established to manage the Wetland Park. Besides, a research entity named the Haizhu Wetland Ecological Science Park was also co-established with a local university – the Sun Yat-Sen University, as an attempt to foster scientific research.

### **The timeframe**

2009-2011: The Municipal Government of Guangzhou confirmed the ecological significance of the Haizhu Wan Mu Orchard for the city and decided to take actions to protect it. An international call was launched for the best proposals to re-design the Orchard. A winning proposal co-designed by the Guangzhou Urban Planning and Design Survey Research Institute and the Hangzhou Landscape Architecture Design Institute was selected.

2012: The State Council approved the property right transfer approach proposed by the Municipal Government of Guangzhou. An initial budget of 4.585 billion RMB was approved for the land acquisition and relocation of some urban migrants. The cost was shared between the Municipal Government of Guangzhou (80%) and the District Government of Haizhu (20%). A work plan for the land acquisition was formulated, and a bill was made to regulate the use of the budget—the land acquisition of 34 thousand people in 11 thousand households across the eight villages neighbouring the Orchard. The first phase of the Wetland Park was delivered.

2013: The Haizhu Wetland Management Office was established.

2014: The second phase of the Haizhu Wetland Park was completed.

2015: The Ministry of Forestry approved the Park as a national-level wetland park.

2016: The third and fourth phases were completed. Meanwhile, the State Council formulated and promoted the national implementation of the *Proposal for Institutionalising Wetland Protection and Restoration* (State Council of China, 2016).

2018: The *Wetland Rehabilitation Plan for the Guangzhou Haizhu National Wetland Park* was compiled to formalise operational guidelines, standards, and targets for the Haizhu Wetland Park.

**Relevance as a case study:** The central government evaluated Haizhu Wetland Park's conservation effort as successful in ecological conservation. The biodiversity at Wetland Park was recorded to have increased by 31.9% (District Government of Haizhu, 2016). The Haizhu Wetland Park transformation was also elected as one of the "40 innovations of local reforms in China's 40 years of economic reform and liberation" (Municipal Government of Guangzhou,

2019b). There are several ways that the Haizhu Wetland Park is relevant as a case study of institutional analysis of urban commons governance in China. First, the land acquisition strategy employed in this case directly deals with the issue of land property rights and it reflected the city government's cogitation in reducing transaction costs. Second, by reserving the 10% collectively-owned land for the villagers as their livelihood alternatives, the Municipal Government of Guangzhou yet could avoid another cost – the responsibility of having to rearrange their livelihood and the associated costs. Third, the urban migrants, who are the *de-facto* majority of residents in these urban villages surrounding the Orchard, have been impacted negatively as the essential urban infrastructures and public services in these urban villages remain poorly developed, the available housing also became more expensive as their supply could no longer be increased, and density increased, as a result, the overall living environmental quality for the urban migrants deteriorated. These negative impacts on the urban migrants are factually hidden or neglected costs of the Wetland Park transformation, which, even the newly created institutions of the Wetland Park could not address.

#### ***5.3.4 Tianhe Sponge City Demonstration Site***

**The urban planning background:** In recent years, waterlogging, or urban inundation, has increasingly become a challenge in many Chinese cities due to rapid urban expansion and the layout of grey infrastructure. The current approach to urban inundation – using hydro-engineering means for fast discharge has been found not only costly but ineffective for resolving the problem (Xia et al., 2017). The increasing deterioration in the urban environment and climate change impacts in Guangzhou determine that climate adaptation measures are urgently needed.

**The reasoning for intervention:** While the subtropical monsoon climate characteristic brings heat- and water-related climate change impacts primarily, it also highlights the potential of a nature-based climate adaptation approach. Such a climate facilitates the rapid development of green infrastructure. Guangzhou's humid subtropical monsoon climate is an exogenous biophysical factor that facilitates the local governments in Guangzhou to adopt a nature-based approach for climate change adaptation (see Figure 25).

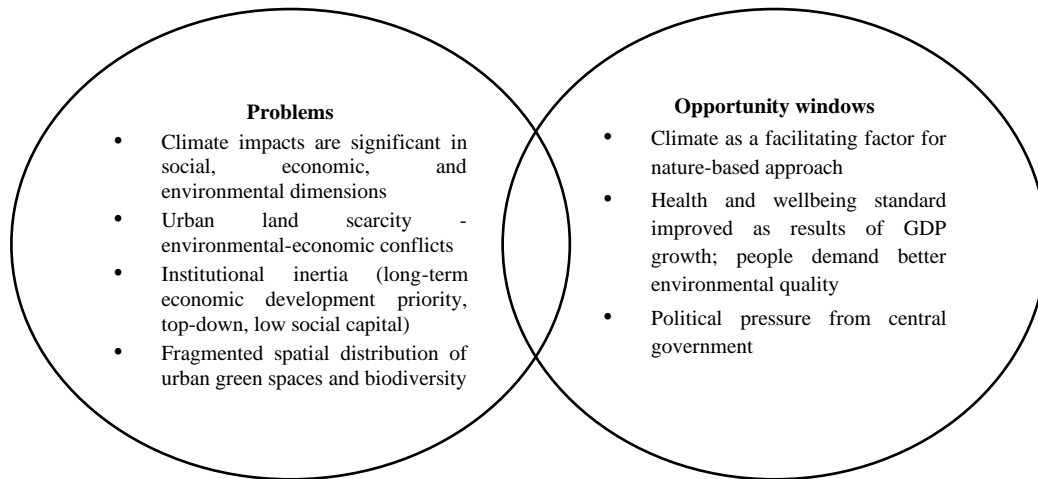


Figure 25: Problems and opportunity windows of nature-based climate management in Guangzhou

Source: Liu 2020a

**The intervention:** The central government took the first systematic action termed “the Sponge City Initiative” in 2013 to embrace urban green infrastructure as a nature-based solution to climate change impacts (see Table 20). This initiative refers to actions that adopt new urban green infrastructure or improve existing ones to enhance the ecological functions, particularly stormwater absorption, storage, retention, purification and release for surface runoff control (Liu and Sun, 2017). The Sponge City Initiative endorses three approaches: 1) conserving existing major urban parks, green spaces, which deliver important ecosystem services; 2) restoring degraded ecosystems; and 3) low impact development (LID). While the first two approaches are ecosystem-based, the third one is characterised primarily by low-impact engineering-based interventions. The basic standard for becoming a Sponge City is to absorb, retain, store, and utilise 70% of the stormwater within an urban territory by applying the three intervention means mentioned above. The Initiative sets the goals that cities should have at least 20% and 80 of urban built-up areas that meet the standard by 2020 and 2030. At the central level, the implementation is led by the Ministry of Housing and Urban-Rural Development (MOHURD) with financial support from the Ministry of Finance and technical support from The Ministry of Water Resources.

## Urban Green Space Governance in China - Institutional Analysis

Main attributes	Characteristics
Launch	2013
Responsible government branches	Lead: Ministry of Housing and Urban-Rural Development (MOHURD) Financial support: Ministry of Finance (MF) Technical support: Ministry of Water Resources (MWR)
Approaches	Conserving existing major urban parks, green spaces Restoring degraded ecosystems LID
Standard	Being able to absorb, retain, store, and utilise 70% of the stormwater within its urban territory Indicator: annual rainfall-runoff rate control
Goals	By 2020, 20% of urban built-up areas meets the standard By 2030, 80% of urban built-up areas meets the standard
Pilot cities	First group: 16 cities in 2015 Second group: 14 cities in 2016
Finance	Funding from the central government for each pilot city varies from 400 to 600 million RMB (57-85 million US\$) per year Implementation via public-private partnerships (PPP)

Table 20: Overview of the Chinese Sponge City initiative

Notably, even though the central government has gradually made the Sponge City Initiative an imperative for big cities and has chosen two groups of pilot cities in 2015 and 2016, Guangzhou was not in the two groups of pilot cities. On a voluntary basis, Guangzhou also has adopted the Sponge City Initiative and established the *Special Plan of Sponge City Initiative Implementation in Guangzhou 2016-2030* (*Special Plan* for short, see Figure 26) under an extensive legal and policy framework. The framework includes the National Environmental Protection Law, the National Water Law, the National Urban and Rural Planning Law, the State Council Guideline on Sponge City Construction, among others. Implementing the Sponge City Initiative on a voluntary basis means that Guangzhou must finance its Sponge City construction independently. Thus, local officials were encouraged to explore financing possibilities for implementation.

**The institutions:** At the local level, the Sponge City Initiative in Guangzhou is implemented by the Leading Group of Sponge City Construction, which is primarily led by the municipal government and participated by the Bureau of Housing and Urban-Rural Development, the Bureau of finance and the Water Agency. Each district is then equipped with the same organisational structure to prioritise implementation. The municipal government aimed to implement the *Special Plan* within a focus urban area of 1092.5 km<sup>2</sup>. The district governments

are then responsible for implementing it within their respective territory. The *Special Plan* also sets a range of technical guidelines and standards for quality inspection, ranging from urban water supply standards to outdoor drainage, urban greening, vertical greening, and flood control standards. These standards constitute the information necessary for implementing the Sponge City Initiative effectively. The *Special Plan* puts local officials accountable for the implementation by making it a key performance indicator (KPI) with possible sanctions in case of non-compliance, which include non-reward or even demotion.

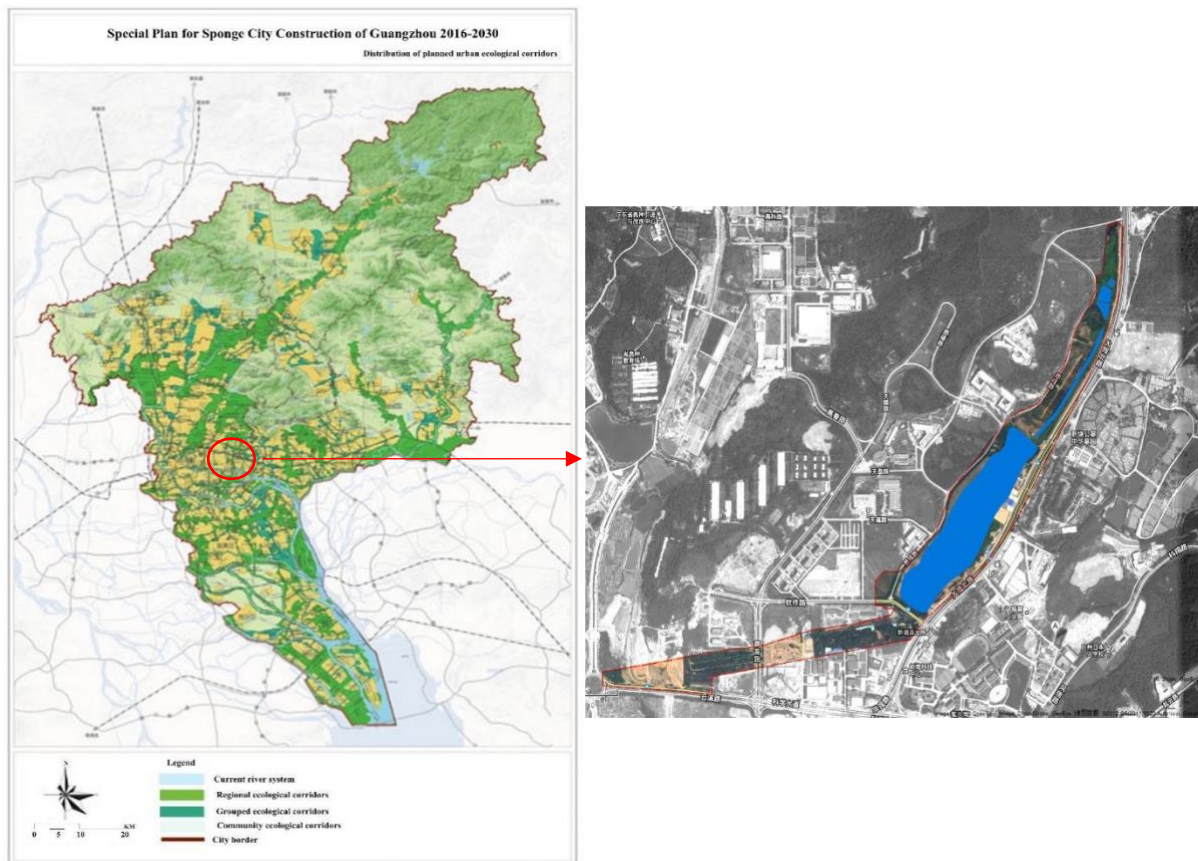


Figure 26: Guangzhou Tianhe Sponge City demonstration site

*Left:* Special Plan for Sponge City Construction of Guangzhou 2016-2030. *Right:* Intervention area of the Tianhe Sponge City demo site. Source: Guangzhou Urban Planning & Design Survey Research Institute, Source: [www.turenscape.com](http://www.turenscape.com)

The Sponge City Demonstration Site discussed in this research involves a wetland park that was converted from abandoned water pools and sweet water aquaculture ponds next to the newly developed Tianhe Smart Industrial Park (in Chinese 天河智慧城, see Figure 28). The Leading Groups of Sponge City Construction commissioned a private urban landscape design

consulting company to transform this area based on landscape design techniques that are adherent to the national Sponge City policy guidelines. The demonstration site is an important part of the natural water corridor in Tianhe District, covering an area of 46.8 hectares (see Figure 26). The low-lying site is composed of a reservoir, farmland, and aquaculture ponds. The demonstration site aimed to address four challenges: 1) to deal with the local natural climate (large annual rainfall and frequent torrential rains highly prone to waterlogging), 2) to reduce water pollution in the Tianhe area and improve the water quality, 3) to create a water-adaptable plant community for adaptation to the drastic drought and flood alternations, and 4) to provide an open space that meets the leisure needs of surrounding residents.

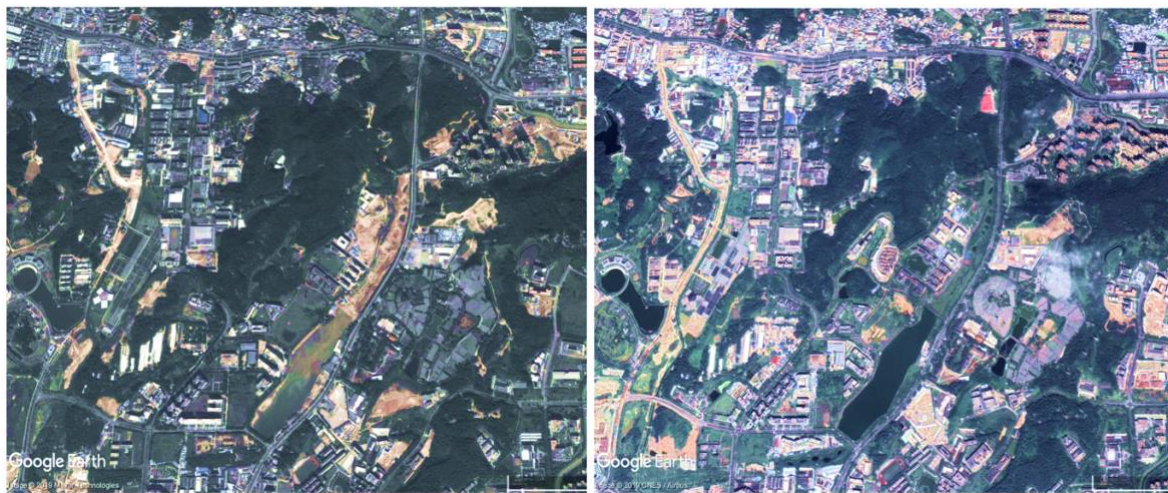


Figure 27: Tianhe Sponge City demonstration site satellite images, prior and after conversion

*Left:* prior to conversion in 2013. *Right,* after conversion in 2019. ©Google Earth



Figure 28: Images of Sponge City Demo Site in Guangzhou - Dagan Wetland Park

Source: [www.turenscape.com](http://www.turenscape.com)

### **The timeframe**

2012: The "Sponge City" concept was first proposed at the Low Carbon Cities and Regional Development Science and Technology Forum.

2013: The Ministry of Housing and Urban-Rural Development (MOHURD) launched the Sponge City Initiative at the national level.

2014: MOHURD launched the *Sponge City Construction Technical Guide*.

2015: The first group of pilot cities, 16 in total, were confirmed and given financial support for implementing the Sponge City Initiative.

2016: The second group of pilot cities, 14 in total, were confirmed and given financial support for implementing the Sponge City Initiative. Guangzhou launched the Special Plan of Sponge City Initiative Implementation in Guangzhou 2016-2030 on a voluntary basis.

2016: The first Sponge City demonstration site – Daguan Wetland Park in Tianhe District, was concluded.

2017: The central government proposes that all cities should take the initiative to build Sponge Cities in the Annual Work Report.

2020: The Guangzhou Municipal Government sets up an expert committee for supervising Sponge City construction.

**Relevance as a case study:** The Sponge City Demonstration Site (TSCD) case represents a conflict of interest between different branches within the municipal government of Guangzhou, e.g., between the Bureau of Water Affairs and the Administration of Forestry and Gardening. In addition, for the equipment and service suppliers in the private sector with established connections to the conventional engineering solutions through public infrastructure construction projects, their vested interests are challenged by the Sponge City Initiative as it is a nature-based rather than engineering-based solution. This is thus a UGS governance case which showcases interaction dynamics of multiple actors, within the public ones as well as between public and private ones, and how institutions both at the national and local level evolve over time.

## CHAPTER VI

### ANALYSIS

The previous chapter contextualised the biophysical conditions of the three case studies, outlined the institutional context, and introduced the three case studies, including the actors and a brief portrait of the local communities (particularly in the 2<sup>nd</sup> case), which correspond to the first three exogenous and independent variables: ① *biophysical conditions*, ② *community attributes* and ③ *rules-in-use* of the IAD framework (see Section 3.5 Analysing Common-Pool Resource Governance through the IAD Framework). This chapter zooms in for an in-depth analysis of all the variables except ① *biophysical conditions*. Section 6.1 analyses the characteristics and tendencies of the ③ *rules-in-use* in the case studies. Section 6.2 analyses the relationships and power dynamics between all the ④ *actors or participants* within the three case study ⑤ *action situations*. Section 6.3 analyses the ⑥ *interactions* between all the actors. Section 6.4 analyses the ⑦ *outcomes* of the three UGS governance case studies, including the outcomes of UGS governance goals, deliverables from national and local plans, as well as the formal and informal institutional change incurred during the three case studies. Finally, Section 6.5 evaluates the ⑥ *interactions* and ⑦ *outcomes* through a comprehensive multi-criteria assessment (MCA), as guided by the IAD framework (see Section 3.5 Analysing Common-Pool Resource Governance through the IAD Framework, and Figure 9: The IAD framework applied in this research).

### 6.1 Characteristics and Tendencies of the Rules-in-Use in Case Studies

#### 6.1.1 Characteristics of the rules-in-use in case studies

The analysis in this section explains how these policy documents were used as different rules to influence the outcome of the three UGS cases. The aim is to understand the institutional dynamics, facilitators, and underlying barriers Chinese local governments have faced regarding the need and mandates to plan and manage UGS that could lead to more effective NbS implementation.

In Section 3.5 Analysing Common-Pool Resource Governance through the IAD Framework, *rules-in-use* are introduced as the information that forms a common understanding of those involved to who must, must not, or may take which actions affecting others subject to sanctions (Crawford and Ostrom, 1995). The *rules-in-use*, alias, *institutions* studied in this research, refers to the formal plans, policies, and environmental agendas made by or agreed upon by the Chinese national government, the municipal government of Guangzhou, and planning institutes, as well as the informal institutional factors such as central-local political dynamics, urban planning culture, and historical land tenure. The official policy documents and government reports both at the national and local levels that meet these two criteria are selected for analysis: 1) have cast direct or indirect impacts on the shaping, planning, and implementation of the three UGS cases in Guangzhou, and 2) have documented these processes (For the complete list of these official policy documents and government reports, please refer to Annex 5. List of Policy Documents).

There are six main types of policy documents (see Annex 5. List of Policy Documents) in this analysis:

- 1) **strategic plans**, which systematically set ambitions for the future and determine how best to achieve them.
- 2) **action plans**, which help actors know what needs to be done to complete a task, project, initiative, or strategy related to UGS planning and implementation, including steps, milestones, and measures of progress, responsibilities, specific assignments, and timeline.
- 3) **conceptual plans**, which are used to introduce novel urban planning concepts and communicate essential information on how to operationalise them. They signal a commitment to a diligent planning effort but are not legally binding.
- 4) **regulation/technical guidelines**, which guide the technical operation of a particular urban plan, including material and human resource input and basic standards.
- 5) **government reports**, which are generated to communicate information that has been compiled as outcome of research and analysis of data and issues.
- 6) **communique/official bulletins** are similar to government reports as they are periodical publications that are authorised to publish legal notices or announce achievements made around UGS planning and governance.

When distinguished by policy document type, the policy documents at the national and local levels as the rules-in-use in this research have the following characteristics:

- The strategic plans and action plans at both the national and local levels serve primarily as *scope rules* and *information rules* as they define the range of possible results by setting anticipated and binding targets and more general directions of development.
- Besides, local strategic plans and action plans also serve as *boundary rules* and *aggregation rules* as they define the geographic and demographic boundaries of actors and actions, as well as how actors interact (collaborate, obey, cooperate, monitor, and more) to achieve the action plans.
- Conceptual plans introduce novel urban planning concepts and communicate essential information on how to operationalise them. Therefore, they serve primarily as *information rules*.
- Regulation/technical guidelines function as *position rules*, *choice rules*, and *payoff rules*, as they define not only material resources but also human resources (actors) and their positions, choices, and possible sanctions if actors did not meet certain standards.
- Finally, reports and communique/official bulletins serve as summaries or feedback to the *scope rules* and the *payoff rules* as they provide data to show the results of a particular UGS intervention.

When distinguished by levels, the policy documents at the national and local levels differ in their focus. For example, when serving as *payoff rules*, the analysis using MaxQDA shows the national level policy documents as *payoff rules* primarily define formal institutional change (see Figure 29). In contrast, the local level policy documents mostly describe known costs and benefits in social, environmental, and economic dimensions (see Figure 30). In this analysis, codes related to costs and benefits and formal institutional changes are considered codes related to *payoff rules*, which define rewards and sanctions.

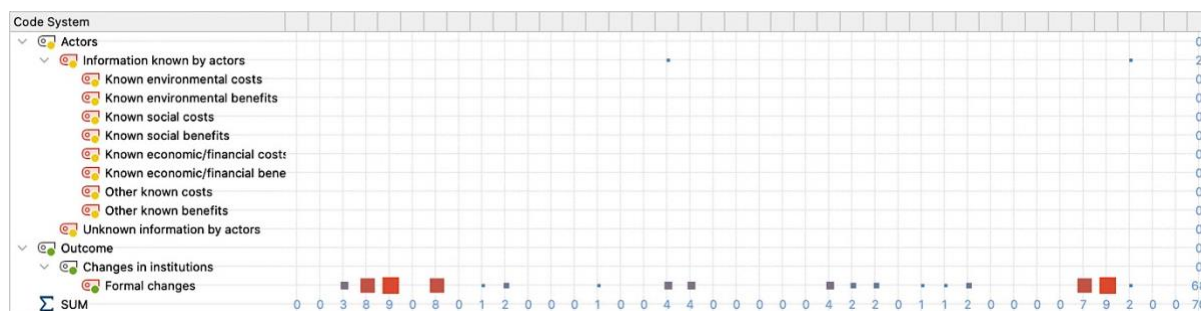


Figure 29: Codes\* on *known costs and benefits* and *formal institutional changes* and their distribution frequency in national level policy documents

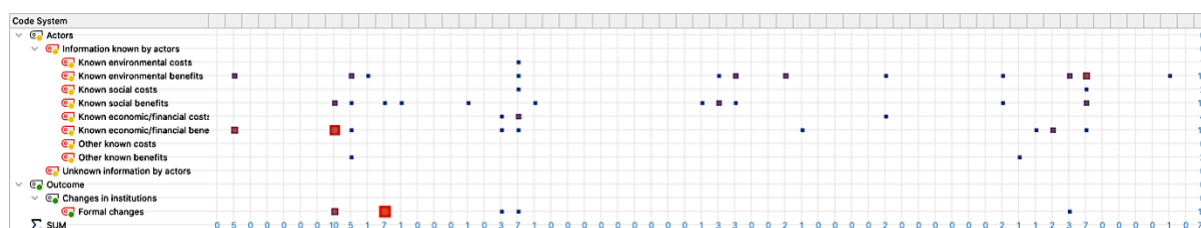


Figure 30: Codes\* on *known costs and benefits* and *formal institutional changes* and their distribution frequency in local level policy documents

\* Each coloured square at the nodes represents a certain number of coded segments. The larger the square, the more segments were assigned with the respective codes

A horizontal inspection on the impact distribution of these policy documents of the three UGS cases shows that, **the quantities of different types of policy documents vary in the three cases; in comparison, the 2<sup>nd</sup> case has the most policy documents as support** (see Table 21). In the 1<sup>st</sup> case - the Panyu Ecological Corridor construction, there are five strategic plans and two action plans at the national level, two strategic plans and four action plans at the local level, plus a conceptual plan but there is no regulation or technical guide. In the 2<sup>nd</sup> case – the Haizhu Wetland Park project, there are as many as 11 strategic plans and eight action plans at the national level, five strategic plans and five action plans at the local level, plus a conceptual plan, and at the same time, there are five regulation/technical guidelines. In the 3<sup>rd</sup> case – the Sponge City demonstration site, there are five strategic plans and five action plans at the national level, four strategic plans and five action plans at the local level, plus a conceptual plan, there are as many as ten regulations/technical guidelines (six at the national level and four

at the local level). Many government reports, especially local government reports, have concluded on the development of the three UGS cases.

