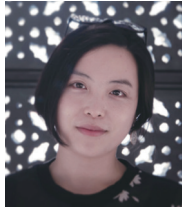


Collaborative Ecological Regeneration —An Adaptable Toolkit for Reviving Ecological Infrastructures With Case Study on Beijing’s Practices



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ABSTRACT

In the background of developing sustainable cities worldwide, Beijing aims at “a harmonious and livable city” with *Master Plan of Beijing (2016–2035)* based on Ecological Security Patterns and a series of renewal projects on ecological infrastructure in the central city. Based on Ecological Urbanism, this study pointed out such practices can help link this green vision to individuals’ actions. The theoretical lens consists of environmental, social and mental ecology, and provides triad indicators for regenerative ecological practices—restore ecological infrastructure, revive neighborhoods, rebuild social-environmental bond. Critical evaluation of an exemplar—Shougang Industry Services Park project revealed gaps on relating landscape with users’ engagement and individuals’ everyday actions. An evolved practice model—“collaborative ecological regeneration” was proposed, to integrate intermediary landscapes transformation with participation. It is supported by an adaptable toolkit including strategies on three aspects to care for EI components, form inclusive social collaboration and raise environmental awareness. The key tool “Urban Prototypes” can connect tactics across layers, conceptualize previous practices, and link to future ones, with proposed application to Beijing inner-city practices setting a few examples. This new mode indicates an open-ended regeneration process, while Urban Prototypes could be adapted to urban dynamics and stakeholders’ desires.

KEYWORDS

Urban Regeneration;
Ecological Infrastructure;
Collaborative Ecological
Regeneration;
Inclusive Social Collaboration;
Socio-Environmental Bond;
Urban Prototypes;
Public Participation;
Shougang Industry Services
Park

HIGHLIGHTS

- Urban renewal practices can help link Beijing’s green vision to individuals’ actions
- Collaborative ecological regeneration process can build a set of relations reviving natural and social communities
- The toolkit provides strategies to restore ecological infrastructure, revive neighborhoods, and rebuild socio-environmental bond
- Urban prototypes draw how intermediary landscapes transformation can combine with public participation

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1 Introduction

Humans have moved into the “urban century,” with more than half of the world population living in city areas^[1]. Cities worldwide are in the complex conditions shaped by global climate change, resource scarcity, population growth, planetary industrialization and urbanization^[2]. In response, an ideological shift from economic progress to sustainability seeks synthetic thinking and a balance between economic, social, and environmental goals^[3].

How to make cities more sustainable remains a key topic in urban planning and design. As moving from the process-centric Modernism, new paradigms have been proposed^[4]. Urban regeneration advocates an intervention process, instead of demolition, that promotes positive physical, social, and economic changes in areas with existing building stock. It is often market-led to some extent, and brings employment and improves life quality in run-down and overcrowded neighborhoods^{[4][5]}. But cities also demand climate adaptation, since extreme weather events increase^[2]. Ecological Urbanism understands city as human-dominated hybrid ecosystem^{[6][7]}. Ecological infrastructure (EI), as natural environmental systems in urban regions, is vital to climate regulation, disaster risk reduction, biodiversity, and public health^[8]. It offers a holistic approach that facilitates the co-evolution of nature and human systems^[9]. With urban regeneration centering on EI, the discourse changes^[5].

In parallel, more and more cities have been developing green visions and refining city-making mechanisms. For example, in the Netherlands, the National Ecological Network (since 1990) aimed to protect and link the natural areas. The hierarchical planning approach has shifted to a network steering form where provinces create individual visions and all stakeholders participate in the integrated landscape development, such as Green Heart project joining Amsterdam and Rotterdam^[10]. In Japan, a series of Eco-Towns were designated by the government, and subsequent projects have been initiated by coalitions between public, private, and third components^[11].

In the face of ecological crises and economic restructuring, Chinese authorities proposed the imaginary of “ecological civilization” in 2007, showing great commitment to global sustainable goals^[3]. Derived from traditional Chinese philosophy, it calls for an environmental and social reform against the backdrop of “industrial civilization”^[12]. China is known for its unique hierarchical city governance and urban planning system^[11]. The government-sponsored research studied the National and Beijing Ecological Security Patterns that illustrated EI to be protected and

restored^[13]. It informed the EI planning in *Beijing Land-use Plan (2006–2020)* and *Master Plan of Beijing (2016–2035)* towards a world-class harmonious and livable capital^[14], and a series of renewal projects on EI in the central city area, such as Shougang Industrial Service Park, have been launched by the government.