A vertical comparison in Table 21 shows that, **the number of technical guidelines has increased from the 1<sup>st</sup> UGS case to the 3<sup>rd</sup> UGS case, indicating that the state and local governments are probably paying greater attention to the technicality and legality of the operation of UGS planning and governance.** Besides, the 2<sup>nd</sup> UGS case is associated with far more numbers of strategic plans and action plans than the 1<sup>st</sup> one, indicating that the national and local governments are paying greater attention to the importance of UGS in urban development.

Policy document type		Strategic plan	Action plan	Conceptual plan	Regulation / Tech guideline	Report	Communique / official bulletin
Cases	Case 1	5:2	2:4	0:1	0:0	1:15	2:0
	Case 2	11:5	8:5	1:0	4:1	2:18	1:0
	Case 3	5:4	5:5	1:0	6:4	4:15	1:0

Table 21: Ratio of national vs. local policy documents in numbers in each type within the list of policy documents for each case study

### 6.1.2 Policy tendencies at the national level

This section inspects the policy characteristics and tendency at the national level through four analyses: 1) the frequency of key policy terms, 2) articulation with international sustainable development agendas, 3) intensity of key policy targets and 4) shifting patterns of contemporary political philosophy. The aim is to understand the institutional dynamics, which might reveal the facilitators and underlying barriers for UGS planning and governance in Guangzhou.

At the national level, the most widely overarching and recurring policy documents are the national macro five-year economic and social development plans (FYPs). Corresponding to the study period of this research 2000-2019, five FYPs are analysed: the 9th FYP corresponds to the period 1996-2000, the 10th FYP corresponds to the period 2001-2005, the 11th FYP corresponds to the period 2006-2010, the 12th FYP corresponds to the period 2011-2015, and

the 13th FYP corresponds to the period 2016-2020. Figure 31 shows the changes in the frequencies of the four key terms ‘Low carbon (低碳 dī tàn)’, ‘Greening (绿色 lǜ sè)’, ‘Climate change (气候变化 qì hòu biàn huà), and ‘Sustainable Development (可持续发展 kě chí xù fā zhǎn)’ mentioned the five FYPs. Figure 31 shows a steady increase in the frequencies of the term ‘Sustainable development’ and ‘Low carbon’, and a sharp increase in that of ‘Climate change’ in the national FYPs.

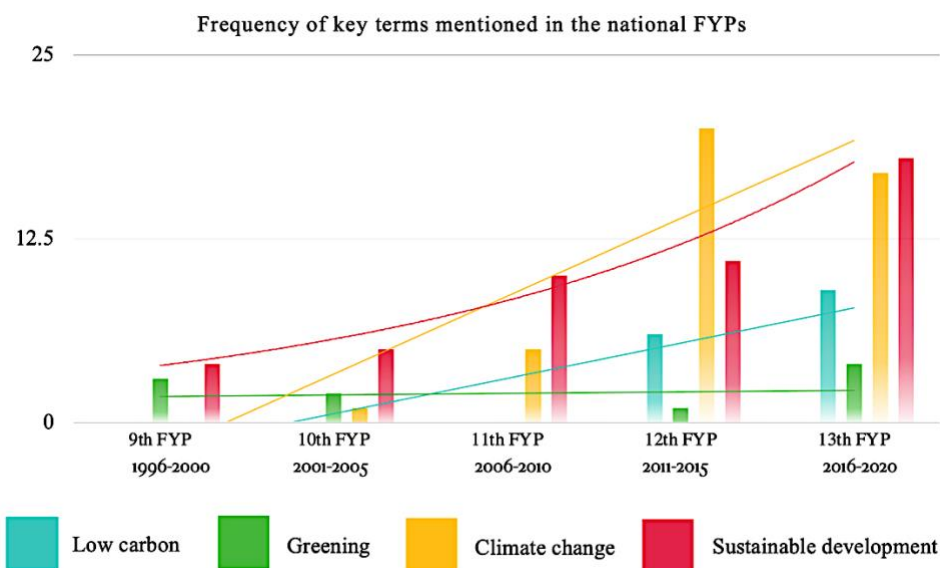


Figure 31: Frequency of key terms mentioned in the national FYPs

Another critical aspect of UGS policy tendency at the national level lies in how actions are defined at this level based on international sustainable development agendas. This research finds **several direct interventions on or related to UGS that the Chinese national government plan to take to fulfil the 2030 Agenda for Sustainable Development**. Six targets altogether in three SDGs: Goal 11 - Sustainable Cities and Communities, Goal 13 - Climate Action, and Goal 15 - Life on Land are responded to with action plans by the Chinese national government (see Table 22).

SDGs and targets		Actions taken in China
<b>Goal 11. Sustainable Cities and Communities</b>	<b>11.6</b> By 2030, reduce the adverse per capita environmental impact of cities, including by paying special	<b>Promote urban and rural green spaces actively and increase the size of green space per capita.</b> Improve the management of urban domestic waste, promote rural domestic waste treatment, and improve waste treatment quality. Develop a plan for

## Urban Green Space Governance in China - Institutional Analysis

	attention to air quality and municipal and other waste management	achieving urban air quality standards. By 2020, the number of days of heavy pollution in prefecture-level and above cities should be reduced by 25%
	<b>11.7</b> By 2030, provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	Control urban development intensity strictly and <b>protect urban and rural green and ecological spaces. Promote urban green belts and ecological corridors</b> combined with the <b>restoration of water bodies and wetlands</b> , road traffic systems, and the protection of scenic resources. By 2020, the green space rate per urban built-up area should reach 38.9%, and green space per capita should reach 14.6 m <sup>2</sup>
<b>Goal 13. Climate Action</b>	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters	<b>Actively adapt to climate change and strengthen resilience to climate risks in agriculture, forestry, water resources and other vital fields, as well as cities, coastal regions, and ecologically vulnerable areas.</b> Gradually establish a forecast, warning, and disaster prevention and reduction system and establish a meteorological early warnings system with full territorial coverage
	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains, and drylands, in line with obligations under international agreements	<b>Maintain water levels in critical wetlands and estuaries. Protect and restore the ecosystems in wetlands, rivers, and lakes.</b> Establish a restoration and protection system for wetlands. Establish a legal system for natural land reserves and improve the sustainable access to natural resources, including forests
<b>Goal 15. Life on Land</b>	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	By 2020, <b>establish a substantial network of ecological corridors and biodiversity protection. Launch major biodiversity protection projects. Improve the management of natural reserves, and increase efforts to protect typical ecosystem, species, gene, and landscape diversity.</b> Increase investment in ecosystem protection and restoration and conduct large-scale surveys on biodiversity. Establish a national monitoring system for biodiversity
	15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	<b>Require local governments at all levels to better protect ecological environment and biodiversity according to local conditions</b> and incorporate the protection measures into local mid-and long-term development plans. Conduct primary survey and <b>assessment of biodiversity and build a monitoring network and database for biodiversity.</b> Launch pilot and demonstration projects for biodiversity restoration and protection

Table 22: Direct interventions on or related to urban green spaces explicated in China's *National Plan on Implementation of the 2030 Agenda for Sustainable Development*

In addition, the intensity of key policy targets, including anticipated targets and legally binding targets, within the most recent three FYPS is inspected. Anticipated targets are development goals anticipated by the government without legal or political obligation to achieve. Binding targets are development goals based on anticipated results that further clarified and strengthened government responsibilities and are required to be accomplished by the local

governments. The analysis, showcased in Figure 32, suggests that **from the 11<sup>th</sup> FYP to the 13<sup>th</sup> FYP, there are more legally binding targets (green) and less anticipated targets (blue) on Resource and Environment, as well as less anticipated targets on Economic Growth, indicating a stronger political will of the Chinese central government for environmental governance and shifting out of the economic growth focus.** The analysis also showcases an increasing focus on Technology and Innovation. The number and ratio between anticipated and binding targets on Public Service and Wellbeing are about the same across the three FYPs.

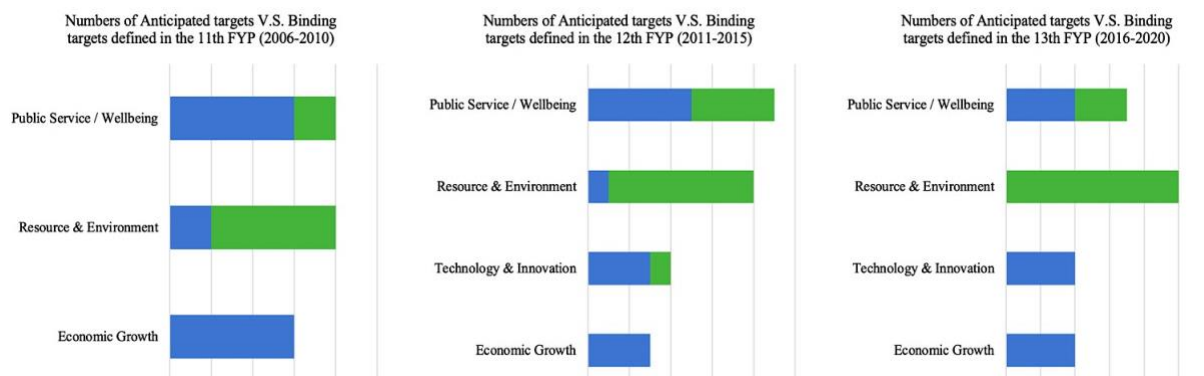


Figure 32: Numbers of anticipated targets vs. binding targets defined in the FYPs

Furthermore, how contemporary political philosophy is narrated in national policy plans was also examined. Figure 33, Figure 34, and Figure 35 showcase the distribution frequency of contemporary political philosophy in the five national FYPs, national climate change and sustainable development plans, and national urban spatial planning and development plans, respectively. These three figures indicate **a similar tendency of shifting from the political philosophy of *Scientific Development* to *Ecological Civilisation*.** A slightly different pattern is found in Figure 36, which demonstrates the distribution frequency of contemporary political philosophy **in national institutional reform plans: the term *Ecological Civilisation* gets less mentioned – probably a sign that the institutional reform initiated by the central government around 2003-2005 is moving into a more problem-specific stage requiring greater technical focus.** In comparison, when *Ecological Civilisation* was at the initial conceptualisation phase in 2003-2005, the term was mentioned much more frequently in the national institutional reform plans.

## Urban Green Space Governance in China - Institutional Analysis

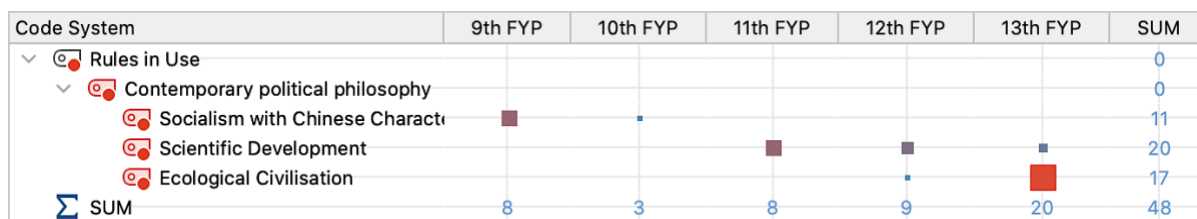


Figure 33: Codes\* on *contemporary political philosophy* and their distribution frequency in the FYPs



Figure 34: Codes\* on *contemporary political philosophy* and their distribution frequency in National Climate Change and Sustainable Development Plans

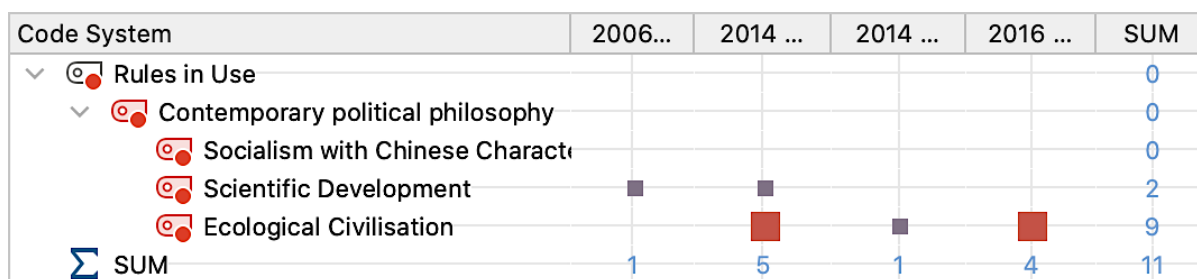


Figure 35: Codes\* on *contemporary political philosophy* and their distribution frequency in National Urban Spatial Planning and Development Plans

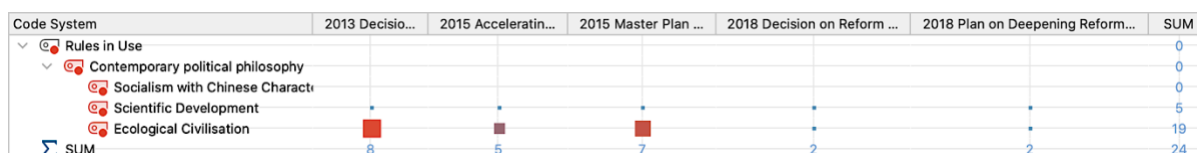


Figure 36: Codes\* on *contemporary political philosophy* and their distribution frequency in National Institutional Reform Plans

\* Each coloured square at the nodes represents a certain number of coded segments. The larger the square, the more segments were assigned with the respective codes.

### 6.1.3 Policy tendencies at the local level

This section inspects the policy characteristics and tendency at the local level through two analyses: 1) changes in the numbers and focus of local development targets in the local FYPs,

and 2) the distribution frequency of contemporary political philosophy in local plans. The aims of these two analyses are to further understand the institutional dynamics, and to examine the extent and approaches for UGS upscaling by the local government, in this case, the municipal government of Guangzhou.

Table 23 reflects several changes from the 12<sup>th</sup> FYP of Guangzhou to the 13<sup>th</sup> FYP, including **increase in the number of targets on Environmental Liveability, Public Service and Social Wellbeing, and Infrastructural Upgrade, and decrease in the number of targets on Economic Structure and Growth**. Also, as one of the targets in Environmental Liveability, **“UGS per capita” changed from an anticipated target to a legally binding one** from the 12<sup>th</sup> to the most recent 13<sup>th</sup> local FYPs.

Type of targets	Environmental Liveability*		Public Service & Social Wellbeing	Economic Structure & Growth	Technology & Innovation	Infrastructural Upgrade
		UGS per capita				
12 <sup>th</sup> FYP Guangzhou	7	15 m <sup>2</sup> → 16.5 m <sup>2</sup> Anticipated	11	6	3	5
13 <sup>th</sup> FYP Guangzhou	10	16.5 m <sup>2</sup> → 18 m <sup>2</sup> Binding	13	4	3	6

Table 23: Numbers of targets in the 12th and 13th FYPs of Guangzhou

Figure 37 shows the distribution frequency of *contemporary political philosophy* in local climate change and sustainable development plans and Figure 38 shows the distribution frequency of *contemporary political philosophy* in local urban spatial planning and development plans. Contradictory to national level policy plans, both two figures show that **political philosophy is rarely narrated in local policy plans**. Except in the *2017 Special Plan on Park Construction and Protection*, in which tens statements were made about *Ecological Civilisation*. Whether this number is significant requires further examination.

Code System	200...	201...	201...	2016 13th FYP for Forestry & Gardening Development in Guangzhou	201...	201...	201...	SUM
Rules in Use								0
Contemporary political philosophy								0
Socialism with Chinese Charact								0
Scientific Development		1					1	2
Ecological Civilisation			1					3
SUM	1	1	0		2	0	1	5

Figure 37: Codes\* on *contemporary political philosophy* and their distribution frequency in Local Climate Change and Sustainable Development Plans

## Urban Green Space Governance in China - Institutional Analysis

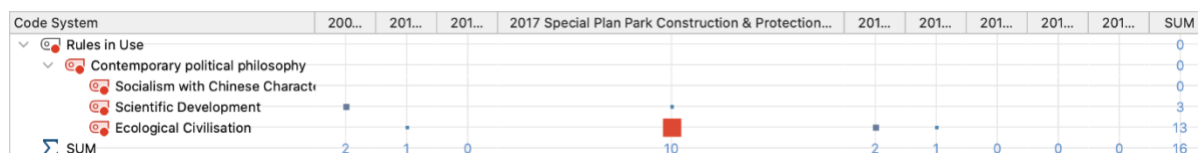


Figure 38: Codes\* on *contemporary political philosophy* and their distribution frequency in Local Urban Spatial Planning and Development Plans

Each coloured square at the nodes represents a certain number of coded segments. The larger the square, the more segments were assigned with the respective codes

### 6.1.4 Summary

The analyses in Section 6.1 shows a steady increase in prioritising sustainable development, low carbon development and actions to address climate change impacts at the national level. The increase in the legally binding targets of Resource and Environment and the decrease in Economic Growth targets indicates a stronger political will of the Chinese central government to government the environment more effectively and to shift out of the economic growth focus. This shows that the Chinese central government has been aware of the need to address climate change impacts and environmental degradation. There is a tendency of shifting contemporary political philosophy in the narratives of national policies and plans from the political philosophy of *Scientific Development* to *Ecological Civilisation*, and a recent decline in the frequency of the latter, probably a sign that the institutional reform initiated by the central government around 2003-2005 is moving into a more problem-specific stage requiring greater technical focus.

While national-level policy documents primarily define formal institutional change at the macro and conceptual level, the local level policy documents mostly describe known costs and benefits in social, environmental, and economic dimensions at the operational level. Besides, the number of technical guidelines has increased from the 1st to the 3rd case, indicating that the state and local governments are paying greater attention to the technicality and legality of UGS planning and governance, the increase of which probably has reduced the overall transaction costs to implement these projects. These policy tendencies also indicate that the national and local governments are paying greater attention to the importance of UGS in urban development. However, contradictory to the national policy plans, political philosophy in local

policy plans is rarely narrated. Furthermore, analysis of the local FYPs of Guangzhou shows an increase in the number of targets on Environmental Liveability, Public Service and Social Wellbeing, Infrastructural Upgrade, and a decrease in the number of targets on Economic Structure and Growth. These findings indicate that local governments focus more on getting the work done and concern less about careful political alignment on paper.

## 6.2 Relationships and Power Dynamics between Actors

Following the IAD framework (see 3.5 Analysing Common-Pool Resource Governance through the IAD Framework) but with a small twist, in this research, *communities*<sup>38</sup> in the three UGS governance cases are treated as equal to the ④ *actors or participants* involved in the three case studies. They include three groups – local governments, communities or local residents (including urban migrants), and landowners, each with its particular attributes. Thus, this section analyses the relationships and nuances of power dynamics between actors in each case study based on the information revealed in the policy documents and by the interview informants (also revealed in Section 5.3 Three Urban Green Spaces Governance Cases in Guangzhou). The aims are to further understand the institutional dynamics, facilitators, and underlying barriers, to examine the approaches for UGS upscaling by the local municipal and district government, and to analyse any potential indirect, non-monetary costs and benefits in between actors that influenced the UGS implementation outcome in the three case studies.

Figure 39 shows seven major actors in the three UGS governance case studies in Guangzhou. The central government is not presented in Figure 39 as it does not participate directly in the three UGS governance cases. Guangzhou municipal government is the highest-level administrative body at the city level, which hosts the three district governments involved in the case studies – Panyu district government, Haizhu district government, and Tianhe district government respectively. Small businesses include small restaurants, rentals, mechanic services and small factories. These small businesses in the case studies also contain a degree of land-use informality in the way these businesses were established. Urban migrants are those

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<sup>38</sup> The researcher recognises the different connotations that the concept of *community* has in different disciplines. For example, many sociological or anthropological studies emphasise the diversity of individuals within a community and often go into great depth portraying those differences.

who came from rural areas outside of Guangzhou and whose household registration, or *Hukou* (in Chinese: 户口; *hù kǒu*) are rural. Household registrations primarily tied to places of birth, and rural household registration holders can only access the services and welfare of the rural areas. This means that the urban migrants in Guangzhou do not have the same rights as their peers with urban household registration in Guangzhou, in terms of access to urban public services and participation in public affairs. Farmland owners in this research refer to those who collectively own the farmlands and neighbouring village residential land within the urban territory of Guangzhou. Finally, the ordinary residents of Guangzhou possess a general citizen right to monitor and report misdemeanours of government officials, even though they are not directly involved or influenced by the three UGS planning and implantation cases.

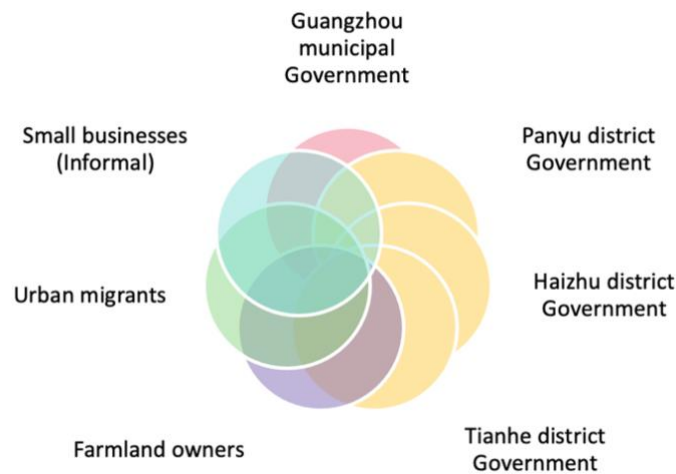


Figure 39: Main actors in the three UGS case study in Guangzhou

There are four main actors in Case 1 - the construction of the Panyu Ecological Corridor network (see Figure 40): Guangzhou Municipal Government, Panyu District Government, small (and informal) businesses, and urban migrants. Guangzhou Municipal Government and Panyu District Government are **superior and subordinate governments, and they have a relationship of collision, cooperation, and collaboration in social, economic, and environmental protection sectors**. This is also the potential costs between superior and subordinate governments in general. The small (and informal) businesses contribute economic benefits and local GDP targets to Panyu District Government. **Panyu District Government has the power to allow the small (and informal) businesses to continue to operate or to exclude them. Migrant workers are “grey” human resources or potential grey economic**

**benefits for Panyu District Government**, or any local urban governments, as they do not have to pay for the social welfare of these migrants even though they are the *de-facto* residents. **The relationship between urban migrant and small informal businesses is a mutually beneficial symbiotic relationship as producers and consumers.**

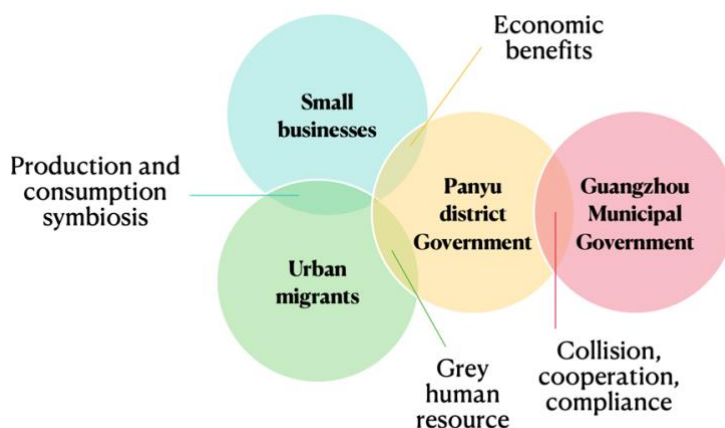


Figure 40: Actor relationships in Case 1 Panyu Eco-Corridor Network Construction

There are six main actors in Case 2 - the conversion of the Haizhu Wetland Park from the Wanmu Orchard (see Figure 41): the central government, Guangzhou Municipal Government, Haizhu District Government, small (informal) businesses, urban migrants, and farmland owners who have collective property rights to the farmland. **The central government, Guangzhou municipal government and Panyu district government are superior and subordinate governments and in a relationship of collision, cooperation, and collaboration in social, economic, and environmental protection sectors.** This is also the potential transaction costs between superior and subordinate governments in general. **The small (and informal) businesses contribute economic benefits and local GDP targets to Haizhu District Government, who, on the contrary, has the power to allow the small (and informal) businesses to continue to operate or to exclude them.** As the small informal businesses expand, they increasingly erode the farmland in the orchard. Under this circumstance, the transaction costs between Haizhu district government and the small informal business community are gradually increasing. **For Haizhu District Government, migrant workers are also “grey” human resources or grey economic benefits**, as the government do not have to pay for the social welfare of these migrants, even though they are also the *de-facto* residents. **Urban migrant and small informal businesses have a mutually beneficial**

**symbiotic relationship as producers and consumers. Urban migrants and farmland owners also have a relationship as producers and consumers, as farmland owners "produce" affordable, semi-formal housing for urban migrants to rent.** But it is not necessarily a mutually beneficial symbiotic relationship. The premise for the symbiosis of the two is that the farmland owners have long-term property rights to the farmland, which became uncertain after the Guangzhou Municipal Government decided to acquire the farmland and transform it into a wetland park.

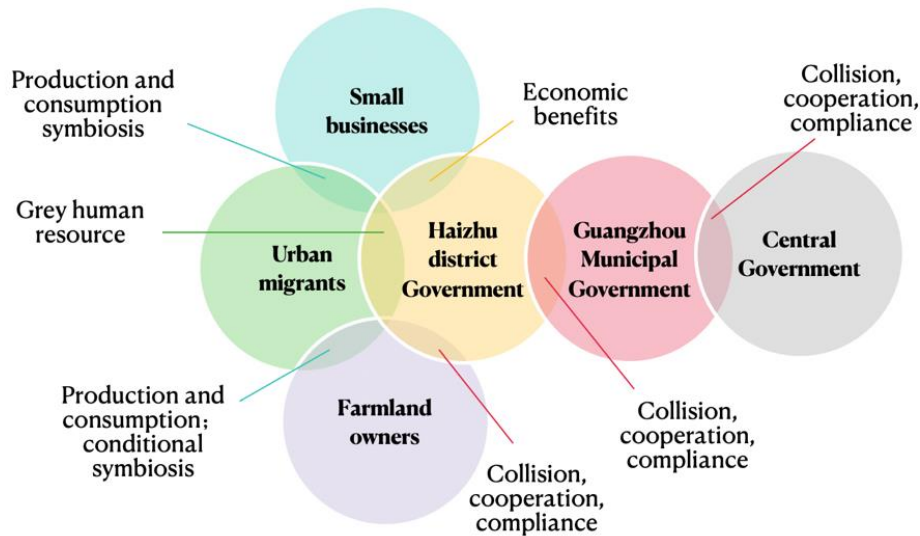


Figure 41: Actor relationships in Case 2 Haizhu Wetland Park Construction

There are only three main actors in Case 3 - the construction of the Tianhe Sponge City demonstration site (see Figure 42): the central government, Guangzhou Municipal Government, and Tianhe District Government. **As superior and subordinate governments, they have a relationship of collision, cooperation, and collaboration in social, economic, and environmental protection sectors.** This is also the potential transaction costs between superior and subordinate governments in general.

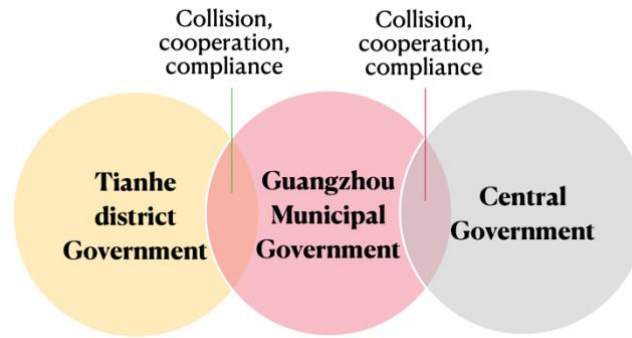


Figure 42: Actor relationships in Case 3 Tianhe Sponge City demo-site Construction

### 6.2.1 Summary

As superior and subordinate governments, the Guangzhou Municipal Government and its cohort district governments have a relationship of collision, cooperation, and collaboration in social, economic, and environmental protection sectors. This is also the potential costs between superior and subordinate governments in general. The small (and informal) businesses provide economic benefits for the district governments and contribute to the local GDP targets. The district governments have the power to allow them to continue to operate or to exclude them. For local governments, urban migrant workers are “grey” human resources or potential grey economic benefits, as the local government do not have to pay for the public social welfare of these migrants. Nevertheless, the urban migrants are also the *de-facto* residents. The relationship between urban migrants and small informal businesses is a mutually beneficial symbiotic relationship as producers and consumers. UGS is a common-pool resource (as framed in Section 3.4.2) for all these actors – as none of them could be excluded from using it but conserving more urban land for UGS could hinder the interests, overlapping rights, and responsibilities of all these actors. All these actors are holders of distinctive property rights and the pragmatic ‘economic man’ who seek to maximise their environmental, social, or economic benefits. Urban migrants as the holder of rural *Hukou* (household registration) do not possess the formal right to participate in urban governance, but ethically speaking, they as the *de-facto* residents of the city have an informal right for the same social welfare as others.

### 6.3 Interactions between Actors

Based on the relationships and power dynamics between actors analysed in the above section, the actual interactions between actors in each case study are analysed in this section. Figure 43 showcases the interactions between all the actors in the three UGS case studies in Guangzhou, a result of co-occurring the frequencies of the coded segments for actors and interactions in all the in-depth interviews about the three UGS cases in MaxQDA.

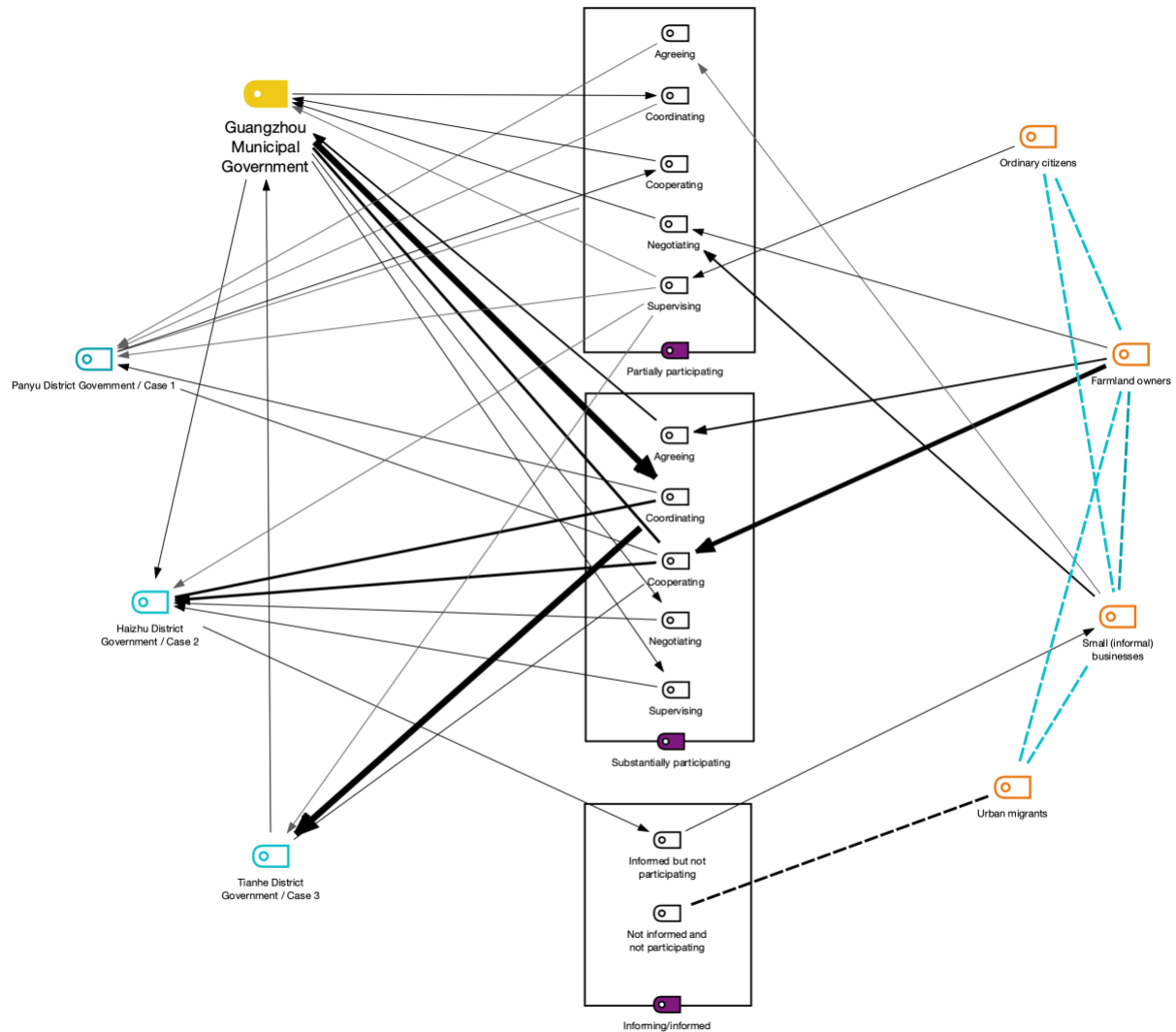


Figure 43: Interactions between actors in the three UGS case studies

Note: The directions of arrows represent interactions from A to B. For example, ordinary citizens participate partially through supervising the municipal and district governments. The size of the arrows are defined by the co-occurrence frequencies of the coded segments in the chosen in-depth interview transcripts in MaxQDA. The stronger the arrow, the stronger the interaction between two particular codes/actors.

For state actors, the analysis shows that **Guangzhou Municipal Government is the most active actor whose primary role is to coordinate with other actors, mainly district governments.** This main coordinating function of municipal governments are also emphasised by government advisors. As revealed in the in-depth interview by Zhao, a senior urban planning researcher and government advisor: *“The common practice of the central government is to give a general task and some general and guiding indicators, for example, building a low-carbon city. How does the local government implement it? Every city needs to make its plans according to local conditions and development needs. Some cities will focus on the development of green buildings. Some cities may have a better climate, and they would focus on developing more urban green spaces. In contrast, others may focus on optimising the industrial structure, penalising enterprises with high pollution and low efficiency, or ordering them to conduct improvements, or ordering them to close. In this process, **the city government plays a highly coordinated and presiding role and work with the lower-level governments to achieve the tasks or goals given by the central government.**”*

Second, **within the coordination process, the municipal government often takes a democratic, creative, and pragmatic approach to build proposals.** As explained by Xiao, a senior environmental scientist and government advisor: *“For example, for constructing Low-Carbon cities, the mayor would discuss plans with city government officials and experts before making the final collective decision together with the Urban and Rural Planning Management Committee. If the mayor alone says that this plan is good, it is not possible (to pass). For example, the mayor said that he wanted to focus on building more urban green spaces, a department chief on land resources or a land economy expert would likely say that the cost of land resources for planting trees is relatively high and would ask the land economy experts to do some calculations. Planting trees may result in the loss of some more direct and more efficient economic benefits, such as building real estate. In such circumstance, the department chief of urban and rural construction may say that they happen to have a residential real estate development project, which could contribute to building Low-Carbon cities by building apartments that fit green building standards.”*

Furthermore, Figure 43 also shows that **the Guangzhou Municipal Government receives a small amount of interaction from fellow citizens and farmland owners in the Haizhu**

**Wetland Park case in the form of partial negotiation and partial supervision.** For Case 1, the Panyu District Government has primarily interacted passively by partially agreeing and cooperating with the Municipal Government and partially coordinating the implementation of the Panyu Eco-Corridor Network construction plan. For Case 2, the Haizhu District Government has played a similar role as the Panyu District Government, except that the interactions with the Municipal Government have been more intense. And for case 3, the Tianhe District Government coordinated quite closely with the Guangzhou Municipal Government to implement the Sponge City Initiative.

However, **the conflictual internal coordination dynamics within the municipal governments, particularly in case 3**, is not evident in Figure 43. This conflict is described by He, a senior urban planner who contributed substantially to the *Guangzhou Sponge City Construction Plan*: *“The Sponge City project has received strong support from the Guangzhou Municipal Government, and now they are establishing a demonstration site in Tianhe District. However, at the same time, the urban planning and construction departments are also experiencing resistance from the bureau of water resources. As the construction of Sponge City necessitates ecological and natural methods for flood retention and wastewater treatment, there will be fewer budgets in the future for the bureau of water resources and negatively impact its downstream stakeholders. Therefore, a conflict of interest has arisen between different departments within the municipal government, and this conflict can be understood as the coordination or negotiation cost within the municipal government.”*

For non-state actors, first of all, their identities overlap with each other and, in some cases, have symbiotic relationships (see Figure 40 and Figure 41). **Ordinary citizens interact with municipal and district actors through partial supervision**, see an interview excerpt from Yuan, a senior urban planner, scholar, and government advisor: *“Ordinary citizens have the legal rights to be informed and make decisions about the environment. The government generally has a process for publicising information on construction projects to obtain public feedback on environmental impacts. In addition, the public can participate in the improvement of a particular project through supervision, and reporting, if they find certain decisions or actions of a government department or an official suspicious or improper.”*

Second, the major actor in Case 2 the transformation of the Wanmu Orchard into the Haizhu Wetland Park – **the farmland owners, have had active interactions with the municipal and district governments by partially negotiating**, some of them fully agree with the proposal, and many others cooperated after being informed, without manifesting agreement or disagreement. See the two interview excerpts from Cai, a government official from the Haizhu Wetland Park Management Office: *“In 2011, the Guangzhou Municipal Government submitted to the Ministry of Land Resources the proposal to acquire the Wanmu Orchard farmland without changing the land function. The Haizhu District Government then established a land acquisition work unit with an advocacy team and land acquisition and demolition team. **The advocacy team informed the farmland owners with materials, including posters and videos of the farmland acquisition plan, through meetings with question-and-answer sessions with representatives**”. **“The representatives of farmland owners, whose role is to express opinions and make decisions for the collective benefits of the farmland owners, have a significant amount of power and long-rooted vested interests in the local social and economic network. The institutional arrangements to trade the farmland ownership for building the Haizhu Wetland Park are against their existing vested interests. Therefore, some farmland owner representatives were not enthusiastic about the proposal. They further negotiated with the municipal government on the financial compensation of farmland property right transfer.”***

Third, **urban migrants are the most silent actor of all, with little interactions registered both from them and to them**. See an interview excerpt from Huang, a retired government official of the Haizhu District Government: *“The institutional arrangements for the Wanmu Orchard farmland acquisition ignored the impact on some actual residents of urban migrants in surrounding urban villages, intentionally or unintentionally. Transforming the orchard into the Haizhu Wetland Park is an improvement in the quality of the ecological environment in the area. It is clearly stipulated that 10% of the reserved land would be used for commercial development (hotels, shops, etc.) for the farmland owners with Guangzhou urban Hukou. These two interventions jointly increased the semi-informal housing prices in the urban villages. The leasing price also indirectly makes these urban villages more crowded, and the quality of life for those urban migrants who live there further declined. **In this process, the migrant workers were indirectly negatively affected by the institutional arrangements for the Haizhu Wetland Park, and they were not officially notified, let alone new institutional arrangements to compensate for the negative impacts.**”*

Finally, if the thickest arrows in Figure 43 represent a more ideal level of interaction, then, the thickest arrow can also be interpreted as where two particular actors can interact with least cost. Then, some further assumptions may be made about the thinner arrows and the greater costs between those actors. This will be discussed in greater detail in Chapter VII.

### *6.3.1 Summary*

In the three UGS planning and governance case studies, the Guangzhou Municipal Government is the most active actor whose primary role is to coordinate with other actors, mainly district governments. Within the coordination process, the municipal government often takes a democratic, creative, and pragmatic approach to build proposals together with each department and urban planning experts. In this process, the primary costs taken into consideration by the municipal government are budget, technical expertise, time to reach a political consensus between departments and time to implement these UGS plans. The technical expertise includes expertise in ecological planning and expertise in the arrangements of rights among actors to access, manage, withdraw, and exclude. Citizens interact with the Guangzhou Municipal Government often in the form of information solicitation and supervision. Citizens interact with the Guangzhou Municipal Government often in the form of information solicitation and supervision. In this process, the primary costs bared by citizens include the time of involvement and the difficulty in accessing information about these projects. Farmland owners can, and some have interacted with the municipal and district governments through negotiation and supervision. In this process, the primary costs bared by the farmland owners are risks of losing the rights to withdraw and manage the orchards, losing local agricultural tradition for the next generations, and not getting what they considered as decent compensation from the local governments. In general, the identities of the non-state actors overlap with each other and, in some cases, have symbiotic relationships. There are also costs involved to maintain these symbiotic relationships - as a group of non-state actors, their transaction costs facing the governmental actors are based on their weigh-in on individual interests *vs.* collective interests in these UGS planning and governance projects.

## 6.4 Outcome in Urban Green Space Implementation and Institutional Change

This section analyses ⑦ *outcomes* in the three UGS governance case studies, including the goals and deliverables of UGS planning/implementation, and resultant formal and informal institutional change.

### 6.4.1 *Urban green space goals and deliverables from national and local plans and policies*

This section presents five major analyses related to the outcome of UGS planning and governance in Chinese cities, in general and in the three case studies, during the study period. The analysis has the aim to examine to which extent local governments have been able to advance and upscale UGS and with what approaches. These analyses made around 1) the UGS actions or deliverables from the national- and local-level UGS-related climate plans or spatial planning policies, 2) the reflections on UGS implementation with evidence from the in-depth interviews, 3) the formal institutional changes which reveal evolving government priorities and local-level institutional changes as response to central-level institutional changes, 4) the reflections on institutional change with evidence from the in-depth interviews, and lastly 5) the types of informal institutional changes incurred.

Figure 44 shows a series of UGS interventions considered in official plans for urban climate change adaptation and biodiversity conservation. These interventions include urban surface coverage, urban green vegetation as a carbon sink, protection of wild plants and species genetic pool, roof gardening, rain gardens, biological water retentions, and more. It also shows that **the linkage between UGS and urban climate change mitigation and adaptation in China has constantly been present in the policy documents at the national level between 2007 to 2019.**

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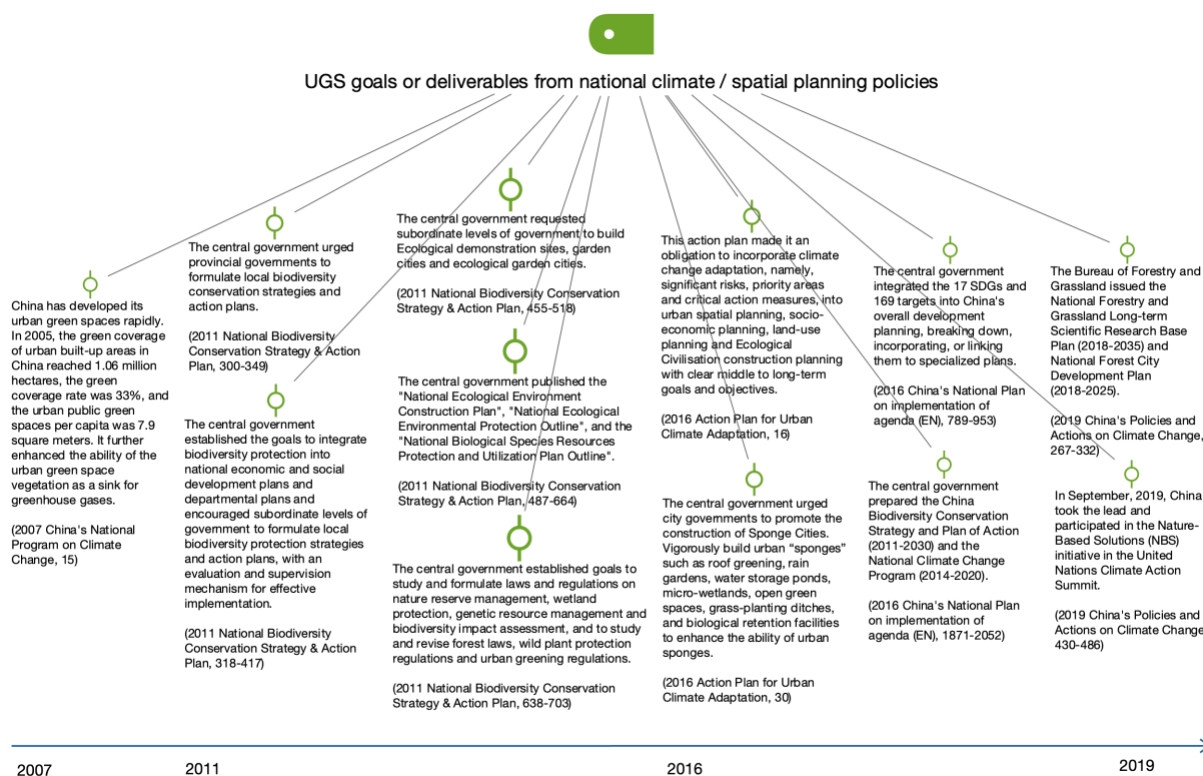


Figure 44: UGS goals and deliverables from the national UGS-related climate plans or spatial planning policies during the case study period

Then, information on UGS intervention in the local UGS-related climate change and urban planning plans and policies during the case study period is extracted and presented in Figure 45. It shows **ambitious goals of the municipal government of Guangzhou in increasing the size of UGS per capita and the rate of total urban surface coverage, as well as strict land-use control and ecological protection.** Furthermore, it shows that **the municipal government laid out concrete measures to build Sponge City for alleviating urban pollution and inundation, including adding vertical greens, recessive green spaces, wetlands, and rainwater gardens, and further emphasised institutional support, including policies, regulations, specifications, and evaluation standards to help it succeed.** Notably, even when these UGS action items or goals do address the impacts of climate change, such as urban inundation, these local-level plans did not link them directly to the word “climate change”. Figure 45 also showcases a linkage between UGS interventions and their role as a public service. The policy document analysis above shows that **the municipal government of Guangzhou responded positively to the UGS goals and requirements put forward by the**

**central government.** Historical data on the actual UGS implementation at the national and local levels also suggested a positive correlation.

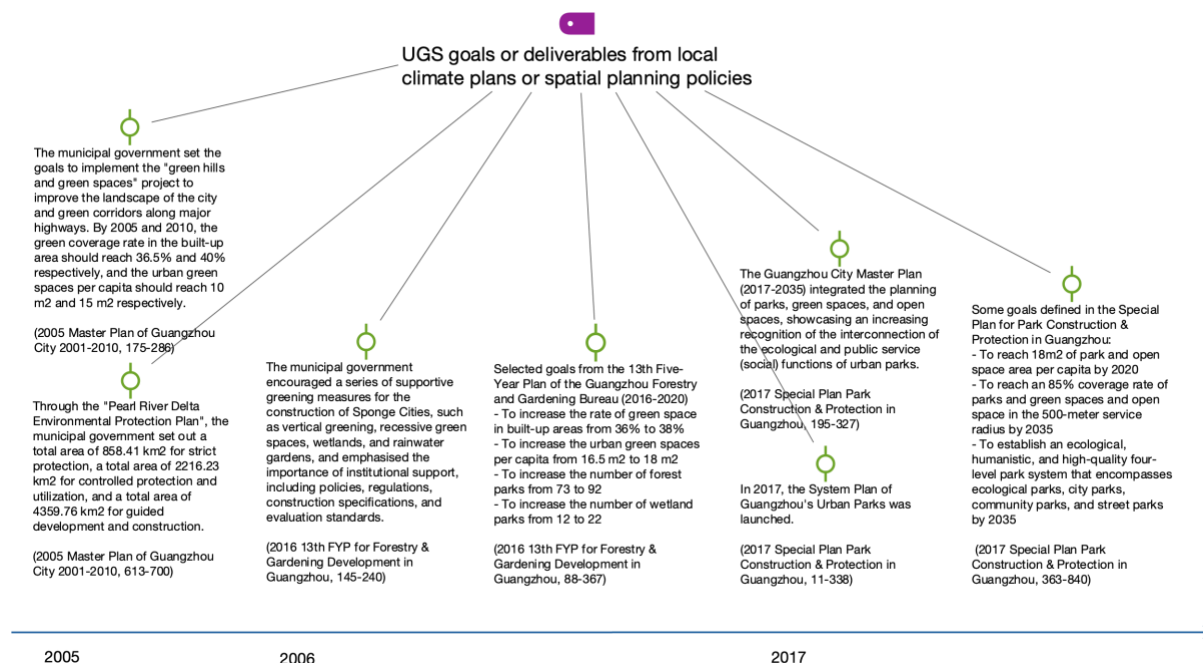


Figure 45: UGS actions or deliverables from the local UGS-related climate plans or spatial planning policies during the case study period

Figure 46 shows a similar increasing trend in both the percentage of UGS size vs. all urban land and the size of UGS per capita, for Guangzhou and national average respectively. **Particularly between 2005-2018, Guangzhou had an above-national-average increase in both UGS size per all urban land and per capita.**

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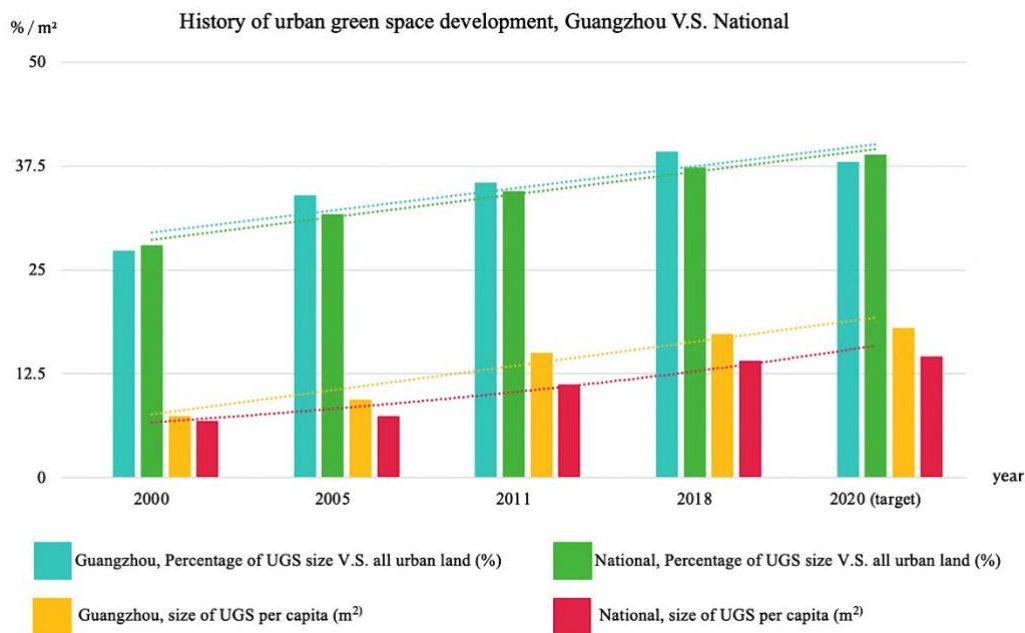


Figure 46: Linear increase trend in urban green space development, Guangzhou vs. National in selected years

Data source: national and local government reports

### 6.4.2 Reflections on urban green space implementation - insights from in-depth interviews

This section presents selected excerpts from the in-depth interviews with 50 professionals of urban planning, urban governance, environmental science, land and political economics, and public administration. These excerpts cover general knowledge as well as specific experiences on UGS policies and intervention from these professionals.