To plan and design sustainable cities in the context of global ecological crises, we must find out how cities can better accommodate a growing population, whilst maintaining a healthy, diverse environment, particularly the provision of clean water, air, food, open spaces, and biodiversity. However, there is little research to clarify how could renewal projects on EI make positive environmental and social changes towards the green vision, and what are the benefits and downsides of the top-down city-making mechanism regarding such transformation. This study could contribute to the discussion about smaller EI components scarcely involved in previous EI studies^[8], as well as urban renewal design methods and process linking urban design theory and practice^[15], with the following objectives: 1) to establish a theoretical framework based on Ecological Urbanism and identify indicators for evaluating urban renewal practice on EI; 2) to explicate the green vision of Beijing through a theoretical lens and examine the advances and gaps of current practice by assessing an exemplary project; and 3) to explore an adaptable toolkit of design strategies supporting an evolved model of urban renewal practice and an open-ended urban design process.

Research methods used in this study include case study^[16] and mapping^[17]. Data were gathered via remote sourcing and online interviews (ten respondents, including designers, developers, and citizens)^[18] during January 2020 to December 2021, due to the circumstances of COVID-19. This study also uses research by design that exploits urban design methods—prototype, scenario building^[19], pamphlet^[20]—to conclude findings.

2 Ecological Ethos and Evaluation Indicators

2.1 Lens of Ecological Urbanism

Ecological Urbanism^[7], as the combination of urbanism and ecology, offers an advanced model of synthetic thinking by building a more comprehensive framework with a plural notion of ecology—environmental, social, and mental ecology—and their symbiosis relation. As a continuity of Landscape Urbanism and a critique to its top-down approach, it emphasizes mental ecology as individual actions in participating the transformation^{[7][21]~[23]}. This is in accord with Urban Ecology

defined by Kate Orff^[9]. Orff's practices, e.g. the Living Breakwater project along New York City's coastline, combine scientific simulation of water system and cultivation of oysters with citizens' participation.

This study draws on the three interrelated themes—environmental, social, and mental ecology—as the theoretical lens^{[7][21]}. Upon this triad, EI conceptualizes nature in the city^{[8][13]}. EI differs from “greenway” (such as Boston's Emerald Necklace) that also takes landscape as infrastructure but mainly considers the forms and recreational uses, or “green belt” (such as Howard's Garden City) that merely arbitrarily plans green spaces.

Developing with similar concepts like “green infrastructure” and “ecological network,” EI is process-oriented and refers to a functioning network of interconnected natural and semi-natural elements, which preserves ecosystem processes and provides valuable services for people^[8]. It is composed of diverse-sized patches and corridors, containing flows within or across geophysical, biotic, or human systems^[13]. The integrity of EI defines its capacity to provide ecosystem services^{[8][24]}: provisioning services, regulating services, supporting services, and cultural services. Unfortunately, the EI in most cities has been largely fragmented by rapid urban expansion, reducing habitats and increasing the likelihood of further ecological degradation^[2].

The Negative Approach, developed by Kongjian Yu shows a more objective, holistic way to plan regional EI with system-based models and simulations and frame urban growth by EI. It made progress in measuring risks and visualizing certain ecological processes in low-, medium-, and high-security patterns that provide minimum, satisfying, and ideal ecosystem services, respectively^[13]. It can be generated on ArcGIS platform, integrating “surface model” from landscape ecology, Geodesign evolved from the layer-cake model^[6], and “Feng-Shui” that prioritizes the patterns of mountains and water course^[13]. This approach has been applied on national and regional scales, to map the spatial configuration of EI that grounds on critical ecological processes relating to local issues. In the case of Beijing Ecological Security Patterns (BESP), it includes geological disasters prevention, flood control, storm water management, biodiversity conservation, cultural heritage, and recreation. EI at the medium (satisfactory) quality (70% of the total land) could balance the preservation of natural and cultural resources, and the requirements of competing land uses was chosen to inform urban planning^[13]. Such a desirable configuration could guide urban planning for green open spaces and the initiation of ecological projects. But how to restore various types of EI should be considered.

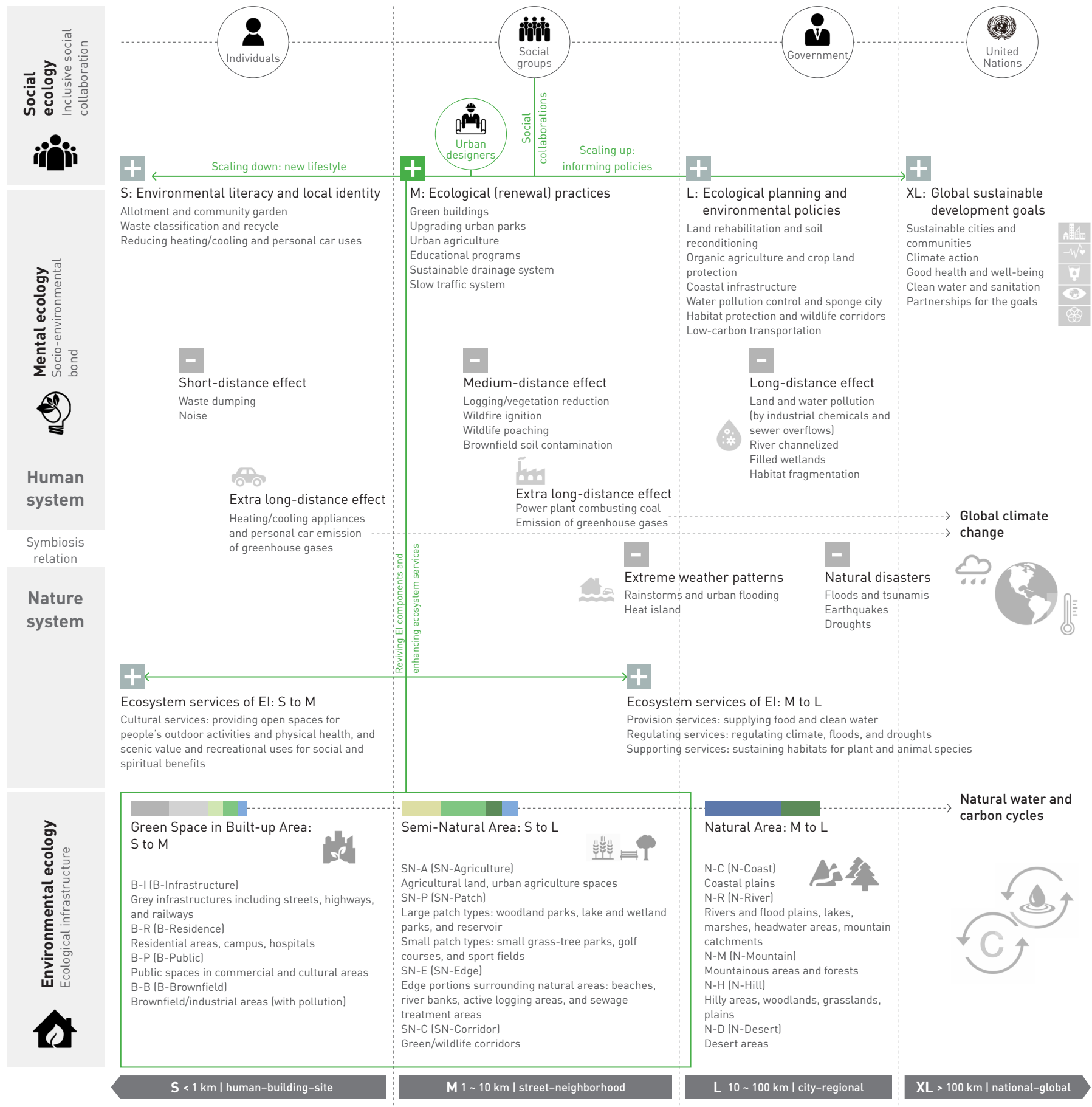
2.2 Indicators for Building Reviving Ecological Infrastructures

While zooming in to EI components and human actions, scale is a crucial concept to consider parts with the whole in mind^[25]. Based on positive and negative interactions between people and nature, this study builds a framework (Fig. 1) applying a set of nested scales: 1) XL, global to national scale (> 100 km); 2) L, regional to urban scale (10 ~ 100 km); 3) M, neighborhood or street scale (1 ~ 10 km); and 4) S, site, building or human scale (< 1 km)^[26].

Regarding the nature system related to environmental ecology, there are three types of EI components, composing the overall EI configuration (L) and relating to the larger natural cycles (XL). First is the Natural Areas (N) less disturbed by human activities in the outer urban ring, such as native forests and protected headwaters. The second type is the scattered Semi-Natural Areas (SN) in the intensively utilized and managed inner urban ring, like river stretches, agricultural land, wetlands, and grass-tree parks. Last is Green Space in Built-up Areas (B)^[26]. Larger components are mainly responsible for provisioning, regulating, and supporting ecosystem services, and smaller components further provide cultural ecosystem services; the service area of which depends on the accessibility^[9].

Human system relates to social ecology and mental ecology. Social ecology means social cohesion and inclusive collaboration between citizen groups^{[7][21]}, involving different social groups of differing sizes, types, and levels, from the government to individuals. Environmental policies and ecological planning (L) play a greater role in linking EI components to the overall configuration, and initiate projects on larger EI components, like habitat conservation, water restoration, and primary agricultural lands protection^[9]. The collaborative efforts of government, stakeholders, and communities in urban ecological design projects (M) could play a pivotal role in smaller EI components. They are to increase the number of urban parks or revive existing ones and construct/upgrade buildings and grey infrastructures (separated, mono-functional, rigid objects) into green-grey hybrids that are well-connected, multi-functional, and resilient^[8].