Xiao, a senior environmental scientist argues that **China's UGS planning practice has become more ecology-oriented compared to the conventional approach and describes the stark land-use tension in the recent rapid urban expansion history in Guangzhou:** *"In China, the traditional UGS planning practice is to plan UGS as a supporting facility, that is, to provide public services. Similar to schools and medical institutions, the amount and distribution of UGS planned are based on the calculation of the scale and density of the residential population. UGS planning in China has not been deliberately oriented toward economic services due to the technical difficulty to quantify its direct economic benefits. But UGS may improve the quality of a residential community, thereby increasing property value.*

*Therefore, most of the existing UGS is planned as a kind of public service and supporting facilities. But now, **with the popularisation of concepts such as environmental protection and Ecological Civilisation, UGS planning is slowly taking into consideration the ecosystem services, that is, adopting the ideas and concepts similar to those proposed by Ian McHarg and protecting land properties with exceptional ecological functions***”

Rao, a urban planning and architecture scholar, points out that **even though national UGS policy orientation has gradually opted towards more sophisticated requirements and indicators, most current local UGS evaluation still focuses on incomprehensive indicators such as “UGS size per capita”**: *“The current urban planning system has increased the requirements for green space planning greatly. However, most of the current evaluation of green space quality still only focuses on the green space coverage area or green space per capita. The ecological concepts and indicators of species and biodiversity are still relatively rare.”*

Yue, a researcher in land economics and urbanisation reveals that **private actors also participate in creating more UGS but often through commercial means which often create gentrification**: *“Since the direct economic benefits of UGS are difficult to estimate, for economic efficiency considerations, the government usually packs/bundles UGS into a commercial complex, such as a commercial housing complex, in order to increase the amount of UGS in the city.”*

Yu, a senior urban landscape architect, scholar and practitioner, criticises the dubious city beautification movement and the negative impact of the hardening of natural rivers, and **considers the Sponge City demonstration site in Guangzhou as a novel and nature-based design more effective in treating urban pollution and climate change impacts**: *“It is sad to see that, in the process of rapid urban expansion, the canalisation and hardening of natural rivers and the "beautification" movement are continuing to increase in large and small cities in China. We totally can be wiser in the way we utilise our rivers and natural landscape. The Tianhe Daguan Wetland Park, as a pilot project of Guangzhou's Sponge City construction, for example, demonstrates the possibility of a novel design for urban greening and landscaping. In this case, we used the natural resources at the original site and the least design to create a genuinely economical urban green space, provide contemporary urban residents with the most*

*and best ecological services, slow down urban waterlogging, and treat water pollution ecologically. It integrates the needs of residents, management of environmental pollution and climate change impacts, and preserving native plant species.”*

Lv, a senior government official of the urban planning system of Guangzhou, **reaffirms not only the overall improvement in the city’s urban environmental quality, but also the potential for improvement in UGS governance:** *“The environmental quality of Guangzhou needs to be improved. The total amount of urban green spaces has increased, but so is the trend of ecological landscape fragmentation, While the proportion of urban construction land has decreased. Although Guangzhou is in the subtropical zone with abundant rainfall, the city has faced a lack of usable, quality water sources due to the severe pollution of rivers.”*

Huang, a retired senior government official in the Haizhu District Government approves the **positive change in the ecological condition of the Haizhu Wetland Park and the overall environmental quality, admitting a few unintended externalities including the circumstance of the urban migrants:** *“Farmland owners have lost the right to manage the orchard, running the possibility of losing their agricultural traditions and knowledge not being able to be passed on to the next generation. And because farmland owners could no longer develop their farmland into informal housing for urban migrants, many have made informal additions to their existing homesteads, which surpasses the legal height limit for these homesteads. As a result, the urban villages surrounding the Haizhu Wetland Park have become more crowded, and the living environment of urban migrants has further deteriorated.”*

#### ***6.4.3 Formal institutional changes, evolving priorities, and central-local correlation***

This section presents analyses on the formal and informal institutional changes accompanying the UGS interventions revealed in section 6.4.1 and 6.4.2. The aim is to further understand the changes in the institutional dynamics between actors and between the central and local levels, as well as to examine to what extent local level governments responded to central-level government objectives.

Figure 47 shows the formal institutional changes outlined in the 11th, 12th, and 13th national social and economic development Five-Year Plans (FYPs) respectively, and the occurrence of



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*Text in red:* formal institutional changes related to the economic system

*Text in brown:* formal institutional changes related to governance and roles of multiple actors

*Text in blue:* formal institutional changes related to government internal reform, structural or functional

*Text in green:* formal institutional changes related to environmental protection and climate change mitigation and adaptation

*Text in purple:* reform for urban development and urban-rural integration

An examination through the national-level climate plans and spatial planning policies finds **four major areas of formal institutional change: 1) environmental regulations, 2) government reform, 3) economic system reform, and 4) the role of societal actors and governance** (see Figure 48). It is also notable that more institutional changes have been planned during the transition years between the national FYPs or the macro socio-economic planning cycles, for example, in 2005 (between the 10<sup>th</sup> and 11<sup>th</sup> FYPs), and in 2014-2016 (between the 12<sup>th</sup> and 13<sup>th</sup> FYPs). **Half of the formal institutional changes outlined in these policy documents focus on government reform**, ¼ of them focus on environmental regulations, less than 10% of them focus on economic system reform or the role of societal actors and governance.

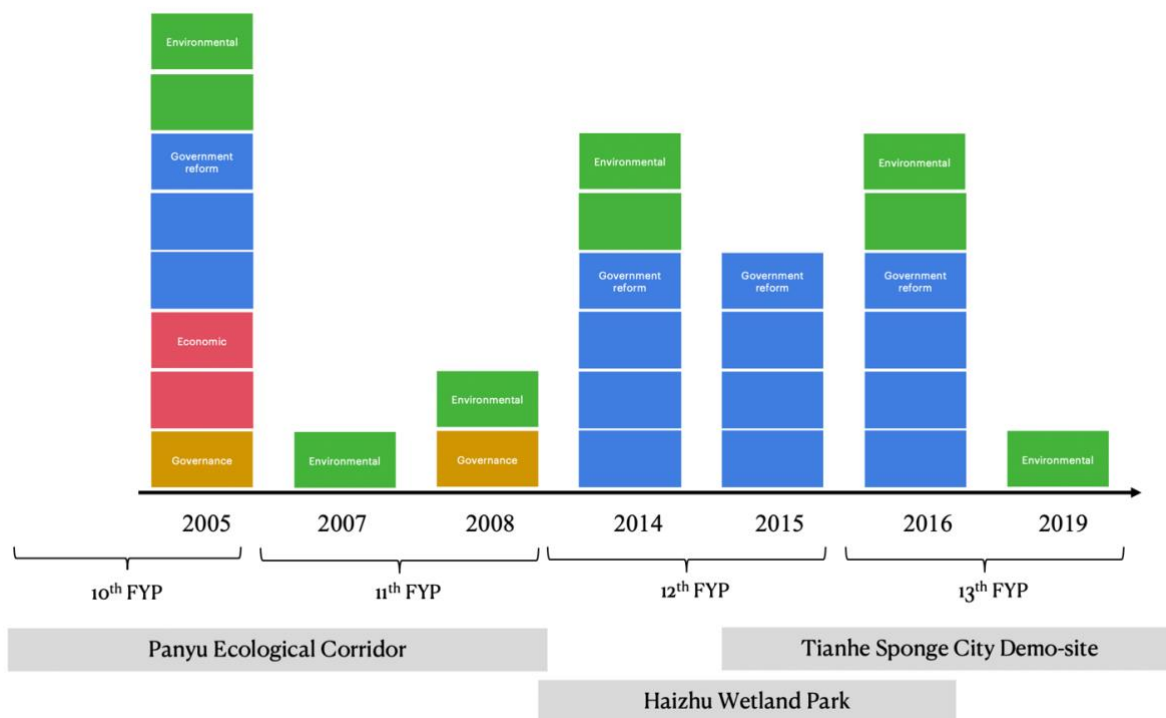


Figure 48: Areas and numbers of formal institutional changes presented in national climate plans and spatial planning policies

*Green*: environmental regulations. *Blue*: government reform. *Red*: economic system reform. *Brown*: the role of societal actors and governance

Having examined how formal institutional change has been outlined in official policy documents at the national and local levels respectively, it is necessary to assess how local level governments, in this case, the municipal government of Guangzhou, has reacted to the national-level formal institutional changes led to the correlations between central and local levels. As shown in Figure 49, **local level institutional changes primarily incurred/reacted to national level institutional change in environmental protection and climate change mitigation and adaptation** (text in green). Less than one third focus on internal government reform. Only a slim amount focusses on urban development and urban-rural integration, or governance and roles of multiple societal actors. The call to establish a government performance index and to implement a pollutant discharge system are the most responded institutional change items from the local level. **In general, institutional changes at the local level have responded more to the more recent FYPs**, for example the 13<sup>th</sup> FYP (2016-2020), indicating a stronger central-local coordination.

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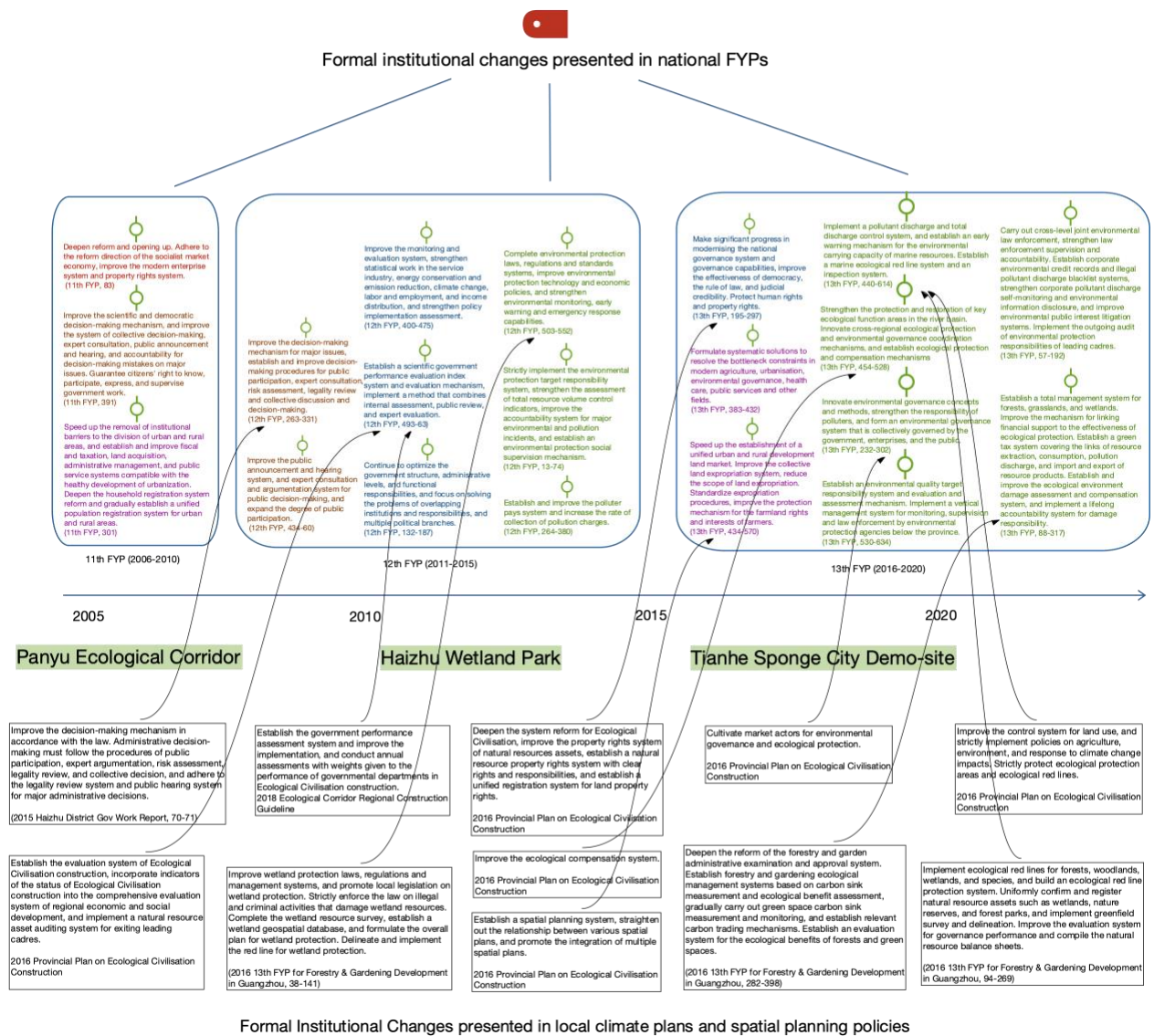


Figure 49: Correlation between local and national levels in formal institutional change

*Text in red:* formal institutional changes related to the economic system

*Text in brown:* formal institutional changes related to governance and roles of multiple societal actors

*Text in blue:* formal institutional changes related government internal reform, structural or functional

*Text in green:* formal institutional changes related to environmental protection and climate change mitigation and adaptation

*Text in purple:* reform for urban development and urban-rural integration

#### **6.4.4 Reflections on formal institutional change - insights from in-depth interviews**

Reflections from the interviewees can support one of the aims of this research to identify and understand intrinsic-value-related factors of potential institutional barriers. The reflections from the interviewees on formal institutional change mainly focus on four aspects: 1) the introduction of ecological performance measures, 2) the unification and systematisation of urban planning, 3) property rights reforms, and 4) government reform with regards to rule of law, accountability, and participation.

**One aspect of formal institutional change is the ecologicalisation evaluating and promoting government officials' performance through environmental protection indicators, natural resource asset audit sheets.** Zhao, a senior urban planning researcher and government advisor, argues that this aspect can strongly motivate government to deliver environmental goals: *“Environmental protection is now the most important indicator to evaluate the performance of local governments: once any major environmental, ecological, and environmental pollution problems have occurred, they will not be promoted to higher positions. This provides local governments with a stronger motivation and passion for environmental protection and management. They are now making corresponding adjustments to their local development policies more actively, focusing on environmental protection. Previously, the environmental protection work was only driven by political pressure, but today it is driven by a more formal governance system with accountability mechanisms.”*

Another aspect is **the unification and systematisation of urban planning with reduction in the types of plans and departments in charge, but with increase in land-use restrictions and regulations aimed to protect the environment.** Zhao, senior urban planning researcher and government advisor, calls this change the “modernisation of governance capabilities”: *“One of the actions was to establish the Ministry of Natural Resources to manage various natural resources in a more unified and systematic manner. The biggest benefit of this reform action was to enable more efficient and economical use of natural resources, which is a major manifestation of Ecological Civilisation... In the past, the ecological red line was rarely considered when making an urban plan. Now, full attention to ecological and environmental protection is required. We as urban planners need to follow the "rules of the three lines" strictly. These three strictly controlled lines are: ecological space protection line, ecological red line and basic farmland protection line. Secondly, the three lines in the previous plan belonged to*

*three different departments: The Ministry of Housing and Urban-Rural Development, the Ministry of Land Resources, and the Ministry of Agriculture respectively. Now in any determined urban plan, we need to integrate all these lines.”*

Additionally, **institutions around property rights arrangements have become increasing complex.** Zhao, a senior urban planning researcher and government advisor, gave an example of the collectively owned farmland in rural areas: *“For example, collective land in rural areas could have the same functional attributes as before (the reform of land property rights), but now it's managed uniformly throughout the country. E.g., a plot of collectively owned farmland is now defined as a key ecological protection area, for this reason, although farmers continue to own the farmland collectively, they can no longer develop it for farming or other purposes. At this time, the local government should compensate the farmers financially for replacing their source of livelihood with ecological conservation. For farmers, their collective ownership remains, but their income source has changed from the original development and use model to the current ecological conservation model.”*

Furthermore, **a serious of reform on the government system tend to create more political space for societal actors and strengthen the rules of the law.** Li, a senior urban development expert and government advisor, revealed how to go about modernising the government and urban governance: *“(I think that we would focus on) the reform of the administrative management system: transform government functions, reduce administrative levels, improve administrative efficiency, form good government-enterprise and government-society relations, thereby modernising urban governance. The result of the reform should reflect the requirements for the integrated development of urban and rural areas, greater autonomy of the private sector and the society, and the spirit of the rule of law. At the same time, reform the cadre appointment management system: change the traditional economic development-based performance model, instead, incorporate livelihood improvement Ecological Civilisation construction into the cadre evaluation system.”*

**All these four formal institutional change trends have been advanced through small-scale trial-and-error experiments and from the central level down to the local level.** Yuan, a senior urban planning researcher, practitioner, government advisor, shares his insights: *“Many existing types of urban plans in China are a result of a series of trials and errors by selected*

*local governments. The experiments and experiences are gradually summarized and then assessed and approved by the central government before they were institutionalised and promoted nationwide.”*

#### **6.4.5 Informal institutional changes**

This section presents five major types of informal institutional changes identified in all the national- and local-level policy documents as well as in-depth interviews. The aim of this analysis is to further understand the institutional dynamics, approaches, and emerging norms or intrinsic-value-related factors which influenced UGS governance in China. **These five major types of informal institutional changes are: 1) enhanced urban-rural coordination in urban planning, 2) enhanced notion of public participation, 3) enhanced ecological notion in urban planning, 4) increase in government officials’ environmental awareness, and 5) enhanced citizens role for government supervision** (see Figure 50).

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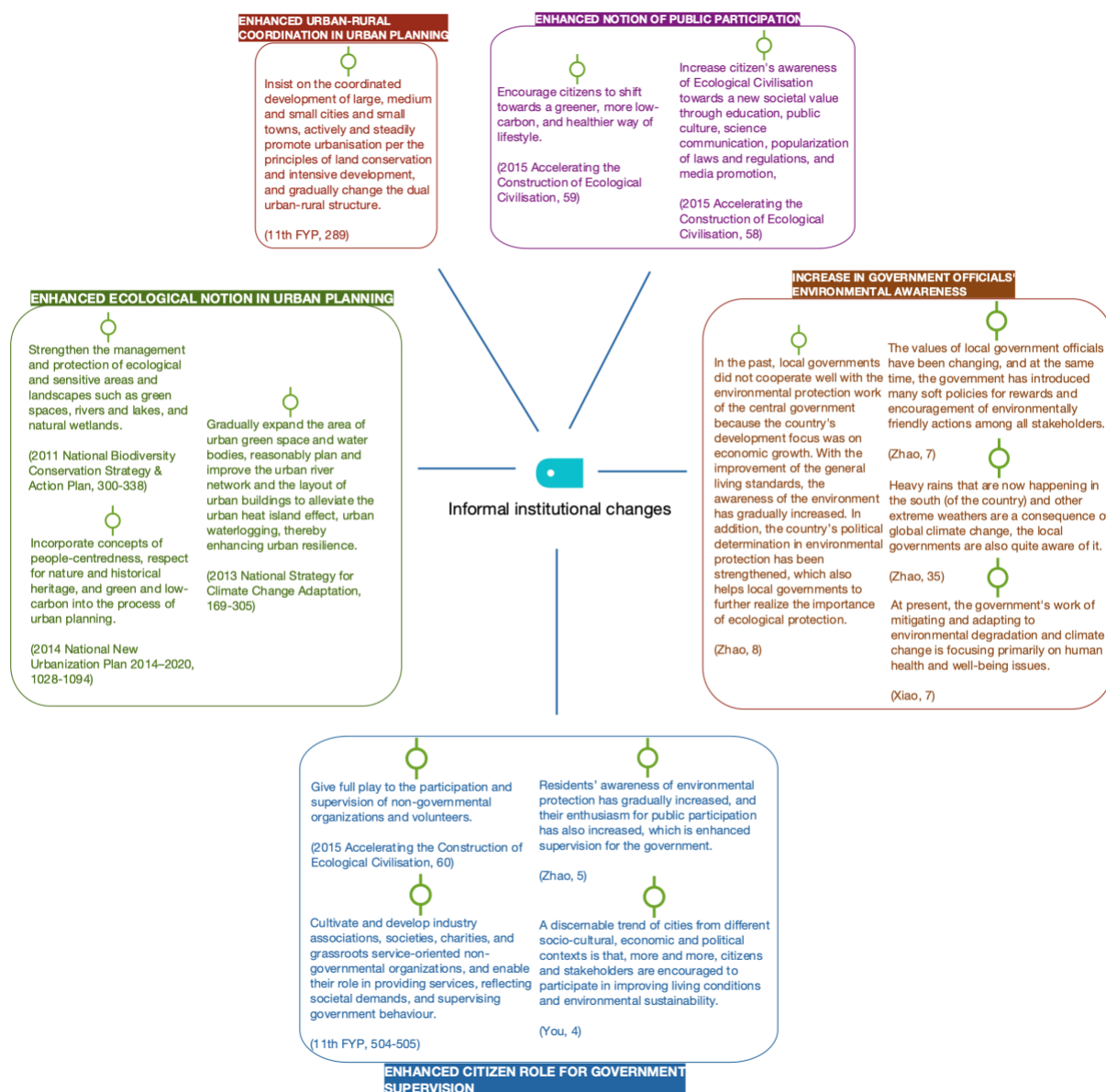


Figure 50: Five types of informal institutional changes identified in policy documents and in-depth interviews

### 6.4.6 Summary

Analysis of UGS goals in national policy documents finds a series of UGS interventions outlined for urban climate change adaptation and biodiversity conservation, including urban surface coverage, urban green vegetation as a carbon sink, protection of wild plants and species genetic pool, and more. It also shows that the potential of UGS for urban climate change mitigation and adaptation is believed and has constantly been considered by the Chinese

national government. Analysis in local policy documents shows ambitious goals and concrete measures of the Guangzhou municipal government to increase the UGS size per capita and per total urban surface coverage and enhance land-use control and ecological protection. The analysis also shows the local government's intention to enhance institutional support, including policies, regulations, specifications, and evaluation standards to help it succeed, indicating a positive sign of systematic thinking. Notably, even when these UGS action items do address the impacts of climate change, these local-level plans did not link them directly to the term "climate change". There are three possible reasons: 1) a perception gap of climate change between the central and local governments, 2) the technical-scientific challenge to confirm the direct causal relations between local economic activities and regional climate change impacts, or to quantify properly the benefits of UGS ecosystem services at local levels, or 3) a strategy with differentiated focus distributed across levels of government and scales of time, population, and resources.

Comparing the actual historical development of UGS implementation at the local levels with that of the national average, it reveals a positive response by the Guangzhou municipal government to the UGS goals defined by the central government. Traditional UGS planning practice in China tended to treat UGS merely as a product for public service but has evolved to become more ecology-oriented in recent years. The UGS policy orientation at the national level has gradually opted towards more sophisticated requirements and indicators. However, most current local UGS evaluation still focuses on incomprehensive indicators, such as "UGS size per capita". These findings indicate the ongoing learning progress of government officials and urban planning professionals, with obstacles remain in operationalising those more sophisticated requirements and indicators. These obstacles require substantial investment in technical expertise, institutional change, and human resources to tackle.

Guangzhou has suffered a stark land-use tension in recent decades due to high-speed urban expansion. The overall hardening of natural rivers and land surfaces has caused many negative impacts on urban environmental health. Besides, many urban greening attempts taken place along the so-called "city beautification" movement did not resolve the problems. Furthermore, even though private actors have also been allowed and encouraged to create more UGS via commercial means, they have often produced externalities such as gentrification. Interventions like the 2nd case (Haizhu Wetland Park) and the 3rd case (Tianhe Sponge City

demonstration site) have resulted in positive changes in the overall ecological condition and strengthened climate resilience, however, shortcomings remain. These reflections show that a more systemic approach is needed to improve the technical expertise and institutional support and include more non-state actors, specifically those whose property rights are informal or poorly established.