The mental ecology—socio-environmental bonds—points to inhabitants' attachment to a place and local identity, defined by its unique physical characters and scenic and recreational values^{[7][21][27]}. Particularly, it binds environmental awareness with individuals' everyday actions (S), which resembles the interdependency between people and nature in agriculture^{[7][9]}. Since individual behaviors, like greenhouse gas emission from private cars, are closely related to global climate change^[25], the continual



1. Framework of this study that applies a set of nested scales across XL, L, M, and S.

engagement should not only respond to users' needs and create the sense of belonging, but also maintain EI components for a long term.

It is important to note that the transformation of intermediary landscapes (M) could serve as a medium. As hybrids between the natural and the architectural components, they bridge EI and ecological processes from city scale (L) to site scale (S). Thus, the intermediary landscapes could support the articulation of varying human–nature relationships in culture, in different temporal scales^[9]. This study claims that ecological renewal practice (M) should motivate a regenerative process for the co-evolution of nature (landscape) and human (inhabitants) systems. It is to revive EI and to build a set of relations energizing natural and social communities. Such practice should be aimed at restoring EI components, reviving neighborhoods, and rebuilding socio-environmental bonds. Urban designers can play a pivotal role in facilitating social collaboration (M), which could scale down to form new lifestyles (S) and scale up to inform policies (L)^[9], improving human-nature partnership.

3 Reflection on Beijing's Green Vision and Renewal Practices

3.1 Rapid Urbanization and Ecological Issues of Beijing

Beijing is located on the North China Plain, with mountainous areas in the north and west, occupying an area of 1,369 km². Most population is concentrated in the metropolitan area, including Xicheng, Dongcheng, Haidian, Chaoyang, Fengtai, and Shijingshan districts^[28]. As the population rising and the implementation of an array of Five-year Plans for economic growth, the city has been rampantly expanding. The rapid urbanization has significantly eroded the natural and cultural landscapes. The original native forests, rivers, lakes, wetlands, grasslands, crop lands, etc. were reduced and damaged, while the biodiversity was decreased and EI was fragmented and degraded^[13]. This lowers its resilience in responding to extreme weather events and leads to water crisis threatening urban security and public health^[8]. With more heavy rainstorms, the impermeable surface in built-up areas and concrete river banks obstruct the natural infiltration of water and cause excessive urban flooding^[29], preventing the recharging of underground water that has considerably decreased and causing water scarcity^[13].

Despite the extensive automobile network, few green open spaces are connected by pedestrian and cycling paths, which makes them less accessible in fact. The demolition of historical

districts and the loss of cultural landscapes have also fragmented the social fabrics and weakened the local identity^[13]. As mobilizing to newly developed areas, inhabitants are displaced physically and mentally. People become increasingly distant and isolated from each other and the environment.

3.2 Reading Beijing's Green Vision Through the Theoretical Lens

Based on the imaginary of “ecological civilization” and BESP, the authorities set the urban vision towards a “harmonious and livable” city with *Master Plan of Beijing (2016–2035)*. This plan draws three red lines based on the capacity of environment, to control population size (23 million), limit construction land in seven main zones (central city, a sub-center on the east, and five dispersed new towns in the suburb), and protect the ecological areas, reducing and reusing building stock whilst increasing green spaces^[14].

Interpreting this green vision through the theoretical lens is to make a critical projection about the goals, changes (strategies), and stakeholders (inclusion) in the context. The key word “harmonious” prefigures reciprocal human–nature interactions and vibrant social relations among individuals, groups, and in their relations to the society—a society comprising of environmentally conscious citizens who utilizes natural resources in a sustainable way. The key word “livable” emphasizes public health, and the life quality will be enhanced when human and nature systems are in a symbiosis relationship.

In terms of the potential spatial configuration of EI, ecological conservation zones (larger EI components) protect lakes, forests, and wetlands, for water provisioning, habitat supporting, and climate regulating; in rural and suburb areas, agricultural lands and green corridors are to be protected for food production, climate regulating, and water management; green open spaces in the central city are to be upgraded for outdoor activities, recreational uses, and scenic values—ecosystem services of these smaller EI components relate closely with citizens' physical, social, and mental health; regional and urban parks will be connected by a network of green ways to improve accessibility. But regarding social and mental dimensions, there are only goals like “enhancing public participation” and “increasing environmental awareness,” without detailed action plans to follow^[14].

A series of renewal projects have been working on EI components, guided by detailed planning with quantitative indices, based on national and local codes. Examples include the Beijing–Zhangjiakou Railway Heritage Park (since 2019) that

attempts to transform an abandoned railway into a green corridor and revitalize the commercial clusters and communities along the way; Cheng Nan Project in Qianmen East Area (since 2005) that reconstructs public spaces along the Sanlihe River; and Shougang Industry Services Park (since 2005, Shougang Park hereafter) that sits on a significant industrial district, covers various types of EI components, and involves social groups with different interests over years of intervention. This study takes Shougang Park as the case study, since the construction of the core area has been completed where citizens' feedback could be collected, and the rest parts are to be built in the following years, during which new findings could be applied and tested.