Analysis of the formal institutional change outlined in national policy documents finds a notable increase in the requirements of institutional change environmental protection and climate change mitigation and adaptation, and a drastic decrease in the requirements of economic system reform. Structural or functional government internal reform and environmental protection and climate change actions are equally essential priorities for the central government. These findings indicate a sharp rise in the central government's political determination to tackle environmental and climate challenges. Analysis of the formal institutional change in local policy documents finds more institutional changes being planned during the transition years between the national FYP planning cycles. Most of those focus on government reform and environmental protection and climate change actions, showcasing positive response to the institutional changes outlined at the national level, and mainly responded to the more recent FYPs, indicating stronger multi-level coordination.

Reflections from the interviewees on formal institutional change mainly focus on four trends: 1) The ecologicalisation in the evaluation and promotion of government officials' performance through environmental protection indicators and natural resource asset audit sheets. 2) The unification and systematisation of urban planning with reduction in the types of plans and the numbers of departments in charge, but with increase in land-use restrictions and regulations of environmental protection. 3) Increasing complexity in property rights arrangements. And 4) Government reform in critical aspects such as the inclusion of societal actors and the rules of the law. These four formal institutional change trends have been advanced through small-scale trial-and-error experiments, first at the local levels and, once proven effective, promoted by the central government and scaled-up nationwide. These findings show great efforts of the central and local governments in institutionalising mechanisms of self-check regarding environmental deeds; in the meantime, the rights, or the legal power to govern the environment and climate change are more concentrated in fewer departments.

Furthermore, five major types of informal institutional changes are identified: 1) enhanced urban-rural coordination in urban planning, 2) enhanced notion of public participation, 3) enhanced ecological notion in urban planning, 4) increase in government officials' environmental awareness, and 5) enhanced citizens role for government supervision. These findings show changing values of governments in urban environmental governance, with 1) greater attention to improving the government's environmental knowledge and awareness, which is also useful for reducing the costs of environmental damage or mistakes made by improper response measures, and 2) mobilisation of non-state actors to supervise the government, which could help reduce the costs of law enforcement and internal government supervision.

### **6.5 Final Evaluation through Multi-Criteria Assessment (MCA)**

The above analyses have teased out many subtleties about the ⑥interactions and conflicts between the ④actors in the three case studies, the ⑦outcome in UGS implementation as well as formal and informal institutional changes. This section evaluates the ⑥interactions and ⑦outcomes through a comprehensive multi-criteria assessment (MCA), as guided by the IAD framework (see Section 3.5 Analysing Common-Pool Resource Governance through the IAD Framework, and Figure 9: The IAD framework applied in this research). The MCA is conducted/scored by the researcher according to the information provided by interviewees/informants as well as the analysis done in the above sections. As introduced in Section 3.5, considering the flexible and context-specific nature of the IAD framework, this research extends the five basic evaluative criteria that Ostrom (2005) defined into a more comprehensive set of criteria (see Table 24), based on these three additional references: 1) The universal principles for effective governance in the *Millennium Ecosystem Assessment (MEA)*, 2)The *Technical Assessment Synopsis Reports* of the European Green Capital Award, and 3) The Multi-Criteria Evaluation (MCE) guideline for ENavi - the Energy Transition Navigation System developed to evaluate the German national energy transition scheme 'Energiewende'. For reasons of selection of these references, see Section 4.3.2.2. The new set of evaluation criteria enables a more detailed evaluation of the variables, thereby increasing the credibility of the results of this MCA.

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1 <sup>ST</sup> TIER & STRUCTURAL CRITERIA	DIMENSIONS	2 <sup>ND</sup> TIER CRITERIA	1 <sup>ST</sup> CASE	2 <sup>ND</sup> CASE	3 <sup>RD</sup> CASE	CORRESPONDING SUB-CODES (SUB-THEMES)	CORRESPONDING CATEGORIES
<b>1. Economic efficiency</b>	Economic	1. Financing adequacy	N/A	7	N/A	UGS goals from plans/policies UGS Implementation	⑦Outcome
		2. Direct cost-benefit efficiency	N/A	7	N/A		
	Technical	3. Temporal efficiency of planning	7	7	7	UGS goals from plans/policies UGS Implementation	⑦Outcome
		4. Temporal efficiency of implementation	1	7	7		
	Institutional	5. Interlinkages between institutions	2	6	5	UGS goals from plans/policies UGS Implementation Urban climate governance	⑦Outcome
<b>2. Equity</b>	Social	6. Cultivation of social cohesion	2	5	4	UGS Implementation Informing/informed Partially participating Substantially participating	⑦Outcome ⑥Interactions
		7. Inclusion of health and wellbeing benefits	N/A	5	6	Human health and wellbeing	⑦Outcome
		8. Inclusion of rights to access information	2	6	7	UGS Implementation Informing/informed Partially participating Substantially participating	⑦Outcome ⑥Interactions
		9. Inclusion of rights to monitor	1	6	6		
		10. Inclusion of rights to participate	2	5	4		
	Ecological	11. Environmental protection and resource conservation	4	7	7	UGS Implementation Climate resilience	⑦Outcome
	Economic	12. Inclusion of economic benefits	6	5	5	UGS goals from plans/policies UGS Implementation	⑦Outcome
<b>3. Adaptability, resilience, and robustness</b>	Technical/ecological	13. Sustainability in land use	3	6	6	UGS Implementation Climate resilience Human health and wellbeing	⑦Outcome
		14. Environmental quality (air, noise, waste, water)	2	7	7		
		15. Ecological resilience (ability to stay resilient)	N/A	7	7		
		16. Effectiveness in climate change mitigation and adaptation	4	7	7		
		17. Significance and relevance to the SDGs	4	7	7		
		18. Technical replicability	2	7	7		
	Economic	19. Economic predictability and contribution to the common good	6	6	7	UGS goals from plans/policies	⑦Outcome
		20. Green growth and eco-innovation	5	6	5		
Institutional	21. Innovativeness in governance	7	7	6	UGS goals from plans/policies UGS Implementation	⑦Outcome	

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		22. Institutional adaptability (changes over time)	5	6	N/A	Formal changes Informal changes Urban climate governance	
		23. Transferability of practices	6	6	6		
<b>4. Accountability</b>	Institutional	24. Compliance with upper-level governments and agendas	1	7	7	UGS goals from plans/policies UGS Implementation Urban climate governance	⑦Outcome
		25. Administrative accountability within own level	2	6	6	UGS goals from plans/policies UGS Implementation Urban climate governance	⑦Outcome
<b>5. Conformance to general morality</b>	Institutional	26. Information transparency	2	6	6	UGS goals from plans/policies UGS Implementation	⑦Outcome
		27. Legitimacy (conformity to the law)	2	6	7	UGS goals from plans/policies UGS Implementation Formal changes Informal changes	⑦Outcome
		28. Ethical acceptability	4	5	7	UGS goals from plans/policies UGS Implementation Formal changes Informal changes	⑦Outcome

1	Very clearly negative	7	Very clearly positive
2	Clearly negative	6	Clearly positive
3	Slightly negative	5	Slightly positive
N/A	Not sufficient information to assess	4	Neutral / Insignificant

Table 24: Final Evaluation of UGS planning and governance in Guangzhou through a Multi-Criteria Assessment (MCA)

As showcased in Table 24, the first case – the Panyu Ecological Corridor construction project is quite successful in terms of temporal efficiency of planning and inclusion of economic benefits. It also scores high in economic predictability, innovativeness in governance, and transferability of practices. The Panyu Ecological Corridor construction project scores low in social equity, technical/ecological adaptability, resilience, and robustness, accountability, and conformance to general morality, particularly in information transparency and legitimacy (conformity to law).

The second case – the Haizhu Wetland Park transformation project is highly successful in general, particularly in the criteria of economic efficiency in economic, technical, and institutional dimensions, as well as in the criteria of adaptability, resilience, and robustness in technical/ecological, economic, and institutional dimensions, and in institutional accountability.

The Haizhu Wetland Park transformation project scores slightly lower in social equity and conformance to general morality.

The third case – the Tianhe Sponge City demonstration site construction is deemed successful in general, particularly in the criteria of adaptability, resilience, and robustness, accountability in technical/ecological and economic dimensions. This case has also demonstrated high efficiency in planning and high compliance with upper-level governments and agendas. Overall, the local government, in this case, the Guangzhou municipal government and the Tianhe district government, did well in fulfilling administrative accountability within own levels and have been quite transparent in terms of public information. The project scores high in legitimacy (conformity to the law) and ethical acceptability. It is comparatively less successful in the inclusion of public participation and there is no sufficient information yet to determine the institutional adaptability over time.

**The commonalities shared by all these three cases are the evident temporal efficiency in planning, and innovativeness in governance in each owns terms, despite not all led to successful UGS implementation outcome.** The second and third cases – the Haizhu Wetland Park and the Tianhe Sponge City demonstration site projects, respectively, share a high level of technical/ecological adaptability, resilience, and robustness.

From the first to the third cases, **an increasing trend is identified** in the following criteria: 1) technical/ecological adaptability, resilience, and robustness, 2) inclusion of health and wellbeing benefits, and 3) inclusion of rights to access information, 4) sustainability in land-use, 5) information transparency, 6) legitimacy (conformity to law), and 7) ethical acceptability.

### **6.5.1 Summary**

Results from the MCA show that **all three case studies are efficient in terms of planning and implementation within relatively short periods**, despite not all have been successful, possibly due to the lack of information or understanding of the fundamental challenges of UGS planning within that particular time and social-economic development context - an information cost that the actors missed to consider. It also shows **high governance innovativeness in all three cases in each owns terms, despite not all have been successful**. In this 1st case, the

innovativeness in governance is reflected by the fact that the Panyu Ecological Corridor was promoted as a conceptual plan and the weigh-ins of urban planning experts, which was considered innovative at that time. In the 2nd case, the Haizhu Wetland Park project was the first to have a land property right transfer scheme for collective agricultural land conservation and prevention of urban sprawl. Regarding adaptability, resilience, and robustness, there is **an overall increasing trend from the 1st to the 3rd cases in the technical/ecological dimension of adaptability, resilience, and robustness**. The 2nd case (Haizhu Wetland Park) and the 3rd case (Tianhe Sponge City demonstration site) score high. There is **also an overall increasing trend on the inclusion of health and wellbeing benefits and the rights to access information, legitimacy (conformity to the law) and ethical acceptability in all the case studies**. Compared to the 1st case, the Tianhe Sponge City project is backed by technically more proficient and meticulous plans and greater central government preference. Compared to the 2nd case, the Tianhe Sponge City demonstration site construction was more straightforward and did not involve property rights complications nor social justice issues of urban migrants.

**The 1st case – the Panyu Ecological Corridor project scores high on economic predictability and transferability of practices. However, these criteria do not necessarily guarantee success.** The high economic predictability also indicates little intervention incurred, alias the “business as usual” path dependency. **On social equity and conformance to general morality, the 2nd case - Haizhu Wetland Park transformation project scores slightly lower.** Compared to the 1st case, the difference in the 2nd case began with the institutionalisation of land property rights changes from collective ownership to state ownership. Besides, the 2nd case also benefited from a much larger budget, which sorted out the direct cost-benefit equation better than in the 1st case for both local government and non-state actors. Furthermore, the 2nd case was facilitated by a greater political preference from the central level and the emergence of the new national development philosophy *Ecological Civilisation*. **The comparatively lower score in social equity results from the project’s inability to improve the living environment of the urban migrants inclusively within the wetland area due to the lack of institutional support for the urban migrants, which is probably too costly to combine with this project.**

## CHAPTER VII

### DISCUSSIONS

Chapter VI analysed the institutions, actors, interactions between actors and outcomes in the three empirical UGS governance case studies and evaluated the interactions and outcomes of both the UGS implementation and resultant institutional change in a multi-criteria assessment (MCA). This chapter summarises and discusses the main findings in combination with the literature reviewed and the theoretical framework established in Chapters II and III, followed by considering the policy implications and scientific contributions and implications of this research.

#### 7.1 Summary and Discussion of Main Findings

##### *7.1.1 Land property rights arrangements determine UGS governance*

**First, the analysis finds that in Guangzhou, land property rights as well as actors who have the power to influence land property rights arrangements determine the extent to which they participate in UGS governance, which also indirectly indicate that UGS resources in China are still governed primarily in the same way as land resources.** Under this premise, the Guangzhou government plans and governs UGS proactively through first obtaining land property rights, including ownership and management rights, and legalising those UGS plans under the guidance of urban planning experts. Through this approach, the municipal government can gain better control of the overall land use in urban development. For example, in the 2<sup>nd</sup> case, the municipal government acquired the collectively owned farmland and transferred it into a state-owned property while maintaining the agricultural function of the land. In the 3<sup>rd</sup> case, the Guangzhou government first created a legally binding special plan before implementing the Sponge City Initiative based on a specific technical guideline produced by the central government.

From the CPR theory point of view, well-defined property rights help solve the problem of over-appropriation and free riding of urban land resources. Clarifying property rights can enable individuals or collective actors in UGS governance to fully enjoy the goods or products they own and thereby participate in UGS governance to a greater extent. This also explains why the participation of urban migrants in the Haizhu Wetland Park project (the 2nd Case) was

relatively low, while the collective farmland owners could negotiate and bargain with the municipal and district governments. In this example, the environment of the urban village where the migrants live has not been improved, which shows that the property rights transfer of the Haizhu Wetland Park project is not sufficiently inclusive, which externalised the cost of social equity. However, in this Case, the ecological achievement is relatively successful because it re-divided the physical boundaries of UGS resources and the participation boundaries of the farmland owners and migrant workers. The farmland owners were able to negotiate with municipal governments and participate in decision-making, and for that, the Haizhu Wetland Park case can also be considered having had a collective choice arrangement to a certain extent. In addition, practices like the Panyu Ecological Corridor project (the 1st Case) exemplified a simplistic UGS governance logic that treats UGS resources the same as the physical land. This perhaps overly simplistic arrangement was due to the low awareness of the actors on the ecosystem services that UGS provide or the lack of knowledge on the critical factors that influence the quality of UGS ecosystem services, including connectivity, biodiversity, and landscape diversity. The foregone benefits of UGS ecosystem services are essentially an opportunity cost.

**Property rights arrangement is an essential formal institutional arrangement in CPR governance. Conceptualising UGS as CPR tells us that, the property rights bundles for UGS governance should contain two separate sets - one for the urban land and the other for the UGS as urban ecological CPRs - each set with more refined definitions on the rights of access, withdrawal, management, exclusion, and alienation.** As land resources in Chinese cities are usually scarce but not necessarily low exclusivity, land resources can either be governed as a CPR or a private resource. Although the ecological functions and services of UGS are also scarce as urban land resources, they are shared by all citizens and are not exclusive. In this circumstance, properly defined rights of ownership, management, and withdrawal of UGS resources could bring different outcomes. Based on this reasoning, a policy suggestion can be made to the Haizhu Wetland Park case: after obtaining the ownership of this agricultural land, it is entirely possible to allow the original farmers (or even enable the urban migrants) to continue managing their orchards, preserve the ecological functions as well as the local Lingnan ecological farming culture. The only property right that the Guangzhou Municipal Government needs to retain is to supervise the management and strengthen the standards and requirements in environmental conservation. This will mobilise non-state actors

to participate in the management of the Haizhu Wetland Park to a greater extent and reduce maintenance costs.

*7.1.2 Guangzhou's UGS governance mostly in line with characteristics of successful CPR governance regimes*

**Secondly, the analysis shows that although China's UGS is mainly governed as land resources, its ecological functions, including the potential to cope with climate change, have gradually been formalised in the institutional arrangements in the past two decades. Guangzhou's UGS governance is mostly in line with the eight common characteristics of successful CPR governance regimes.** Under the concept and national environmental governance framework *Ecological Civilisation*, the focus on environment and climate change, the number and intensity of legally binding UGS targets in national policy documents increased, and that implies enhanced consideration of social costs and environmental benefits of UGS, which shows increasing clarity in the definition of CPR resource boundaries. Besides, the rigorous internal government reform and stricter environmental regulations and their enforcement show increasing clarity in the definition of CPR user boundaries, more arrangements for collective/choice or public participation, and improved monitoring, sanctions, and conflict resolution mechanisms. From the 1st to the 3rd case, Guangzhou's UGS governance increasingly considered UGS resources as part of a larger and more complex social-ecological system and improved multi-level government supervision, reflecting the characteristic of nested enterprise in successful CPR governance regimes. **Although not all the eight common characteristics of successful CPR governance regimes were identified in Guangzhou's UGS governance.** There was no minimal recognition (by state actors, e.g., upper-level governments) of the rights to organise as State actors dominate Guangzhou's UGS governance. By default, and need not be recognised by a higher-level government, the municipal government has both the right and (more as) responsibility to organise UGS governance together with non-state actors. This demonstrates the decisive role of China's institutional context in its CPR governance arrangements.

However, maintaining clear physical boundaries might not work the best for resources like UGS as the way and physical extent to which ecosystem services benefit urban areas are fuzzy. For this reason, UGS governance might be better governed with a fuzzy boundary which recognises the complexity of ecological compositions of a UGS. This again indicates the need

to shift out of the current land-property rights-based approach to UGS governance. The idea that fuzzy resource boundaries could be more advantageous for promoting the ecosystem services of UGS for climate adaptation, urban environmental health and wellbeing contradicts the theory of CPR governance. But how to govern a CPR with fuzzy physical boundaries? This is a real challenge to be researched and explored for solutions.

Except for the boundary clarity issue, which is now debatable, **governing UGS as CPRs in Chinese cities can be improved in the following areas: proportional equivalence between benefits and costs for all actors and broader collective-choice arrangements.** To achieve proportional equivalence between benefits and costs for all actors, actors first need to gain a balanced and better understanding of UGS as an essential part of the urban complex social ecosystem and all the benefits and costs associated with UGS governance, including the ecological value UGS and the social value of collective choices made by non-state actors (the opposite of which are the costs of the ecosystem and social justice). A better understanding of ecological value is essential to reduce the costs of information acquisition gradually. Collective choice by non-state actors can help reduce the differences in the interest or willingness of actors in urban governance, thereby reducing the costs of cooperation.

### ***7.1.3 Guangzhou's UGS governance attunes with Ecological Civilisation***

**The third finding is that Guangzhou's UGS governance tends to attune with the national environmental governance framework *Ecological Civilisation* through conducting both the *means* and *ends* of institutional change.** Guangzhou's UGS governance gradually went through these formal institutional changes from case 1 to case 3, focusing on changing the *means* of UGS institutions:

- The ecologicalisation in evaluating and promoting government officials' performance, for example, institutionalising mechanisms of self-check regarding environmental deeds.
- The unification and systematisation of urban planning with reductions in the types of plans and the numbers of departments in charge, but with an increase in land-use restrictions.
- Increasing complexity in property rights arrangements.
- Government reform in critical aspects such as the inclusion of societal actors and the rules of the law.

All of these are institutional changes of the *means*. These four formal institutional change trends have been advanced through small-scale trial-and-error experiments, first at the local levels and, once proven effective, promoted by the central government and scaled-up nationwide. From case 1 to case 3, Guangzhou's UGS governance went through several informal institutional changes which focused on changing the *ends* of UGS institutions, including enhanced notions of urban-rural coordination, public participation, ecological planning, environmental awareness among all actors, and citizens' role for government supervision.

Regarding value propositions, Case 1 - the Panyu Ecological Corridor explicitly sought ecological adaptability on a conceptual plan but implicitly and predominantly pursued economic interests. Case 2 - Haizhu Wetland Park was able to balance between seeking explicitly ecological values and compensating implicitly with economic development opportunities. Case 3 - the Tianhe Sponge City demonstration site focused explicitly on ecological resilience, health benefits and technical robustness. Oddly, even when these explicit ecological value propositions are evident in all three cases, they rarely directly address the issue of how these UGS resources might tackle climate change impacts. This is possibly due to:

- a gap in climate change perception between the central and local governments,
- the technical-scientific challenge to confirm the direct causal relations between the local economic activities and regional climate change impacts, or to quantify the ecosystem services of UGS adequately, or
- that it is a strategy with differentiated focus distributed across levels of government and scales of time, population, and resources.

#### *7.1.4 Sustained barriers to institutional change for UGS governance in China*

**Fourthly, the analysis finds three main institutional barriers/challenges that remained in Guangzhou's UGS governance despite substantial progress under Ecological Civilisation: the lack of legal foundations for regular ecological status assessments, low awareness of local state actors on climate change impacts and the ecological potential of UGS, and the lack of long-term commitment for governing UGS based on recognising its ecological values and potentials.** First, Chinese cities have developed a path dependence on land-based and economy-based urbanisation in the last few decades. A rigorous set of performance

evaluation systems and governance trends based on economic development was established for local officials. In this context, the central government's political determination and recent ambition in *Ecological Civilisation* are plausible but not sufficient for UGS governance to succeed. **This is an institutional barrier that impedes multilevel institutional coordination, which requires solutions that establish the legal foundation for regular and long-term ecological status assessments so that UGS governance in Chinese cities can become more nature- and ecosystem-based in the long run.** Second, due to the current definition of UGS as a type of urban development land, UGS in Chinese cities has been chiefly regarded as green infrastructure to serve urban economic development, which is a rather pragmatic and utilitarian approach that is no longer very suitable for the high complexity and uncertainty in the urban social-ecological system today. Under this premise, actors in UGS governance fail to consider many ecological functions that are not yet entirely quantifiable in scientific research or monetisable in policy design. **Local state actors might not be as proactive in improving their awareness or collaborating with other departments on addressing climate change impacts through better UGS governance. This is an institutional rigidity that limits the horizontal interplay within local governments that requires institutional solutions.** The third aspect relates to the dimension of time. Chinese city government officials are appointed and transferred hierarchically or from one city to another by the central government with a certain frequency to prevent corruption from emerging. Under this premise, local officials are required or are under political pressure to perform during their tenure. Hence, compared to UGS governance projects that require a long-term commitment and are often less impressive economically and politically, most local officials prefer to build a visible and highly efficient infrastructure or economic project, e.g., host a G20 meeting or build a train station. **This is another institutional rigidity that implies conflicting objectives, tensions, and trade-offs in political dimensions, which requires institutional solutions to foster long-term commitment to govern UGS genuinely based on recognising its ecological values and potentials.**

## 7.2 Policy Implications

It is hardly straightforward to resolving these remaining challenges as they are institutional barriers that require fundamental change within the legal and administrative system of the country across levels as well as in the intrinsic values of all actors on a large scale. These

changes require a high learning and communication capacity among all actors in order to reach a consensus on such institutional changes, build trust among each other, and support their efforts to achieve them. These institutional changes can be hugely costly in time, financing, political inconveniences, and even social stability. To design more integrated UGS plans that would also be more effective in addressing social issues, it requires reforms in the urban planning system, the inter-departmental coordination mechanism, the household registration system (Hukou) and most importantly, change the narrow framing and targeting of UGS planning in policy documents towards more comprehensive framing. To enable more public participation in planning and governance and not just supervision, it would also require an institutional change to enlarge the rights of citizens to create legal space for them. It also requires normative changes in how government officials and citizens perceive their relationships from the conventional "the governor" and "the governed" relationship to one that recognises all urban actors' capacity and willingness to contribute to the betterment of the urban living environment as a *commons*. To ensure the institutional sustainability of these interventions so that when one type of UGS intervention is proven effective, there is decent institutional support to enable replicating in other parts of the city or upscaling in other cities. Finally, a set of intrinsic values that are more ecologically embedded and common-pool resource (CPR) oriented among all actors would also be effective and efficient for promoting more ambitious decisions on UGS planning.

The main findings presented above are expected to have the following implications on the UGS policies in Chinese cities for climate adaptation, urban health, and well-being.

1. Influence on the current practice of information public exposure, with the tendency to extend the time and scope of exposure so that citizens could be better informed about the respective UGS plans and be in a proper position to supervise local governments during the implementation process, thereby securing citizen's right to know and improving public acceptance.
2. Influence on the current speed of UGS planning, with the tendency to allow more time in the planning process. This would enable more internal synergy to raise or increase between departments. In addition, it would allow more feedback to come from non-state actors, including the urban migrants, which would make the UGS plans more socially inclusive, alias more people centred.

3. Influence on the institutional foundation of UGS planning, with the tendency to create a more solid institutional foundation to improve the administrative accountability of respective departments and the rights and responsibilities of other actors.
4. Influence on the science-policy nexus, with the tendency to commission more scientific studies to enhance the scientific rigour and thereby feasibility and success rate of the UGS plans for climate change mitigation and adaptation.
5. Influence on the way local governments narrate and understand climate change, with the tendency to enhance the narratives of climate change locally and make the nexus between UGS and climate change more pronounced, to enhance citizen's awareness of climate change and mobilise more local and voluntary climate actions. Finally, the logic that ecosystem services need to be more adequately quantified and monetised to facilitate more ambitious UGS planning decisions might need to be contested; instead, a set of intrinsic values that are more ecologically embedded and common-pool resource (CPR) oriented among all actors would also be effective and efficient for promoting more ambitious decisions on UGS planning.