3.3 Case Study on Shougang Park

Shougang Park, covering an area of 8.63 km², is situated at the west end of Chang'an Avenue and along the Yongding River. As a previous iron and steel enterprise, the site accommodated furnaces, workshops, power plants, and railways, with dwellings, cultural center, and "Danwei Dayuan" (residential units for workers)^[29] over the 100 years of development. As one of the most important manufacturing bases in the country, the enterprise's expansion has increasingly eroded surrounding croplands and caused serious pollution problems, which could hardly be mitigated by simple greening interventions. Catalyzed by Beijing's economic restructuring and 2008 Olympics Games, all the plants were relocated to Caofeidian, Hebei Province in 2005. Shougang Group (SG) was eager to redevelop this abandoned site to rebalance the economic loss. But proposals were rejected by Beijing Municipal Institute of City Planning & Design (BMICPD) who valued the great legacy and aimed at a sustainable development. It gave rise to the challenge of how to regenerate the industrial remains for the developer, workers, politicians, academics, and professionals^[30].

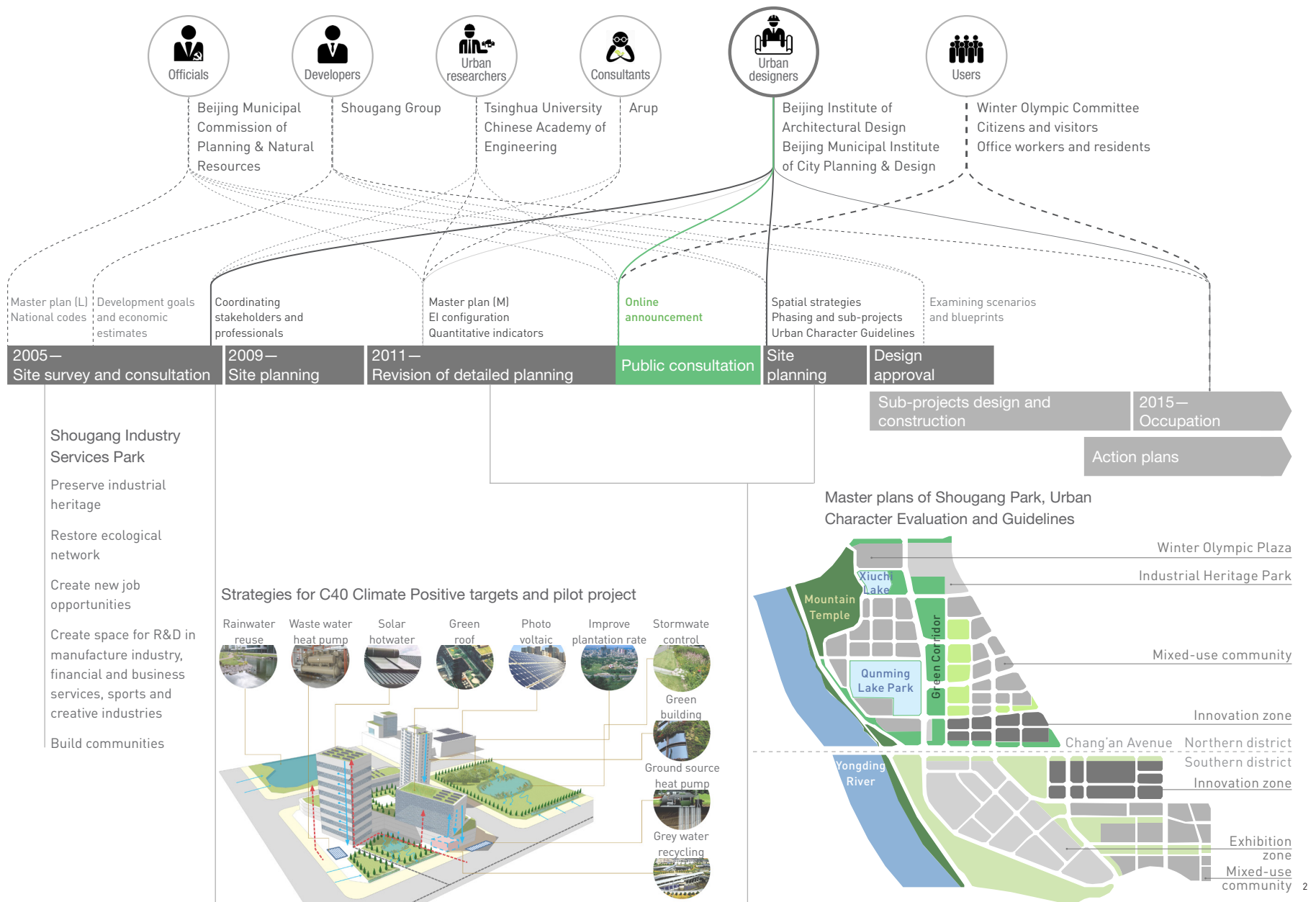
This case study examines the intervention process in terms of stages, actors, and strategies on the dimensions of environmental, social, and mental ecology (Fig. 2). During the consultation stage, a working team was formed, including representatives from SG (developer) and BMCPNR (government), urban designers from Beijing Institute of Architectural Design (BIAD), urban planners from BMICPD, and researchers from Tsinghua University (THU) and Chinese Academy of Engineering (CAE). The goals of Shougang Park was proposed to preserve the industrial heritage as a whole, restore ecological network, create new job opportunities and spaces for research and development in manufacture industry, and introduce financial and business