## CHAPTER VIII

### CONCLUSIONS

#### **8.1 Research Overview and Reflection of Main Findings**

Facing expeditious urbanisation and climate change impacts, how has China governed urban green spaces? This thesis has presumed the task to find out. UGS is an entry point where actions and results matter for every urban citizen for better climate resilience, health, and well-being regardless of the social, economic, and political contexts in which they live. China bears a huge responsibility as well as potential due to the scales of its economy, population, and total carbon footprint and has seen strong political determination to act upon climate and environmental challenges amidst constant urbanisation and economic development needs. So how did Chinese cities approach the planning and governance of UGS? What institutional facilitations or challenges have they received or confronted when planning and managing UGS? How have local governments managed to upscale UGS towards more effective NbS? What are the good practices to be shared? Furthermore, why some challenges persisted despite the centralised government system and strong political determination? This thesis sets out to study three case studies on UGS planning and governance in Guangzhou, a highly populated, compact, vulnerable coastal city in Southeast China. The aims were to understand the institutional dynamics, facilitators, and underlying barriers that could be at play in UGS planning and governance, examine the extent and approaches for UGS upscaling, analyse the costs and benefits taken into consideration, and understand the intrinsic-value-related factors of institutional barriers, which is essential for institutional innovation for promoting more NbS.

Based on insights from literature review of the Chinese and Western theories and practices of urban planning, and urban governance from the institutional perspective, this thesis builds a theoretical framework of common-pool resource (CPR) governance developed by American political scientist Elinor Ostrom to proceed. The theoretical framework establishes UGS as an essential part of the complex urban social-ecological system that should theoretically be governed as a common-pool resource (CPR), with formal and informal institutional arrangements designating property rights and responsibilities to both state and non-state actors appropriate to respective levels and scales. The theoretical framework also expounds on how

institutions evolve or change along with the changing transaction costs or the changing perceptions of them between actors and action situations. The breakdown of transactional cost-benefit balances constitutes a major driver of institutional change, formal or informal, leading to two types of institutional change: the means and ends. The thesis selects three empirical cases and uses the Institutional Analysis and Development (IAD) framework to structure a case study-based qualitative content analysis and an MCA, with data collected from semi-structured in-depth interviews and a selection of national and local UGS-related policies and plans.

The qualitative content analysis and an MCA yielded the following findings. First, land property rights and actors who have the power to influence land property rights arrangements determine the extent to which they participate in UGS governance, which also indirectly indicate that UGS resources in China are still governed primarily in the same way as land resources. Property rights arrangement is an essential formal institutional arrangement in CPR governance. Conceptualising UGS as CPR tells us that the property rights bundles for UGS governance should contain two separate sets - one for the urban land and the other for the UGS as urban ecological CPRs - each set with more refined definitions on the rights of access, withdrawal, management, exclusion, and alienation. In addition, although China's UGS is mainly governed still as land resources, its ecological functions, including the potential to cope with climate change, have gradually been developed into formal institutional arrangements in the past two decades. Guangzhou's UGS governance is mostly in line with the eight common characteristics of successful CPR governance regimes. Governing UGS as CPRs in Chinese cities can be improved by striking a better equivalence between benefits and costs for all actors and broaden the extent of collective-choice arrangements.

The above two findings indicate that UGS as an essential part of the complex urban social/ecological system cannot be simply governed as land resources. To attach importance to the ecosystem services and ecological values of UGS, it is necessary to define them with an exclusive and clear set of property rights. In addition, the phenomenon of over-exploitation and free-riding of CPRs tells us that recognising the irrational and rent-seeking nature of human beings is the prerequisite for successful human cooperation and sustainable CPR governance.

Furthermore, Guangzhou's UGS governance tends to attune with the national environmental governance framework *Ecological Civilisation* through conducting both the *means* and *ends* of

institutional change. Last but not least, despite substantial progress under *Ecological Civilisation*, three main institutional barriers/challenges remained in Guangzhou's UGS governance: the lack of legal foundations for regular ecological status assessments, low awareness of local state actors on climate change impacts and the ecological potential of UGS, and the lack of long-term commitment for governing UGS based on recognising its ecological values and potentials. The lack of legal foundations for regular ecological status assessments is an institutional barrier that impedes multilevel institutional coordination, which requires solutions that establish the legal foundation for regular and long-term ecological status assessments so that UGS governance in Chinese cities can become more nature- and ecosystem-based in the long run. Local state actors might not be as proactive in improving their awareness or collaborating with other departments on addressing climate change impacts through better UGS governance. The low awareness of local state actors on climate change impacts and the ecological potential of UGS is an institutional rigidity that limits the horizontal interplay within local governments that requires institutional solutions. The lack of long-term commitment for governing UGS based on recognising its ecological values and potentials is another institutional rigidity that implies conflicting objectives, tensions, and trade-offs in political dimensions, which requires institutional solutions to foster long-term commitment to govern UGS, recognising its ecological values and potentials.

These two findings indicate that some institutions can achieve specific goals efficiently, but one cannot tell yet whether they can be sustained in the long run. The CPR theory tells us that institutional arrangements for long-term sustainable resource governance should provide individual and collective actors with the time and opportunity to participate in the process thoroughly and achieve the end goals/benefits. In UGS governance, a set of long-term, sustainable institutional arrangements should not only allow individual or group actors to participate in the governance process but also fulfil their needs for good health, well-being, and a resilient environment facing climate change impacts.

## 8.2 Reflecting on the Aims, Objectives, and Methodology

This research has fulfilled the aims set forth at the beginning, some better than others. The theoretical framing and the empirical inquiry succeeded in capturing the institutional dynamics, facilitators, and underlying barriers at play in Guangzhou's UGS governance. The empirical analysis also successfully examined the extent and approaches for upscaling UGS and improving UGS governance in Guangzhou. Costs and benefits taken into consideration by state- and non-state actors were not understood by the researcher as clearly as desired, partially since some costs and benefits related to ecosystem services and related to social equity could not be decently quantified or compared. Finally, some intrinsic-value-related factors of institutional barriers were identified, but more research is needed to understand how these intrinsic-value-related factors influence Guangzhou's UGS governance, in which the researcher did not intend to invest. This research also has realised its objectives of fulfilling the research gap of institutional insights of UGS governance within the Chinese context, sharing successful practices, providing new insights from the institutional analysis based on the common-pool resource (CPR) theory for local state actors, and verifying the potential of system reform for achieving *Ecological Civilisation* through identifying existing institutional barriers and proposing solutions.

Regarding the methodology, this research has represented an earnest attempt to tackle the methodological challenges in measuring and evaluating institutional arrangements and institutional change by establishing comprehensive criteria, combining in-depth interviews with official policies and plans, and conducting an in-depth qualitative content analysis and a comprehensive MCA. It is also an attempt to approach the subject of sustainable development and climate change policies without getting too much subjected to normative or ideological influences. The researcher has attempted to create case-study representativeness as high as possible by choosing those that are in the highest contestation of land-use tension, environmental conflicts, climate impacts, economic development needs, and urban-rural division, and by setting the study period for 20 years to allow pieces of evidence of institutional evolution or change to be included. The use of semi-structured in-depth interviews without time limits allowed a large amount of information to surface for this subject. The shortcoming of this semi-structured in-depth interview method is the substantial quantity and heterogeneity of the information generated, which complicated the analysis process.

Nevertheless, given that this is qualitative research, the large quantity and diversity of information can still be considered advantageous. Furthermore, the professional qualitative data analysis software MaxQDA has enabled a robust and thorough content analysis. Finally, a multi-criteria assessment (MCA) enabled a comprehensive evaluation of the three UGS planning and governance cases. The positive side of the MCA is the multiple references it has as the foundation, while the downside is that the MCA was conducted only by the researcher. The result might have been even more compelling if conducted both by the researcher and the interviewees.

### **8.3 Policy Recommendations**

Based on the thorough institutional analysis of the local UGS governance in Guangzhou, China, the researcher presents the following recommendations for policymakers for better UGS governance practices in the future:

- Recognise UGS as an essential part of the complex urban social/ecological system and attach importance to the ecosystem services and ecological values of UGS by defining them with an exclusive and clear set of property rights.
- Extend the time and scope of information public exposure for individual or group actors to be better informed and to fully participate in UGS governance.
- Allow more time in the UGS planning process to enable more internal synergy to raise or increase between departments. This would also allow more feedback from non-state actors, including urban migrants, thereby improve inclusivity.
- Improve the accountability mechanism so that state- and non-state actors could better fulfil their rights and responsibilities.
- Commission more scientific research on the science-policy nexus of UGS to enhance the scientific rigour and policy effectiveness of UGS governance for climate change adaptation, urban health and wellbeing improvement.
- Enhance the local narratives of climate change and the nexus between UGS and climate change to improve citizens' awareness of climate change.
- Accurate monetisation of ecosystem services could facilitate more ambitious UGS governance, yet it has so far remained a scientific challenge. Instead, local governments may focus on cultivating intrinsic values for citizens that treats UGS as CPR and are more ecologically oriented.

- Increase the number of long-term UGS governance arrangements and foster a more systemic approach to climate resilience, urban health, and wellbeing across administrative levels for the middle- to long-term.

## **8.4 Key Scientific Contributions and Limitations of This Research**

### *8.4.1 Key scientific contributions*

One important scientific contribution of this thesis is having introduced the common-pool resource (CPR) theory to understand CPR in both an urban setting and in the Chinese socio-economic and political setting. This research complements existing studies on UGS governance, which primarily depart from the perspectives of urban planning, landscape ecology, urban ecology, or political economy. The CPR theory has been well used in many countries such as Nepal, Switzerland, Brazil, India, the United States to understand resource sustainability governance but has been rarely applied to analyse empirical resource governance in the Chinese socio-economic and political settings. The concepts such as property rights bundles, collective choice arrangements, transaction costs and institutional change yielded new insights about the power dynamics and interactions between actors, the processes of policy formation and dissemination, and the central-local government coordination and their evolution trends. These new insights have helped researchers understand why sometimes even ecologically conscient, socially just, and well-versed urban plans could fail.

Besides, this research tested the applicability of the CPR theory - a set of concepts and analytical elements created by scholars within the Western social and economic context to case studies in the Chinese urbanisation context, especially at the local level, which is broadly considered distinctive to the Western ones. There are limits to doing so. One of such limits might be the unfamiliarity of the interviewees, for which they often were surprised by the questions asked. Another limit is that the CPR theory could not explain every finding in the empirical analysis. Nonetheless, these reactions precisely showed the novelty of the perspective introduced and the potential of yielding insights undiscovered before. However, at the same time, applying these so-called "Western" concepts and analytical elements in the Chinese context also helps to reduce the limits of the results only being applicable back to Western realities.

Another important scientific contribution of this research is having identified the need to define UGS with a set of property rights different than those of land resource. To attach importance to the ecosystem services and ecological values of UGS, it is necessary to define them with an exclusive and clear set of property rights.

Furthermore, this thesis has provided a detailed illustration to show how China's urban planning has primarily aligned with the evolutionary trends in Western urban planning theories. China's urban planning practices evolved 1) from viewing cities as simple, physical to complex, social-ecological systems, 2) from focusing on the comprehensive "end-state" of planning and the aesthetic-oriented "city beautification" movements and to the rational process of planning, 3) from context insensitive (political, economic, and environmental) to context-sensitive, 4) from local non-state actors exclusive to local actors inclusive, and 5) from focusing on the method of planning to the practical problems that planning seeks to resolve.

#### ***8.4.2 Limitations of the IAD framework and the MCA method for this research***

Although scholars are increasingly finding the IAD framework convincing for analysing a vast range of action situations thanks to the powerful meta-language that Ostrom (2005) developed after decades of theoretical inquiry and empirical testing, there are some limitations using the IAD framework to analyse UGS governance in the Chinese context. First, the IAD framework is developed by Ostrom (2005), an American political scientist who drew empirical evidence largely from the US and other less centralised political contexts around the world. Compared to most empirical evidence Ostrom had drawn on, the Chinese socio-economic and political contexts are drastically different in many ways: geographical and demographical sizes, the pace of environmental change, the tension between economic development and environmental protection, the systematic effect of policy change orchestrated by the central government, cultural perceptions of the environment, and access to official information by the public. To compensate for this shortage, this thesis elaborated a detailed chapter of contextualisation and case introduction (see Chapter V). In addition, even though the meta-language of the IAD framework is powerful for conducting institutional analysis for CPR governance, the researcher also finds the meta-language too dry to convey a normative, value-embedded message, e.g., on climate resilience, or environmental sustainability in general, which is quite necessary for this research. Although the MCA is an emerging method well praised for its capability to navigate

complex, multi- and interdisciplinary research (Chambwera et al., 2015), the method is sometimes criticised for being subjective, especially if it is used in non-participatory research.

### **8.5 Future Research Directions**

A few future research directions emerged from this thesis. One of the directions can be picked up from the intrinsic-value-related institutional barriers identified in this research and the new research can focus on how these intrinsic-value-related factors influence UGS governance. Another future research direction is to understand what kind of property rights bundles could be suitable for CPRs like UGS, to reflect the ecosystem services and ecological values of UGS more appropriately. Besides, the Multi-Criteria Assessment (MCA) is a modern research method for governance studies. Thanks to its flexible, adaptive nature, future research can and should experiment with diverse ways of conducting MCAs to determine its potential for informing urban environmental and climate governance. Finally, the institutional change currently taking place in China under *Ecological Civilisation* is a fascinating phenomenon, with immense implications across sectors, levels, and population, which requires more research to understand further its patterns, approaches, and long-lasting effects on the Chinese society and its sustainability in this rapidly changing and drastically uncertain post-pandemic era under climate change.

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## ANNEX

### 1. Form of Informed Consent for Interview

#### 采访同意书

##### Background

This interview aims to gather data for the PhD research project "Governance of Urban Green Spaces in China - Institutional Theories and Analysis with Case Studies from Guangzhou" of Jieling Liu, PhD Candidate in the Interdisciplinary Program on Climate Change and Sustainable Development Policies at the Institute of Social Sciences – University of Lisbon (ICS-ULisboa), Portugal, and junior researcher at the "Urban Health and Wellbeing - A Systems Approach" (UHWB) program at the Institute of Urban Environment - Chinese Academy of Sciences (IUE-CAS). The ideal candidates of this interview include but are not limited to local government officials, urban planners, urban governance consultants, environmental and climate policy scholars, landowners, land appropriators, and residents. The researcher declares that the proposed questions of this interview will be non-sensitive topics only, and will be towards adults, non-vulnerable populations only.

##### Conditions to participate

You are invited to participate in the semi-structured, in-depth interviews voluntarily. Your answers will be kept confidential and used solely for this research. All the interview data will be collected, either in audio recording or hand-written notes, depending on your preference, and will then be stored and treated in a confidential, anonymous and codified way.

By signing this consent form, you agree to participate in this semi-structured, in-depth qualitative interview with the researcher, Jieling Liu, and permit her to use your answers as data/evidence for her PhD research project. The researcher will retain one copy of the consent form signed by both parties. You will be given a copy of the consent form as a record for what you have signed up.

The semi-structured, in-depth interview could last between 1- 2 hours, depending on the development of the conversation.

The researcher Jieling Liu appreciates your collaboration!

##### 背景

本次采访旨在为博士候选人刘洁玲的博士研究项目“中国城市绿地的治理——制度理论和案例分析以广州为例”收集数据。刘洁玲是葡萄牙里斯本大学社会科学学院气候变化与可持续发展政策跨学科项目的博士候选人以及中国科学院城市环境研究所“城市健康与福祉——系统性方法科学”项目的初级研究员。本次访谈的理想受访者包括但不限于地方政府官员、城市规划师、城市治理顾问、环境和气候政策学者、土地产权所有者、土地实际使用者以及居民。本次访谈的问题具有低敏感性的特征，并且受访人只限于成年人及非弱势群体。

##### 参加条件

研究人员刘洁玲诚邀您自愿参加此次半结构深度访谈。您的答案将被保密，仅用于本研究。所有采访数据将根据您的喜好进行记录，如音频记录或手写笔记，然后将其以保密、匿名和编码的方式进行存储和处理。

签署此同意书，即表示您同意参加与研究人员刘洁玲的半结构深入定性访谈，并允许她将您的答案用作其博士研究项目的数据或证据。研究人员将保留双方签署的同意书的一份副本。您将获得同意书的副本，以记录您所签署的内容。根据对话的发展情况，本次半结构深度访谈可能会持续 1-2 小时。

研究人员刘洁玲提前感谢您的合作！

##### 同意参与研究

**Consent to Participate in Research**

I, \_\_\_\_\_, voluntarily agree to participate in this interview for the research.

1. I understand that even if I agree to participate now, I can withdraw at any time during the interview or refuse to answer any question without any consequences of any kind.
2. I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
3. Before this interview, I have had the purpose and nature of the study explained to me in writing, and I have had the opportunity to ask questions about the study.
4. I understand that participation involves sharing the insights of my work and my opinions directly or indirectly related to the three chosen cases of urban green space planning and governance in Guangzhou.
5. I understand that I will not benefit directly or indirectly from participating in this research.
6. I understand that all information I provide for this study will be treated confidentially.
7. I understand that in any report on the results of this research, my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview that may reveal my identity or the identity of people I speak about.
8. I understand that disguised extracts from my interview may be quoted in the interviewer/researcher's published work, including scientific papers, dissertation, blog posts, and more.
9. I understand that signed consent forms, original audio recordings, and transcripts of my interview (if applicable) can be obtained from an online storage service shared by the researcher for the period up until one year after her dissertation.
10. I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

本人，\_\_\_\_\_，自愿同意参加此研究。

1. 我了解，即使同意立即参加，在采访期间我也可以随时退出或拒绝回答任何问题，而不会造成任何后果。
2. 我了解我可以在采访后的两周内撤消使用采访数据的同意书，在这种情况下，采访记录将被删除。
3. 在本采访前，研究人员已通过书面形式向我解释了这项研究的目的和性质，并且我也得到了提出关于这项研究相关问题的机会。
4. 我了解，参与此次采访需要我分享与该研究选定的三个广州城市绿地规划和治理案例直接或间接相关的专业见解和观点。
5. 我了解参与这项研究不会直接或间接地给我带来好处。
6. 我了解我为这项研究提供的所有信息都会被保密。
7. 我了解，在任何有关这项研究结果的报告中，我的身份都将保持匿名。研究人员表示，可以通过更改我的名字并掩饰采访的任何可能揭示我身份的有细节来保持匿名。
8. 我了解采访研究人员发表的著作中可能会引用我的采访中变相的摘录，包括科学论文、博士论文、博客文章等。
9. 我了解，通过签署本同意书，现在至论文发表后的一年内，我可以从研究人员共享的在线存储服务中获取原始的录音或采访记录（如适用）。
10. 我了解我可以自由地与参与研究的任何人联系，以寻求进一步的澄清和信息。

Please choose the following options that apply:

## Urban Green Space Governance in China - Institutional Analysis

I agree that my interview will be recorded by

- Audio
- Video
- Handwriting notes only

Names, affiliations and contact details of the interviewee:

Name:

Affiliation and contact details:

Date:

Signature:

The researcher believes the participant is giving informed consent to participate in this interview.

Names, affiliations and contact details of the researcher:

Name: Jieling Liu

Affiliation and contact details: Institute of Social Sciences – University of Lisbon  
jielingliu@campus.ul.pt

Date:

Signature:

请选择以下符合选项：我同意我的采访将被以下方式记录

- 录音
- 录像
- 仅手写笔记

受访者的姓名、隶属关系和联系方式：

姓名：

隶属单位和联系方式：

日期：

签名：

研究人员认为参与者已获得知情并同意参加此次采访。

研究人员的姓名、隶属单位和联系方式：

姓名：刘洁玲

隶属单位和联系方式：里斯本大学社会科学研究所，jielingliu@campus.ul.pt

日期：

签名：

## 2. Semi-Structured In-Depth Interview Outline

### 半结构深入访谈大纲

Part of the research data in this thesis is obtained through semi-structured in-depth interviews with officials from the Guangzhou Municipal Government, urban planning professionals, urban governance consultants, academic researchers, urban land appropriators (private enterprises, etc.), and community/residents. This outline contains initial questions for identifying the expertise of interviewees.

The table (with the Chinese version below) below presents the main research questions of this research and the questions formulated accordingly for the semi-structured in-depth interviews.

本文的部分研究数据通过与广州市政府官员、规划专员、城市管理顾问专家、学术研究员、城市土地使用者（私营企业等）、社区居民进行深度访谈所得。下表列举了本论文的主要研究问题，以及在此基础上提出的用之与采访对象交流的半结构深入访谈问题。

# Urban Green Space Governance in China - Institutional Analysis

MAIN RESEARCH QUESTIONS & SUB-QUESTIONS	SEMI-STRUCTURED IN-DEPTH INTERVIEW QUESTIONS			CORRESPONDING VARIABLES
	Questions oriented for experts in land resources and land economics (government officials, land economics scholars and urban governance consultants)	Questions oriented for experts in urban landscape ecology / green space planning (government officials, urban planning scholars and practitioners, and residents)	Questions oriented for experts in institutions and governance (government officials and scholars)	
<p><b>Q1. What institutional facilitations or challenges have Chinese urban governments received or confronted when planning and managing UGS?</b></p> <p>Q1.1 What are the formal policy facilitations and challenges that Chinese urban governments have received or confronted when planning and managing UGS?</p> <p>Q1.2 What are the informal normative facilitations and challenges that Chinese urban governments have received or confronted when planning and managing UGS?</p>	<p>Please answer all questions within the contexts of China's urbanisation and the city of Guangzhou.</p> <p>1. The ownership rights of urban land resources in China are public, and urban green spaces is a category of urban development land. What are the advantages and disadvantages of this arrangement, in your opinion, and why?</p> <p>2. The processes of leasing, use and gentrification of urban land resources are often dominated by pursuits of economic benefits. Are the social and environmental benefits included in consideration when it comes to these activities? If so, how are these dimensions measured? Please exemplify using the practices of Guangzhou.</p> <p>3. What are the changes and tendencies in urban land resource management in the last 20 years?</p> <p>4. Have these tendencies influenced the way urban green spaces are planned and managed? If so, how?</p>	<p>5. Most Chinese cities have gone through the path from expansive to intensive urban development. During this process, what has changed in the formal principles of urban planning?</p> <p>6. Is there a general goal or standard for the entire country for urban green space planning? What is that? For what does this goal/standard serve, and does it have any disadvantages?</p> <p>7. During the New Millennium Year, China redefined its urbanisation vision and made long-term urban development plans. What were the main objectives of Guangzhou's urban planning at that time? How is it different from the current goal?</p> <p>8. The urban land resources in Guangzhou have become increasingly scarce in the past two decades. How is this scarcity reflected in the work of the urban planning department? How was the planning and creation of urban green spaces affected?</p>	<p>9. In the past two decades, have there been any policies or regulations that are beneficial to urban green space planning and governance at the central and local levels? If so, what are they?</p> <p>10. What are the changes you have envisioned or observed happening within the city-level government, following the ministerial reform under the environmental governance framework "Ecological Civilisation"?</p> <p>11. What do you think the reform of the government system will bring about changes in urban green space planning and governance?</p>	<p><b>Formal Rules-in-use</b></p>
	<p>12. In your opinion, what constitutes the economic, social, and environmental values of urban green spaces, respectively?</p> <p>13. What roles do you think urban green spaces should play in urban development? Why?</p> <p>14. From the perspective of urban land resources and land economics, what do you think should be considered in the planning and governance of urban green spaces?</p>	<p>15. From the perspective of urban development comprehensive planning, what do you think should be considered in the planning and governance of urban green spaces?</p> <p>16. From the perspective of landscape ecology, what do you think should be considered in the planning and governance of urban green spaces?</p> <p>17. In the process of rapid urbanisation, urban density increases, and the socio-economic system is becoming increasingly complex, and the rules for the use of urban land resources are increasingly demanding. How do you think this reality affects the planning of urban green spaces?</p> <p>18. The economic upgrades in cities have driven residents to have higher standards for the quality of life, social well-being, and for the urban environment. How do you think this reality affects the planning of urban green spaces?</p> <p>19. The impact of climate change, such as heatwaves, heavy rains, floods, and air pollution, has increasingly challenged urban infrastructural planning. How do you think this reality affects the planning of urban green spaces?</p>	<p>20. In the New Millennium Year, the Chinese central government proposed a path of "Scientific Development", whilst nowadays the trend is "People-Centred Development". Many scholars also consider that China's urbanisation has primarily been "tech-centred" – both technically and technologically. What is your opinion on this?</p> <p>21. Are there any elements in the local traditional culture beneficial for urban green space planning and governance? Is there any conventional urbanisation thinking that is unfavourable for urban green space planning and governance? Please exemplify with the city of Guangzhou.</p> <p>22. From the perspective of institutions and governance, what do you think we should consider in the planning and governance of urban green spaces?</p>	
<p><b>Q2. How have local governments managed to upscale UGS towards more effective NbS?</b></p> <p>Q2.1 What has been the approach of the Guangzhou local governments for planning new UGS and managing them?</p> <p>Q2.2 Has the UGS in Guangzhou been effective as an NbS and enhanced local climate resilience and urban health and wellbeing?</p>	<ul style="list-style-type: none"> <li>• <b>Case 1: Ecological Corridor Conceptual Plan</b></li> <li>• <b>Case 2: Haizhu Wetland Park (converted from an orchard)</b></li> <li>• <b>Case 3: Tianhe Sponge City Demo Site</b></li> </ul> <p>23. In your opinion, is the existing state of urban green space in Guangzhou restricted by particular land-use history, topography, or socio-economic factors?</p> <p>24. What measures have been undertaken to increase land for green infrastructures in the last 20 years in Guangzhou?</p> <p>25. Proportionally speaking, how much land within the city consists of urban green spaces 20 years ago and now?</p>	<p>26. What were the urban environmental conditions, community characteristics, and the central and local regulations/guidance taken into consideration in planning and management of Case 1 / Case 2 / Case 3?</p> <p>27. Could you please list the stakeholders involved in the planning, funding, implementation, and management of Case 1 / Case 2 / Case 3?</p> <p>28. How did the municipal government organise the planning of urban green spaces with other stakeholders (interactions with sub-level governments, public and private stakeholders, and citizens) in Case 1 / Case 2 / Case 3? Have any investment or incentive policies been introduced to strengthen the implementation of these projects?</p> <p>29. Was Case 1 / Case 2 / Case 3 a cost-benefit effective project? Who were the primary beneficiaries of this project? Who didn't benefit from it?</p> <p>30. How did the implementation of Case 1 / Case 2 / Case 3 come out? To what extent does the project meet</p>	<p>34. What are the short- and long-term objectives and strategic approaches in establishing and managing urban green spaces in Guangzhou?</p> <p>35. To what extent are these plans supported by commitments and budget allocations?</p>	<p><b>Biophysical Conditions</b></p> <p><b>Community Attributes</b></p> <p><b>Rules-in-use</b></p> <p><b>Actors</b></p> <p><b>Action Situation</b></p> <p><b>Interaction</b></p> <p><b>Outcome</b></p> <p><b>Evaluative Criteria</b></p>

## Urban Green Space Governance in China - Institutional Analysis

		<p>the needs of residents? Did it contribute to improving the urban green space in Guangzhou in general? Why?</p> <p>31. Were there any monitoring and performance evaluation schemes applied in Case 1 / Case 2 / Case 3? If so, what criteria were used?</p> <p>32. What do you think of the quality (size, distribution/accessibility, biodiversity, connectivity, etc.) of urban green spaces that currently exist in the city of Guangzhou?</p> <p>33. Do you think nature-based solutions such as the Tianhe Sponge City demo site can effectively restore the degraded urban environments? Do you think the current layout and management schemes of urban green spaces in Guangzhou can effectively address climate change impacts such as heatwaves, flashfloods, and air pollution on the city? Why?</p>		
<p><b>Q3. What are the good practices to be shared?</b></p> <p>Q3.1 What are the good practices in land-use from the three case studies?</p> <p>Q3.2 What are the good practices in UGS planning from these case studies?</p> <p>Q3.3 What are the good practices in urban governance in general from these three case studies?</p>	<p>36. Are there any recommendable experiences related to the arrangements of land-use types and land property rights from the three case studies above to be shared?</p>	<p>37. Are there any good urban green space planning practices to be shared from the three case studies above? Please explain from the aspects of cost management, planning methods, stakeholder participation and implementation.</p>	<p>38. Is there any good urban management practices to be shared in Guangzhou's experiences? Please explain from the aspects of institutional innovation.</p>	<p><b>Outcome Evaluation</b></p>
<p><b>Q4. Why some challenges persisted despite centralised government system and strong political determination?</b></p> <p>Q4.1 How do the strong political determination and centralised government system manifest themselves?</p> <p>Q4.2 What are the remaining challenges to be resolved?</p> <p>Q4.3 Why is it challenging to resolve these remaining challenges?</p>	<p>39. How do the strong political determination and centralised system in the Chinese central government manifest themselves in urban land resource management? What does the concept 'Ecological Civilisation' entail?</p> <p>40. What are the land-use related challenges revealed in the three case studies above to be resolved? Why is it challenging to resolve them?</p>	<p>41. How do the strong political determination and centralised system in the Chinese central government manifest themselves in urban green space planning? What does the concept 'Ecological Civilisation' entail?</p> <p>42. What are the urban green space planning related challenges revealed in the three case studies above to be resolved? Why is it challenging to resolve them?</p>	<p>43. How do the strong political determination and centralised system in the Chinese central government manifest themselves in urban governance and institutions? What does the concept 'Ecological Civilisation' entail?</p> <p>44. What are the urban governance and institutions related challenges revealed in the three case studies above to be resolved? Why is it challenging to resolve them?</p>	<p><b>Outcome Evaluation</b></p>

Table 25: Semi-structured in-depth interview questions and corresponding variables in the IAD Framework

主要研究问题与展开问题	半结构深度访谈问题		政府体制与城市治理相关问题 (请政府官员及学者回答)	对应变量
<p><b>Q1.在规划和管理城市绿地时，中国城市政府在制度上面临哪些挑战？</b></p> <p>Q1.1正式制度方面，在规划和管理城市绿地时，中国城市政府有哪些利好政策方针？面临哪些挑战？</p> <p>Q1.2非正式制度方面，在规划和管理城市绿地时，中国城市政府有哪些利好政策方针？面临哪些挑战？</p>	<p>1.中国的城市土地资源的所有权为国有，城市绿地隶属城市发展用地。您认为这种安排对规划城市绿地是利是弊？为何？</p> <p>2.城市土地资源的租赁、使用和升级的过程常重视经济效益。城市土地利用的社会和环境生态效益是否纳入考量以及是如何被衡量的？请您以广州为例解释。</p> <p>3.在城市土地资源管理方面，近二十年有何变化趋势？</p> <p>4.这些变化趋势影响了城市绿地的规划和管理吗？是如何影响的？</p>	<p>5.中国城市大多经历了从粗放型到集约型的发展道路，在这个过程中，城市规划在正式规范上发生了何种变化？</p> <p>6.是否存在一个全国的城市绿地规划普遍性目标/标准？该目标/标准是什么以及有何用处？缺点在哪里？</p> <p>7.千禧年时中国在城镇规划方面重新定义了愿景并作出了长远的规划。广州市的城镇规划的主要目标是什么？与现在的目标有何区别？</p> <p>8.广州的城市土地资源在过去二十年间越发稀缺，这种稀缺性在城市规划部门的工作中如何体现？城市绿地规划建设受到了何种影响？</p>	<p>9.在过去二十年是否出现了利好城市绿地规划和治理的政策或规章制度？若是，有哪些？</p> <p>10.中央政府现今在“生态文明”理念指导下进行的部级体制改革会对市级政府内部制度带来何种变化？</p> <p>11.您认为这次的政府系统体制改革会对城市绿地规划和治理造成哪些改变？</p>	正式实践规则
	<p>12.您认为城市绿地资源的经济、社会以及环境价值分别在于哪些？</p> <p>13.您认为城市绿地资源在城市发展中应该扮演何种角色？为什么？</p> <p>14.从土地资源与土地经济的视角来考虑，您认为城市绿地规划治理的需要考虑哪些因素？</p>	<p>15.从城市发展综合规划的视角来考虑，您认为城市绿地规划治理的需要考虑哪些因素？</p> <p>16.从景观生态学的视角来考虑，您认为城市绿地的规划治理需要考虑哪些因素？</p> <p>17.快速城市化进程中，城市密度提高及经济模式愈加复杂，对城市土地资源使用安排要求更高，您认为这一现实如何影响对城市绿地资源的规划？</p> <p>18.城市经济水平提高，带动居民对健康和社会福祉的生活品质要求提高，对城市环境质量要求也更高，您认为这一现实如何影响对城市绿地的规划？</p> <p>19.气候变化的影响，如热浪、暴雨洪涝灾害、空气污染等愈发挑战城市对其基础设施的布局，您认为这一现实如何影响对城市绿地的规划？</p>	<p>20.千禧年时中央政府提倡“科学发展观”，现在提倡“以人为本”，也有很多学者认为，中国的城市发展主要以技术为本，您是怎么看的？</p> <p>21.是否有些本土传统文化是更有利于城市绿地规划治理的？是否有些城镇化的传统思路是对其不利的？请您以广州为例解释。</p> <p>22.从制度和政府治理的视角来考虑，您认为城市绿地规划治理的需要考虑哪些因素？</p>	非正式实践规则
<p><b>Q2.地方政府如何管理城市绿地以使其作为更有效率的自然解决方案？</b></p> <p>Q2.1广州地方政府如何管理城市绿地？</p> <p>Q2.2广州城市绿地作为自然解决方案是否逐渐更有效率？</p>	<ul style="list-style-type: none"> <li>• 案例一：生态廊道概念性规划</li> <li>• 案例二：万亩果园改造为海珠湿地公园</li> <li>• 案例三：天河海绵城市大观湿地公园试点</li> </ul> <p>23.依您看来，广州的城市绿地现存状态是否受到了某些用地历史、地貌形态或者社会经济因素所制约？</p> <p>24.过去二十年间，广州采取了哪些措施来增加城市绿地用地？</p> <p>25.广州市的绿地面积与全市土地面积的比例，在20年前和现在分别是多少？</p>	<p>26.案例1/2/3中，其当时广州的城市自然环境条件、相关居民群体特征以及所涉及的央地法规方案，请您介绍一下？</p> <p>27.参与到案例1/2/3的规划、筹资、实施以及管理的利益相关者，请您列举一下？</p> <p>28.在案例1/2/3中，市政府是如何组织其他利益相关者一起规划城市绿地的（与下一层级的政府部门、私营企业以及居民之间的互动）？是否出台了哪些投资或激励政策用于加强这些绿地项目的实施？</p> <p>29.案例1/2/3在成本效益方面是否成功？那些群体/利益相关者是主要受益者？哪些没能从中受益？</p> <p>30.案例1/2/3的实施效果如何？总体而言，该项目在多大程度上满足了居民的需求？是否改善了广州的城市绿地状况？为什么？</p> <p>31.案例1/2/3的实施是否得到了监督和评估？如是，监督评估的标准有哪些？</p> <p>32.您认为广州城市绿地的总体质量如何（请就规模、分布、可达性、物种多样性以及连接性等方面解释）？</p> <p>33.您认为广州以自然为本设计的方案，诸如海绵城市试点，能有效修复被污染和破坏的城市环境吗？您认为广州现有的城市绿地资源的规划和治理总体上能有效应对如热浪、暴雨洪涝灾害、空气污染等气候变化影响吗？为什么？</p>	<p>34.广州市在建设和管理城市绿地上短期以及长期的目标是什么？有何实现目标的策略？</p> <p>35.在多大程度上这些规划目标有承诺和预算拨款支持？</p>	自然环境条件、社群特征、实践规则、参与者、行动情景、互动、结果、评估准则
<p><b>Q3.有哪些良好的经验值得分享？</b></p>	<p>36.以上三个案例中有哪些良好的关于土地利用类型和土地产权安排经验值得分享？</p>	<p>37.以上三个案例中有哪些良好的规划经验值得分享？请您分别从成本、规划手法、利益相关者参与以及实施四个方面来解释。</p>	<p>38.以上三个案例中有哪些良好的管理经验值得分享？请解释。</p>	结果、评估准则

## Urban Green Space Governance in China - Institutional Analysis

<p>Q3.1 以上三个案例中有哪些良好的土地使用经验值得分享？</p> <p>Q3.2 I有哪些良好的规划经验值得分享？</p> <p>Q3.3 有哪些良好的管理经验值得分享？</p>			<p>您从制度创新的层面来解释。</p>	
<p><b>Q4.在强大政治决心和集中的体制下，为何仍有些挑战未能解决？</b></p> <p>Q4.1 中央政府的强大政治决心和集中的体制表现在哪里？</p> <p>Q4.2 有哪挑战未能解决？</p> <p>Q4.3 为何仍未能解决？</p>	<p>39. 在城市土地资源管理方面 · 中央政府的强大政治决心和集中的体制表现在哪里？“生态文明”这一指导理念有哪些含义？</p> <p>40. 以上三个案例研究揭示了哪些在土地使用方面仍需解决的问题？为何解决这些问题具有难度？</p>	<p>41. 在城市绿地规划方面 · 中央政府的强大政治决心和集中的体制表现在哪里？“生态文明”这一指导理念有哪些含义？</p> <p>42. 以上三个案例研究揭示了哪些在城市绿地方面仍需解决的问题？为何解决这些问题具有难度？</p>	<p>43. 在城市治理和制度方面 · 中央政府的强大政治决心和集中的体制表现在哪里？“生态文明”这一指导理念有哪些含义？</p> <p>44. 以上三个案例研究揭示了哪些在城市治理和制度方面仍需解决的问题？为何解决这些问题具有难度？</p>	<p>结果、评估 准则</p>

### 半结构化深度访谈问题大纲及对应 IAD 框架中的变量

### 3. Selected semi-structured in-depth interview excerpts

(original in Chinese)

**Zhao:** *“The common practice of the central government is to give a general task and some general and guiding indicators, for example, building a low-carbon city. How does the local government implement it? Every city needs to make its plans according to local conditions and development needs. Some cities will focus on the development of green buildings. Some cities may have a better climate, and they would focus on developing more urban green spaces. In contrast, others may focus on optimising the industrial structure, penalising enterprises with high pollution and low efficiency, or ordering them to conduct improvements, or ordering them to close. In this process, the city government plays a highly coordinated and presiding role and work with the lower-level governments to achieve the tasks or goals given by the central government.”*

*(Originally in Chinese: “中央政府的惯例做法是给出一个总任务和一些普遍性的，指导性的指标。比如说，建设低碳城市。地方政府怎么实施呢？每个城市都需要因地制宜，做出自己的方案。有些城市会专注于发展绿色建筑。有一些城市可能气候比较优良，会专注于城市绿化，还有一些城市会专注于优化产业结构，把高污染低效能的工业企业处罚或勒令改进，或勒令关门。这个过程中城市政府需要扮演一个高度协调主持工作的角色，与下级政府共同达成中央政府给出的任务或目标。”)*

**Xiao:** *“For example, for constructing Low-Carbon cities, the mayor would discuss plans with city government officials and experts before making the final collective decision together with the Urban and Rural Planning Management Committee. If the mayor alone says that this plan is good, it is not possible (to pass). For example, the mayor said that he wanted to focus on building more urban green spaces, a department chief on land resources or a land economy expert would likely say that the cost of land resources for planting trees is relatively high and would ask the land economy experts to do some calculations. Planting trees may result in the loss of some more direct and more efficient economic benefits, such as building real estate. In such circumstance, the department chief of urban and rural construction may say that they*

*happen to have a residential real estate development project, which could contribute to building Low-Carbon cities by building apartments that fit green building standards.”*

*(Originally in Chinese: 比如低碳城市建设, 市长会与市政府委员以及行业专家一起讨论方案。最后城乡规划管理委员会一起来集体决定。如果市长他一个人说这个方案好, 那是不可以的。比如这个市长说他想要专注于城市绿化, 土地资源的政府委员或者专家很可能会说种树的土地资源成本比较大。让土地经济学专家算一下, 可能种树会导致失去一些更高效率的经济收益, 比如说盖房地产。这时候城乡建设的政府委员可能会说, 我们正好有个开发商, 要不让他建几万平米的房子全部让他用绿色建筑吧。”)*

**He:** *“The Sponge City project has received strong support from the Guangzhou Municipal Government, and now they are establishing a demonstration site in Tianhe District. However, at the same time, the urban planning and construction departments are also experiencing resistance from the bureau of water resources. As the construction of Sponge City necessitates ecological and natural methods for flood retention and wastewater treatment, there will be fewer budgets in the future for the bureau of water resources and negatively impact its downstream stakeholders. Therefore, a conflict of interest has arisen between different departments within the municipal government, and this conflict can be understood as the coordination or negotiation cost within the municipal government.”*

*(Originally in Chinese: 海绵城市这个方案得到了广州市政府的大力支持, 然后现在他们正在天河区建立一个实验点。但是同时, 规划部门也在经受水利部门的一个阻力, 因为建海绵城市就是用生态和自然的方式去排水, 就意味着水利部门的预算会下降, 其下游的水利工程利益相关者也会受到了影响。因此在市政府内部的不同部门间产生了利益冲突, 这一冲突也就可以理解为政府内部的协调成本。”)*

**Yuan:** *“Ordinary citizens have the legal rights to be informed and make decisions about the environment. The government generally has a process for publicizing information on construction projects to obtain public feedback on environmental impacts. In addition, the public can participate in the improvement of a particular project through supervision, and*

*reporting, if they find certain decisions or actions of a government department or an official suspicious or improper.”*

*(Originally in Chinese: “公众有环境知情权和环境决策权，政府公开建设项目的信息一般有一个公示的过程以求得市民意见反馈。此外公众对于政府官员或部门有操作不当的嫌疑可以通过监督和举报的形式参与到项目的改善上来。”)*

**Cai:** *“In 2011, the Guangzhou Municipal Government submitted to the Ministry of Land Resources the proposal to acquire the Wanmu Orchard farmland without changing the land function. The Haizhu District Government then established a land acquisition work unit with an advocacy team and land acquisition and demolition team. The advocacy team informed the farmland owners with materials, including posters and videos of the farmland acquisition plan, through meetings with question-and-answer sessions with representatives.”*

*(Originally in Chinese: “广州市政府于2011年向国家国土部提交了只征不转的海珠万亩果园管理方案。海珠区政府随后成立了征地工作队，内设宣传组和征地拆迁组。宣传组所用的材料包括征地方案海报和视频，通过与村民代表开会和问答环节来普及方案内容。”)*

**Cai:** *“The representatives of farmland owners, whose role is to express opinions and make decisions for the collective benefits of the farmland owners, have a significant amount of power and long-rooted vested interests in the local social and economic network. The institutional arrangements to trade the farmland ownership for building the Haizhu Wetland Park are against their existing vested interests. Therefore, some farmland owner representatives were not enthusiastic about the proposal. They further negotiated with the municipal government on the financial compensation of farmland property right transfer.”*

*(Originally in Chinese: “村民代表作为村民民意的反映者以及利益安排的执权者，在当地的社会经济关系网络常年积累了诸多既得利益，并拥有大量权力。把农用地的所有权出让并改成海珠湿地公园的方案和制度安排对其原来的利益安排有所冲突，因此有部分村民代表的积极性并不高，进一步与市政府进行了出让农用地的价格的协商。”*

**Huang:** *“The institutional arrangements for the Wanmu Orchard farmland acquisition ignored the impact on some actual residents of urban migrants in surrounding urban villages, intentionally or unintentionally. Transforming the orchard into the Haizhu Wetland Park is an improvement in the quality of the ecological environment in the area. It is clearly stipulated that 10% of the reserved land would be used for commercial development (hotels, shops, etc.) for the farmland owners with Guangzhou urban Hukou. These two interventions jointly increased the semi-informal housing prices in the urban villages. The leasing price also indirectly makes these urban villages more crowded, and the quality of life for those urban migrants who live there further declined. In this process, the migrant workers were indirectly negatively affected by the institutional arrangements for the Haizhu Wetland Park, and they were not officially notified, let alone new institutional arrangements to compensate for the negative impacts.”*

*(Originally in Chinese: “万亩果园征地的制度安排有意或无意地忽略了对周边村社中的部分实际居住者外来民工的影响。万亩果园升级为海珠湿地公园是该区域的生态环境质量的提高，明确规定 10%留用地给拥有广州户口的村民作商业发展（酒店、商铺等）用途，两者共同推高了村社内住房租赁的价格，另外间接使得城中村更加拥挤，生活质量进一步下降。这一过程中，外来民工受到了万亩果园征地的制度安排的间接负面影响，并未得到正式的通知，更别论新的制度安排来补偿其所受到的负面影响。”*

#### 4. List of Interviewees

Number	Interview theme	Name	Profession	Affiliated Institution	Field of Expertise	Location of Interview	Type of Interview	Time of Interview
2	Land Economy and Institutions	* Ho	Academic; governance consultant	Zhejiang University, Land Academy for National Development (LAND)	Land economy and institutions, resource and environmental management, land allocation efficiency and governance efficiency	Beijing	in person	12-Jul-18
3	Land Economy and Institutions	* Tan	Academic; governance consultant	Zhejiang University, Land Academy for National Development (LAND)	Land economy and institutions, resource and environmental management, land allocation efficiency and governance efficiency	Hangzhou	in person	4-Sep-18
4	Land Economy and Institutions	* Yue	Academic; governance consultant	Zhejiang University, Land Academy for National Development (LAND)	Urbanisation, land planning and spatial management, and big data	Hangzhou	in person	4-Sep-18
5	Land Economy and Institutions	* Zhang	Academic; governance consultant	Zhejiang University	Urban development and land institutions, development and governance of characteristic towns, urban environmental governance and sustainable development	Hangzhou	in person	6-Sep-18
6	Land Economy and Institutions	* Gao	Academic; governance consultant	Zhejiang University	Government management and innovation, local government public administration	Hangzhou	in person	6-Sep-18
7	Land and urban planning	* Lin	Urban planner	Guangzhou Land Resource and Planning Committee	Land planning, urban and rural planning, planning system	Guangzhou	phone call	24-Jan-18
8	Land Economy and Institutions	* Wu	Academic; governance consultant	Zhejiang University	Government management and innovation, public administration	Hangzhou	in person	1-Nov-19
9	Urban Planning, Environment and Development	* Zhao	Academic; governance consultant	Peking University	Urban planning, environment and development	Beijing	in person	13-Jul-18
10	Urban Planning	* Lv	Urban planner; local government official	Bureau of Urban Planning of Guangzhou	Land planning, urban and rural planning, preparation and approval of urban plans	Guangzhou	phone call	15-Aug-19
11	Urban Planning	* Rao	Urban planner; local government official	Bureau of Urban Planning of Guangzhou	Land planning, urban and rural planning, preparation and approval of urban plans	Guangzhou	Social network message exchange	14-Aug-19
12	Urban Planning	* Deng	Urban planner; local government official	Guangzhou Urban Planning & Design Survey Research Institute	Land planning, urban and rural planning, preparation and approval of urban plans	Guangzhou	phone call	13-Aug-19
13	Urban Planning	* Xu	Urban planner; local government official	Guangzhou Urban Planning & Design Survey Research Institute	Land planning, urban and rural planning, preparation and approval of urban plans	Guangzhou	in person	14-Dec-17
14	Urban Planning	* Liu	Urban planner	Guangzhou Urban Planning & Design Survey Research Institute	Land planning, urban and rural planning, preparation and approval of urban plans	Guangzhou	in person	3-Jul-18
15	Urban Planning, Environment and Development	* Yuan	Academic, governance consultant, urban planner	South China University of Technology, Urban Planning Committee of Guangzhou	Urban planning theory and design, regional and urban development strategy planning, urban master planning, urban renewal and land institutions	Guangzhou	in person	11-Sep-18
16	Urban Planning, Environment and Development	* Ma	Academic, governance consultant, urban Planner, local government official	Guangdong Urban and Rural Academy of Planning and Design, Urban Planning Committee of Guangzhou	Urban planning theory and design, regional and urban development strategy planning, urban master planning, urban renewal and land institutions	Guangzhou	in person	28-Aug-18
17	Urban Planning, Environment and Development, Institutions of Planning	* Zhao	Urban planner, local government official	China Eco-City Academy	Urban planning theory and design, regional and urban development strategy planning, urban master planning, urban renewal and land institutions	/	phone call	29-Aug-18
18	Urban Planning, Environment and Development	* A.	Academic, governance consultant, urban planner	Alexandria University Egypt	Urban planning theory and design, environment and development	Beirut	in person	28-Oct-18
19	Urban Planning, Environment and Development, Institutions of Planning	* Leung	Academic, governance consultant	Queen's University	Philosophy and theory of urbanisation, urban planning theory and design, environment and development	/	via Email	15-Aug-19
20	Urban Planning, Environment and Development, Institutions of Planning	* Wu	Academic, governance consultant	Bartlett School of Planning, University College London	Urbanisation, government management and innovation, local government public administration and institutions of land economics	Manchester	in person	1-Nov-18
21	Urban Planning, Environment and Development,	* You	Governance consultant	Guangzhou Institute for Urban Innovation	Urban governance, urban government innovation, green development and urban intergovernmental collaboration	/	via Skype	2-Nov-17