services, sports and creative industries, and communities for relocated residents and newcomers^[31].

The urban design proposal by BIAD set several zones, including Temple Mountain, Industrial Heritage Park, Winter Olympic Plaza, Mixed-use Community, Innovation Zone, and Exhibition Zone, connected by Yongding River, green corridors, and Chang'an Avenue^[31]. The consultants from ARUP provided a series of strategies on water, energy, waste, and transportation to reach C40 Climate Positive targets^{[32][33]} (showcased by a pilot project) and solutions to rehabilitating the contaminated earth in the south parcel of the site^[33]. The detailed planning by BMICPD^[31] adopted citizens' opinions collected through a 30-day online public consultation^[34]. The working team provided Urban Character Evaluation and Guidelines for sub-projects, which includes evaluation indicators for reusing existing structures and key features of zones, corridors, and urban interfaces. The core area (including Industrial Heritage Park and Winter Olympic Plaza) will highlight the most iconic blast furnaces (reused as museums), silos (reused as offices), coke ovens, and chimneys, connected by a sky walk on pipes and green corridors. The mixed-use community will accommodate offices, shops, restaurants, and apartments, dotted with industrial elements. In Innovation Zone, high-rises with multi-level greening and slow traffic system will take place of subsidized factories and draw a new image of Chang'an Avenue^{[35][36]}. The construction will be conducted in stages^[31].

3.4 Critical Evaluation on the Renewal Practice

The evaluation with triad indicators is to reveal the effectiveness and blind spots of the planned project. First, the built environment has been improved considerably, and the top-down process coupling with master plans does contribute to the restoration of EI. With a holistic view, the medium scale master plans follow the spatial configuration of EI in *Master Plan of Beijing (2016–2035)*, and clearly define the blue-green spaces by land-use zoning and detailed indices, which are precise to guide spatial transformation. An array of nature-based solutions has been applied on site and effectively revived EI components and enhanced ecosystem services gradually. Yongding River stretch has been restored, and the increased vegetation aside promotes micro-climate and biodiversity^[37]. A network of green corridors, with continuous footpath and cycle paths, connects open spaces and makes them more accessible. The sustainable drainage system aside makes this place more resilient during rain storms and improves micro-climate^[38]. The cooling lake becomes a big leisure park, and community gardens provide pleasant and healthier

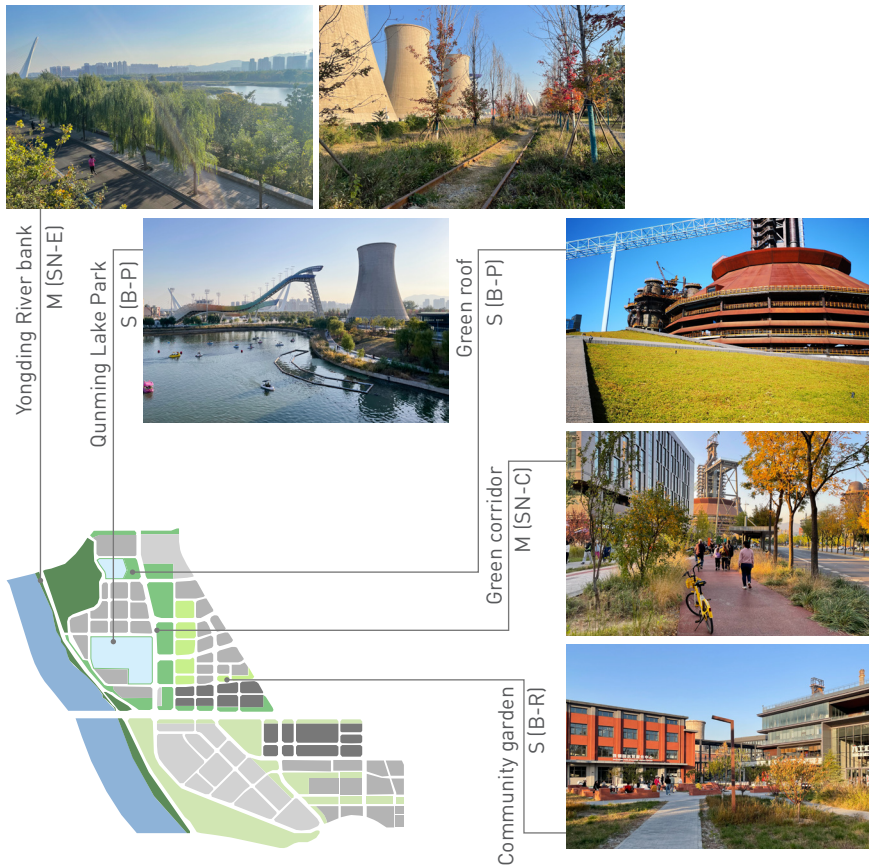


2. Intervention process (stages, actors, and strategies) of Shougang Park (sources: Arup; Refs. [20][29])

places for office workers and residents' gathering. The green roofs of renovated and new buildings catch rain water and provides aesthetic value (Fig. 3).

Second, urban designers have forged a relatively comprehensive collaboration between design professionals, developers, and government officers from the beginning, as well as with the users during online consultation^[31]. They have been integrating interdisciplinary skills and resolving conflicts between stakeholders. With the supervisory system that favors sustainable development, urban designers could better negotiate with the developers'

economic goals (that often goes against environmental ones), and make their co-work more efficient and productive (according to online interview). Yet, those professional technical drawings are not understandable to users, who had very limited time to express their needs, regarding the quality of space measured through their everyday perception and appropriation^[39]. There are few programs to gather residents and form community organizations similar to "Danwei Dayuan," which had been connecting workers and supporting harmonious social relations in the history of Shougang. This would intensify the social fragmentation, especially when



3. EI components restored in Shougang Park

previous residents were mobilized to new houses elsewhere and new comers could be introduced to this place.

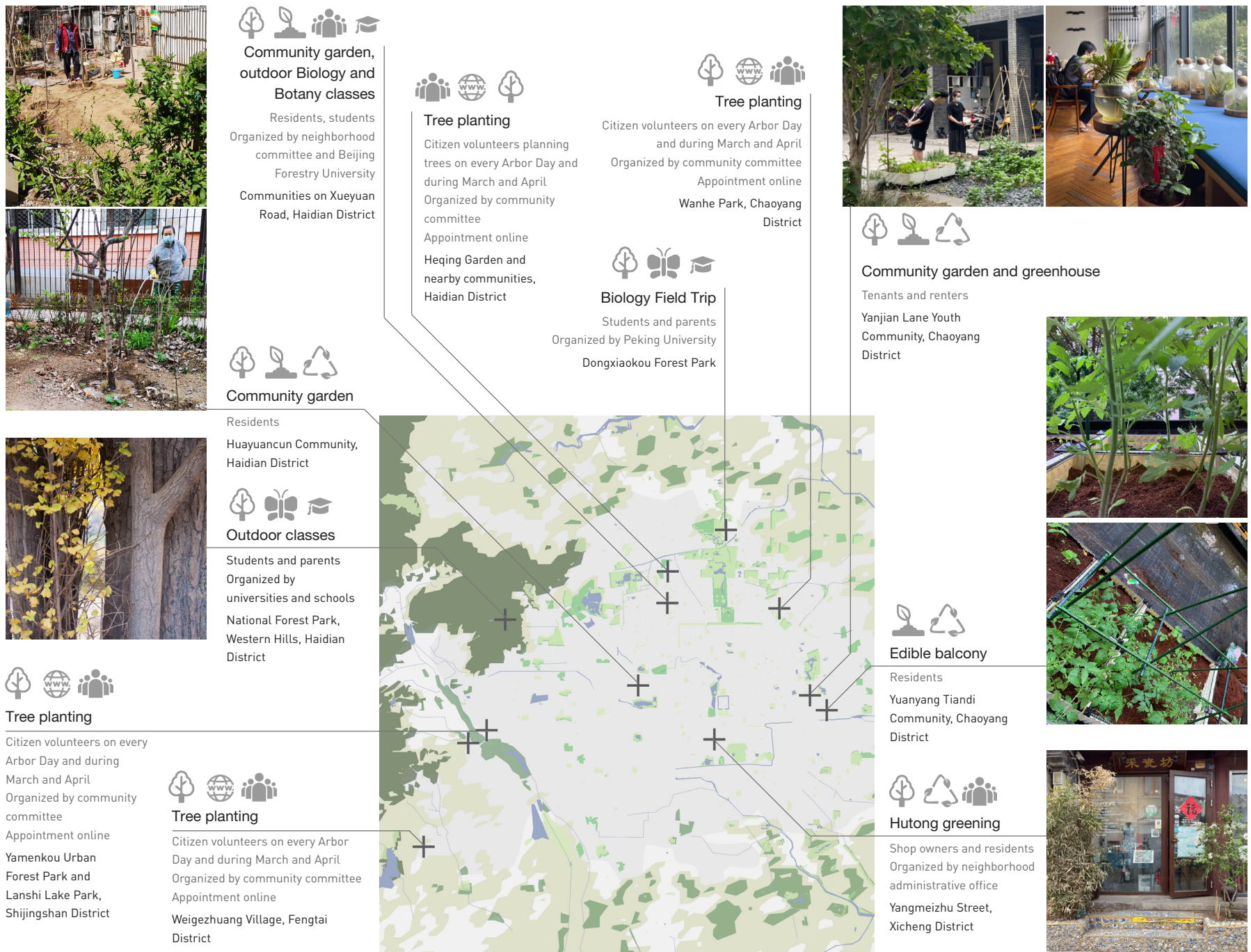
Third, the core area of Shougang Park becomes one of the cultural icons of Beijing and a popular destination for citizens and tourists^[40]. The strategies of “industry services park” are strong in branding by integrating heritage, humanity, and natural resources; and Urban Character Evaluation and Guidelines are creating local identity by shaping unique spatial features blending the natural and artificial boundaries, and enhancing human experiences. This place could properly serve local residents and office workers by supporting diverse lifestyles, as well as serving visitors by introducing the history of industrialization and providing enjoyable leisure time (according to online interview). Shougang spirit was carried on by exhibitions in Shougang No.3 Blast Furnace Museum where former workers act as tour guides. But the action plans mentioned little about programs to involve residents in the place-making process and build deeper emotional ties with the place than recreational values^[41]. Fragile as such a relation is, renewed EI components could be damaged by destructive human activities after occupation^[9].