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	Institutions of Planning, Urban Governance							
22	Urban Planning, Environment and Development, Institutions of Planning, Urban Governance	* Jon.	Academic, governance consultant	TU Delft Netherlands	Eco Cities, Place Branding, Corporate Social Responsibility, Inclusive Prosperity	Suzhou	in person	27-Jul-18
23	Urban Planning, Environment and Development	* Yu	Academic, governance consultant, urban planner	Peking University	Theoretical research and practice of urban and regional planning, urban and landscape design and ecological planning	Beijing	in person	13-Jul-18
24	Urban Planning	* He	Urban planner	Turescape Urban Planning Consultancy	Urban and regional planning, urban and landscape design, ecological planning	Beijing	in person	13-Jul-18
25	Urban Planning, Environment and Development	* Rong	Academic, governance consultant	School of Architecture - Tsinghua University	Theory and method of ecological planning, green building, and urban ecological restoration	Beijing	in person	17-Jul-18
26	Urban Planning, Environment and Development, Institutions of Planning	* Xiao	Academic, governance consultant, urban planner	Guangdong Provincial Academy of Environmental Science	Theory and method of ecological planning, green building, and urban ecological restoration	Guangzhou	in person	31-Aug-18
27	Urban Planning, Environment and Development, Institutions of Planning	* Li	Urban planner	Guangzhou Urban Planning & Design Survey Research Institution, Urban Planning Research Center	Urban development strategy, low-carbon eco-city, historical and cultural city protection and urban renewal	Guangzhou	in person	15-Aug-19
28	Urban Planning, Environment and Development, Administrative Management	* Cai	Local government official	Management Office of the Haizhu Wetland Park, Haizhu District, Guangzhou	Urban planning, environment and development, administration	Guangzhou	in person	13-Aug-19
29	Urban Planning	* Long	Urban planner	Guangzhou Urban Planning & Design Survey Research Institute; Urban Planning Research Center / Eco-spatial Planning & Eco-Restoration	Urban development strategy, low-carbon eco-city, historical and cultural city protection and urban renewal	Guangzhou	in person	14-Aug-19
30	Urban Planning, Environment and Development, Administrative Management	*Huang	Local government official	Bureau of Land-Use and Urban Planning of Haizhu District	Urban planning, environment and development, administration	Guangzhou	in person	13-Aug-19
31	Environment and Development, Administrative Management	*Zhang	Local government official	Bureau of Forestry and Landscaping of Guangzhou	Administration and management of parks and other scenic areas	Guangzhou	phone call	11-Aug-19
32	Climate Change, Urban Health	*Huang	Academic, governance consultant	School of Public Health, Sun Yat-sen University	Health Policy and Management, Climate Change and Health, Environmental Epidemiology	Xiamen	in person	4-Nov-19
33	Climate Change, Urban Health	* Liu	Academic, governance consultant	Chinese Center for Disease Control and Prevention	Health Policy and Management, Climate Change and Health, Environmental Epidemiology	Lisbon	in person	23-Sep-18
34	Climate Change, Urban Health	* Zhu	Academic, governance consultant	Institute of Urban Environment, Chinese Academy of Sciences	Environmental soil science and environmental biology	Xiamen	in person	27-Nov-17
35	Climate Change, Urban Health, Urban Governance	* Mur.	Academic, governance consultant	Public Health England	Climate change, urban health, multi-agency collaboration, urban governance	Lisbon	in person	23-Sep-18
36	Climate Change, Urban Health, Urban Governance	*Ban.	Academic, governance consultant	Asian Development Bank	Health system governance, intersectoral and multi/stakeholder collaborative planning, strategic financial and institutional planning	Xiamen	in person	4-Nov-19
37	Climate Change, Urban Health, Urban Governance	* Dor.	Academic, governance consultant	World Health Organization	Public health, global environmental health governance and justice	/	via email	Jun-20
38	Climate Change, Environment and Development, Intergovernmental Collaboration	* Liu	Governance consultant	C40 Climate Leadership Network	Climate change, urban health, multi-agency collaboration, urban governance	/	via email	3-Aug-18
39	Climate Change, Environment and Development, Intergovernmental Collaboration	* Xie	Governance consultant	C40 Climate Leadership Network	Climate change, urban health, multi-agency collaboration, urban governance	/	via email	3-Aug-18
40	Climate Change, Urban Governance	*Zhang	Local government official	Guangdong Provincial Academy of Environmental Science	Regional atmospheric environment planning, policy, standards, and technology, water environmental management policy and mechanism	Guangzhou	in person	6-Aug-18
41	Climate Change, Environment and Development, Institutional Reform, Urban Governance, Ecological Civilisation	*Zhuang	Academic, governance consultant	Chinese Academy of Social Sciences, CASS Thinktank for Eco-Civilisation Studies	Climate change and low-carbon economics, policy, development strategy and planning, and low-carbon city evaluation methods	Beijing	in person	12-Jul-18

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42	Climate Change, Environment and Development, Institutional Reform, Urban Governance, Ecological Civilisation	* Su	Academic, governance consultant	Institutes of Science and Development - Chinese Academy of Sciences	Climate change policies, urban development paradigm, Ecological Civilization	/	via Email	22-Jun-18
43	Climate Change, Environment and Development, Institutional Reform, Urban Governance, Ecological Civilisation	* Li	Academic, governance consultant	Institute of Urban Development and Environment - Chinese Academy of Social Sciences	Climate change policies, urban development paradigm, Ecological Civilization	Beijing	in person	13-Jul-18
44	Climate Change, Environment and Development, Institutional Reform, Urban Governance, Ecological Civilisation	* Kang	Academic, governance consultant	Development Research Center of Guangdong	Strategic issues of ecological construction and green development in Guangdong province, policies and regulations for environmental protection, energy conservation and emission reduction, climate change adaptation, and institutional reform under Ecological Civilization	Guangzhou	in person	6-Aug-18
45	Climate Change, Environment and Development, Institutional Reform, Urban Governance, Ecological Civilisation	* Luo	Academic, governance consultant	Institute of Urban Development and Environment - Chinese Academy of Social Sciences	Environmental economics, urban economy and sustainable development, eco-city construction	Beijing	in person	14-Jul-18
46	Urban planning, inclusive development	* Liu	Urban planner, governance consultant	Morrow Architects & Planners Pte.Ltd	Urban planning, landscape design, sustainable urban development, people-centred urbanism	/	phone call	29-Dec-17
47	Environmental information disclosure and public participation	* Ma	Head of environmental non-governmental organization	China Institute of Public & Environmental Affairs (IPE)	Water pollution prevention and control and environmental information disclosure, public participation	/	phone call	10-Jul-18
48	Urban Planning, Environment and Development, Institutions of Planning	* Yao	Urban planner, local government official	Guangzhou Urban Planning Research Center	Formulation and implementation of urban plans and regulations	Guangzhou	in person	15-Aug-19
49	Urban Planning, Environment and Development, Institutions of Planning	* Wang	Urban planner, local government official	Guangzhou Urban Planning Research Center	Formulation and implementation of urban plans and regulations	Guangzhou	in person	in person
50	Urban Planning, Environment and Development, Institutions of Planning	* Zhang	Academic, governance consultant, urban planner	Urban Planning Society of China	History of urban development and construction in China, the history of western urban planning thought, institutional reform and urban structuring in China, and the evolution of urban system planning and development in China	Beijing	in person	15-Jul-18

### 5. List of Policy Documents

<i>Level</i>	<i>Theme</i>	<i>Title in Chinese</i>	<i>Title in English</i>	<i>Time of publication</i>	<i>Target period</i>	<i>Type</i>	<i>Publication entity</i>	<i>Coordination entity</i>	<i>Overarching political philosophy / policy principle</i>
National	Climate change/ sustainable development	2001 年 中国 土绿化 状况公 报	Communiqué on the Land Greening Status in China 2001	2001	/	communiqué	National Greening Committee Office	/	<i>Scientific Development &amp; Harmonious Society</i>
		2005 年 中国 土绿化 状况公 报	Communiqué on the Land Greening Status in China 2005	2005	/	communiqué	National Greening Committee Office	/	<i>Scientific Development &amp; Harmonious Society</i>
		国务院 关于落 实科学 发展观 加强环 境保护 的决定	Decision of the State Council on Implementing Scientific Outlook on Development and Strengthening Environmental Protection	2005	2010	strategic plan	State Council	All ministries and levels of government institutions	<i>Scientific Development &amp; Harmonious Society</i>
		中国应 对气候 变化国 家方案	China's National Program on Climate Change	2007	2010	strategic plan	State Council	All ministries and levels of government institutions	<i>Scientific Development, Resource Saving &amp; Environmental Protection</i>
		国家环 境与健康 行动计 划 2007- 2015 年	National Action Plan on Environment and Health (2007-2015)	2007	2015	strategic plan	State Council	National Environmental Protection Bureau & Healthy Ministry	<i>Scientific Development, Harmonious Society, &amp; People-Centred</i>
		中国应 对气候 变化的 政策与 行动	China's Policies and Actions on Climate Change	2008	/	report	State Council	/	/
		中国生 物多样 性保护 战略与 行动计 划 2011— 2030 年	China National Biodiversity Conservation Strategy and Action Plan (2011-2030)	2011	2030	strategic plan, action plan	State Council	National Environmental Protection Bureau	<i>Scientific Development</i>
		2012 年 中国 土绿化 状况公 报	Communiqué on the Land Greening Status in China 2012	2012	/	communiqué	National Greening Committee Office	/	<i>Scientific Development &amp; Ecological Civilisation, &amp; People-Centred</i>
		国家大 气污染 防治行 动计划	National Air Pollution Prevention and Control Action Plan	2013	2017	action plan	State Council	National Environmental Protection Bureau & Meteorological Administration	<i>Scientific Development &amp; Ecological Civilisation</i>
		国家适 应气候 变化战 略	National Strategy for Climate Change Adaptation	2013	2020	strategic plan	State Council	National & local departments of development and reform	<i>Scientific Development &amp; Ecological Civilisation, &amp; People-Centred</i>
		国家应 对气候 变化规 划 2014- 2020 年	National Plan on Climate Change 2014-2020	2014	2020	action plan	National Development and Reform Commission	All government departments at city level	<i>Scientific Development, Resource Saving &amp; Environmental Protection, Ecological Civilisation</i>
		环境保 护法修 订版	Revision of the Environmental Protection Law	2014	/	regulation	State Council	Environmental protection departments at national and local levels	<i>Sustainable Development &amp; Ecological Civilisation</i>
		中国应 对气候	China's Policies and Actions on Climate Change	2015	/	report	National Development	/	/

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	变化的政策与行动					and Reform Commission		
	城市适应气候变化行动方案	Action Plan for Urban Climate Adaptation	2016	2020	action plan	State Council	All government departments at city level	<i>Sustainable Development &amp; Ecological Civilisation</i>
	中国落实 2030 年可持续发展议程国别方案	China's National Plan on Implementation of the 2030 Agenda for Sustainable Development	2016	2030	strategic plan	State Council	All ministries and levels of government institutions	Innovation, Coordination, Green, Open, Sharing, <i>Sustainable Development &amp; Ecological Civilisation</i>
	中国应对气候变化的政策与行动	China's Policies and Actions on Climate Change	2018	/	report	Ministry of Ecology and Environment	/	/
	中国应对气候变化的政策与行动	China's Policies and Actions on Climate Change	2019	/	report	Ministry of Ecology and Environment	/	/
	2019 年中国国土绿化状况公报	Communiqué on the Land Greening Status in China 2019	2019	/	communiqué	National Greening Committee Office	/	"Two Mountains" theory & <i>Ecological Civilisation</i>
	"健康中国 2030" 规划	Healthy China 2030	2016	2030	strategic plan	State Council	All ministries and levels of government institutions	<i>Sustainable Development</i>
Urban spatial planning and development	全国城市生态保护与建设规划 2015-2020 年	National Plan of Urban Ecological Protection and Construction (2015-2020)	2015	2020	strategic plan	Ministry of Housing and Urban-Rural Development & Ministry of Environmental Protection	All ministries and levels of government institutions	Innovation, Coordination, Green, Open, Sharing
	国家新型城镇化规划 2014-2020 年	National New Urbanization Plan (2014-2020)	2014	2020	strategic plan	State Council	All ministries and levels of government institutions	<i>Scientific Development &amp; People-Centred</i>
Institutional reform	关于全面深化改革若干重大问题的决定	Decision of the Central Committee of the Communist Party of China on Some Major Issues Concerning Deepening the Reform	2013	2020	strategic plan	State Council	State Council	<i>Scientific Development</i>
	关于加快推进生态文明建设的意见	Opinions on Accelerating the Construction of Ecological Civilization	2015	2020	conceptual plan	State Council	All ministries and levels of government institutions	<i>Scientific Development &amp; Ecological Civilisation, &amp; People-Centred</i>
	生态文明体制改革总体方案	Master Plan of Ecological Civilization System Reform	2015	/	action plan	State Council	Central Leading Group for Deepening Overall Reforms & Special Group on Reform of the Economic and Ecological Civilization System	<i>Scientific Development, Resource Saving &amp; Environmental Protection, Human-Nature Harmony</i>
	中共中央关于深化党和国家机构改	Decision of the CPC Central Committee on Deepening the Reform of the Party and State Institutions	2018	/	strategic plan	State Council	All ministries and levels of government institutions	<i>Scientific Development</i>

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		革的决定										
		深化党和国家机构改革方案	Plan to Deepen Reforms in Party and State Institutions	2018	2019	action plan	State Council	All ministries and levels of government institutions				<i>Scientific Development &amp; People-Centred</i>
	Macro socio-economic planning	中国国民经济和社会发展第十个五年计划	10th Five-Year National Socio-Economic Development Plan	2001	2005	macro socio-economic development plan	National Development and Reform Commission	All ministries and levels of government institutions				Development as Priority, People-Centred, Economy and Society Coordinated Development
		中国国民经济和社会发展第十一个五年计划	11th Five-Year National Socio-Economic Development Plan	2006	2010	macro socio-economic development plan	National Development and Reform Commission	All ministries and levels of government institutions				<i>Scientific Development &amp; People-Centred</i>
		中国国民经济和社会发展第十二个五年计划	12th Five-Year National Socio-Economic Development Plan	2011	2015	macro socio-economic development plan	National Development and Reform Commission	All ministries and levels of government institutions				<i>Scientific Development, Resource Saving &amp; Environmental Protection</i>
		中国国民经济和社会发展第十三个五年计划	13th Five-Year National Socio-Economic Development Plan	2016	2020	macro socio-economic development plan	National Development and Reform Commission	All ministries and levels of government institutions				<i>Scientific Development, Innovation, Coordination, Green, Open, Sharing, People-Centred</i>
<i>Municipal level</i>	Climate change/sustainable development	广州市城市总体规划2001-2010	Master Plan of Guangzhou City 2001-2010	2005	2010	action plan	Municipal Government of Guangzhou	All ministries and levels of government institutions				<i>Scientific Development, Sustainable Development &amp; Harmonious Society</i>
		广州市土地利用总体规划2006-2020	Land-Use Master Plan of Guangzhou City 2006-2020	2006	2020	action plan	Municipal Government of Guangzhou	Guangzhou Land Resources and Housing Administration				<i>Scientific Development, Resource-Saving &amp; Harmonious Society</i>
		广州市城市绿地系统规划	Urban Green Space System Plan of Guangzhou City	2010	2020	action plan	Municipal Bureau of Parks and Forestry of Guangzhou	Municipal Bureau of Parks and Forestry of Guangzhou				Ecology as Priority, People-Centred, Urban-Rural Integration
		广州市花城绿城水城建设方案	Construction Plan of Guangzhou for Flower City, Green City and Water City	2014	2016	strategic plan	Municipal Government of Guangzhou	Committee of Urban-Rural Construction of Guangzhou				<i>Scientific Development &amp; Ecological Civilisation, &amp; People-Centred</i>
		广州市林业和园林十三五发展规划	The 13th Five-Year Plan for Forestry and Gardening Development in Guangzhou	2016	2020	action plan	Municipal Bureau of Parks and Forestry of Guangzhou	Municipal Bureau of Parks and Forestry of Guangzhou				Innovation, Coordination, Green, Open, Sharing, Scientific Development
		广州市海绵城市专项规划	Special Plan for Sponge City of Guangzhou	2016	2030	special plan, technical guideline	Land Resources and Planning Commission of Guangzhou	Land Resources Commission of Guangzhou				<i>Ecology as Priority, Ecological Civilisation</i>
		广州市生态文明规划建设纲要	Outline of Ecological Civilization Construction in Guangzhou	2016	2020	strategic plan	Municipal Government of Guangzhou	All government institutions at or under municipal level in Guangzhou				Innovation, Coordination, Green, Open, Sharing, Scientific Development & Ecological Civilisation

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Urban spatial planning and development	广州市城市环境总体规划 2014-2030	Environmental Master Plan of Guangzhou City 2014-2030	2017	2030	action plan	Municipal Government of Guangzhou	Environmental Protection Bureau of Guangzhou	Innovation, Coordination, Green, Open, Sharing, <i>Scientific Development</i> , Environment as Priority
	广州市公园建设与保护专项规划	Special Plan of Park Construction and Protection in Guangzhou	2017	2035	action plan	Municipal Bureau of Parks and Forestry of Guangzhou & Landscape Architecture Planning and Design Institute of Guangzhou	Municipal Bureau of Parks and Forestry of Guangzhou	<i>Resource-Saving, Human-Nature Harmony</i>
	广州市生态廊道总体规划与生态廊道规划建设指引	Ecological Corridor Master Plan and Construction Guideline of Guangzhou	2018	/	conceptual plan, technical guideline	Center of Urban Planning Research of Guangzhou	Municipal Bureau of Parks and Forestry of Guangzhou	<i>Ecology as Priority, People-Centred</i>
	广州市生态廊道地区项目建设指引	Ecological Corridor Regional Construction Guideline of Guangzhou	2018	/	technical guideline	Center of Urban Planning Research of Guangzhou	Municipal Bureau of Parks and Forestry of Guangzhou	/
	广州市生态廊道地区规划建设行政审批工作手册	Manual for Administrative Examination and Approval of the Ecological Corridor Regional Planning and Construction in Guangzhou	2018	/	administrative guideline	Center of Urban Planning Research of Guangzhou	Center of Urban Planning Research of Guangzhou	<i>Ecological Civilisation</i>
	广州市生态廊道保护利用研究报告	Assessment Report on the Protection and Utilization of Ecological Corridors in Guangzhou	2018	/	report	Center of Urban Planning Research of Guangzhou	/	/
Macro socio-economic plans	广州市经济和社会发展第十个五年计划	10th Five-Year Municipal Socio-Economic Development Plan of Guangzhou	2001	2005	macro socio-economic development plan	Development and Reform Commission of Guangzhou	All government institutions at or under municipal level in Guangzhou	<i>Scientific Development, Sustainable Development</i>
	广州市经济和社会发展第十一个五年计划	11th Five-Year Municipal Socio-Economic Development Plan of Guangzhou	2006	2010	macro socio-economic development plan	Development and Reform Commission of Guangzhou	All government institutions at or under municipal level in Guangzhou	<i>Scientific Development, People-Centred, Harmonious Society</i>
	广州市经济和社会发展第十二个五年计划	12th Five-Year Municipal Socio-Economic Development Plan of Guangzhou	2011	2015	macro socio-economic development plan	Development and Reform Commission of Guangzhou	All government institutions at or under municipal level in Guangzhou	<i>Scientific Development</i>
	广州市经济和社会发展第十三个五年计划	13th Five-Year Municipal Socio-Economic Development Plan of Guangzhou	2016	2020	macro socio-economic development plan	Development and Reform Commission of Guangzhou	All government institutions at or under municipal level in Guangzhou	<i>Scientific Development, People-Centred, Sustainable Development</i>
Work Report	广州市政府工作报告	Report on the Work of the Municipal Government of Guangzhou	2001	/	Report	Municipal Government of Guangzhou	/	<i>Scientific Development, People-Centred, Sustainable Development</i>



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	广州市政府工作报告	Report on the Work of the Municipal Government of Guangzhou	2018	/	Report	Municipal Government of Guangzhou	/	Scientific Development, People-Centred, Sustainable Development, Ecological Civilisation
	广州市政府工作报告	Report on the Work of the Municipal Government of Guangzhou	2019	/	Report	Municipal Government of Guangzhou	/	Scientific Development, People-Centred, Sustainable Development, Ecological Civilisation
Sub-municipal/ District level	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2006	/	Report	District Government of Panyu	/	Scientific Development, Harmonious Society
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2007	/	Report	District Government of Panyu	/	Scientific Development, Harmonious Society
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2008	/	Report	District Government of Panyu	/	Scientific Development, Harmonious Society
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2009	/	Report	District Government of Panyu	/	Scientific Development, Harmonious Society
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2010	/	Report	District Government of Panyu	/	Scientific Development, Harmonious Society
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2011	/	Report	District Government of Panyu	/	Scientific Development
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2012	/	Report	District Government of Panyu	/	Scientific Development
	番禺区政府工作报告	Report on the Work of the District Government of Panyu	2013	/	Report	District Government of Panyu	/	Scientific Development
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2009	/	Report	District Government of Haizhu	/	Scientific Development
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2010	/	Report	District Government of Haizhu	/	Scientific Development
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2011	/	Report	District Government of Haizhu	/	Scientific Development
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2012	/	Report	District Government of Haizhu	/	Scientific Development, New Urbanisation
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2013	/	Report	District Government of Haizhu	/	Scientific Development, New Urbanisation
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2014	/	Report	District Government of Haizhu	/	Scientific Development, New Urbanisation
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2015	/	Report	District Government of Haizhu	/	Reform & Innovation
	海珠区政府工作报告	Report on the Work of the District Government of Haizhu	2016	/	Report	District Government of Haizhu	/	Scientific Development, People-Centred, Innovation, Coordination, Green, Open, Sharing, Sustainable Development
	天河区政府工作报告	Report on the Work of the District Government of Tianhe	2014	/	Report	District Government of Tianhe	/	/

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天河区 政府工 作报告	Report on the Work of the District Government of Tianhe	2015	/	Report	District Government of Tianhe	/	/
天河区 政府工 作报告	Report on the Work of the District Government of Tianhe	2016	/	Report	District Government of Tianhe	/	/
天河区 政府工 作报告	Report on the Work of the District Government of Tianhe	2017	/	Report	District Government of Tianhe	/	<i>New Development</i>
天河区 政府工 作报告	Report on the Work of the District Government of Tianhe	2018	/	Report	District Government of Tianhe	/	<i>New Development</i>
天河区 政府工 作报告	Report on the Work of the District Government of Tianhe	2019	/	Report	District Government of Tianhe	/	<i>New Development</i>

## 6. List of Scientific Publications during the PhD

- Ferreira, Lurdes J., Luís P. Dias, and **Jieling Liu**. 2022. Adopting Carbon Pricing Tools at the Local Level: A City Case Study in Portugal. *Sustainability* 14(3):1812. <https://doi.org/10.3390/su14031812>
- **Jieling Liu**, Franz Gatzweiler, Simon Hodson, Gabriele Harrer-Puchner, Giles B. Sioen, Mamello Thinyane, Ronit Purian, Virginia Murray, Xiaofeng Yi & Alejandro Camprubi. 2022. Co-creating solutions to complex urban problems with collaborative systems modelling - insights from a workshop on health co-benefits of urban green spaces in Guangzhou. *Cities & Health*, DOI: [10.1080/23748834.2022.2026694](https://doi.org/10.1080/23748834.2022.2026694)
- **Jieling Liu** & Franz Gatzweiler. 2020. The Institutional Challenge to Co-Deliver Migrant Integration and Urban Greening—Evidence from Haizhu Wetland Park Project in Guangzhou, China. *Journal of Chinese Governance*. DOI: [10.1080/23812346.2020.1760069](https://doi.org/10.1080/23812346.2020.1760069)
- **Jieling Liu**. 2021. COVID-19 Shows Us the Need to Plan Urban Green Spaces More Systematically for Urban Health and Wellbeing. In: Gatzweiler F. (eds) *Urban Health and Wellbeing Programme. Urban Health and Wellbeing*. Springer, Singapore. Zhejiang University Press. [https://doi.org/10.1007/978-981-33-6036-5\\_7](https://doi.org/10.1007/978-981-33-6036-5_7). ISBN: 978-981-336-036-5.
- **Jieling Liu**. 2020. Institutional Barriers and Transformation to Climate Change Management in Emerging Coastal Megacities: A Case Study from Guangzhou, China. Chapter of book: *Handbook of Climate Change Management*. DOI: [10.1007/978-3-030-22759-3\\_37-1](https://doi.org/10.1007/978-3-030-22759-3_37-1). Part of ISBN: 9783030227593
- **Jieling Liu**, Franz Gatzweiler, Manasi Kumar. 2020. An Evolutionary Complex Systems Perspective on Urban Health. *Socio-Economic Planning Sciences*. 2020. DOI: <https://doi.org/10.1016/j.seps.2020.100815>
- **Jieling Liu**. 2020. Narrating the Impacts of Climate Change for Urban Health Governance in Guangzhou, China. *Journal of Cities and Health*. Published online: January 2020. DOI: <https://doi.org/10.1080/23748834.2019.1701945>
- Thomas Elmqvist, Franz Gatzweiler, Elisabet Lindgren, **Jieling Liu**. 2019. Resilience Management for Healthy Cities in a Changing Climate. Chapter of book: Marselle M., Stadler J., Korn H., Irvine K., Bonn A. (eds) *Biodiversity and Health in the Face of*

*Climate Change*. Springer, Cham. First Online: June 2019. [https://doi.org/10.1007/978-3-030-02318-8\\_18](https://doi.org/10.1007/978-3-030-02318-8_18)

- **Jieling Liu**. 2019. Financing and Implementing Resilience with a Systems Approach in Beirut. In: Gatzweiler F. (eds) *Urban Health and Wellbeing Programme. Urban Health and Wellbeing (Systems Approaches)*. Springer, Singapore. [https://doi.org/10.1007/978-981-15-1380-0\\_9](https://doi.org/10.1007/978-981-15-1380-0_9). ISBN: 978-981-15-1379-4.
- **Jieling Liu**, Franz Gatzweiler, Luísa Schmidt. 2019. Addressing the Nexus Challenge of Climate Change, Human Health, and Urban Sustainability. *ICS Estudos e Relatórios*. ISSN: 2183-6922. Available at: [https://www.ics.ulisboa.pt/flipping/er2019\\_1/12/](https://www.ics.ulisboa.pt/flipping/er2019_1/12/)
- Charles Ebikeme, Franz Gatzweiler, Tolullah Oni, **Jieling Liu**, Andrea Oyuela & José Siri. 2019. Xiamen Call for Action: Building the Brain of the City—Universal Principles of Urban Health, *Journal of Urban Health*. Published online: January 2019. Springer: Volume 96, Issue 4, pp 507–509. ©The New York Academy of Medicine. DOI: <https://doi.org/10.1007/s11524-018-00342-0>

## 7. Declaration of Original Authorship

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Jieling Liu



June 22, 2022