4 Collaborative Ecological Regeneration

4.1 Potentials of Individual Eco-actions

While the evaluation reveals that the renewal projects are mainly consistent with the triad indicators on environmental ecology and show disparity on the social and mental ecology, spontaneous eco-friendly actions suggest a way to improve ecological practice. Various ongoing eco-actions spontaneously initiated by citizens and institutions were identified (Fig. 4). In Yuanyang Tiandi community, residents use planting boxes on balcony with composting kitchen waste to harvest organic vegetables (according to online interview). In Huayuancun community, residents appropriate vacant land to plant fruit trees and flowers, and build a summer pavilion covered by grape vines, where they exchange products and chat with neighbors. The tenants and renters of Yanjing Lane Youth Community grow vegetable and plants to build a garden and greenhouse together (according to site investigation). Some universities and schools have outdoor classes for children and students’ nature observation, such as Biology Field Trip held by Peking University^[42]. Although being a small amount, these activities show the potential of binding inhabitants to the land and nurturing the place attachment, which could be combined with those renewal projects in Beijing central city. Such low-tech actions are easy to replicate by curating in the design intervention process.

Further, those small scale acts should be coordinated to the extent that they contribute to the maintenance of EI components^[9]. Taking tree-planting events as an example (on every Arbor Day and during March and April), while the spots are chosen according to EI planning and saplings provided by local government, people could make appointment and design work plans online^[43]. Even better, the ecological actions could be jointly managed by professionals and institutions, like the case of regeneration project of Yangmeizhu Street, where designers collaborated with neighborhood administrative office and allowed shop owners and residents to participate in greening activities, making diversified shop fronts and streetscapes^[44]. Alongside Xueyuanlu Road, teachers from Beijing Forestry University designed a community garden and families voluntarily grow vegetables in plots. Biology and Botany classes are open to the community in return and become more and more popular. Such activities are well organized and guided by community committee and designers^[45], which not only promote social cohesion, but also build social resilience to cope with climate change conditions^[39].



4. Examples of spontaneous eco-friendly activities in Beijing (photographed by Biao Chen, Hua Ye, and Chi Zhang; sources: Refs. [42]–[45])
 5. Toolkit for collaborative ecological regeneration

4.2 Toolkit for Collaborative Ecological Regeneration

To merge the gaps, the mode of renewal practice should be evolved into “collaborative ecological regeneration” that aims at the threefold changes—restoring EI components, reviving inner-city neighborhoods, and rebuilding socio-environmental bonds—in a long term. Urban designers should play a pivotal role in combining

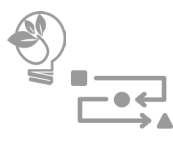
intermediary landscapes transformation with public participation. A toolkit (Fig. 5) is proposed to equip urban designers with adaptable strategies from case studies on international precedents and initiatives. It gathers an array of tools on three aspects matching the triad indicators and denotes the scales of human–nature reciprocity.

Rebuilding socio-environmental bond

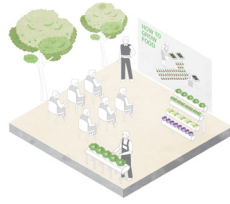
20 Online database
Sharing findings of outdoor classes (Billion Oyster Project, New York)



21 Green tour
Environmental literacy with pamphlet (Biology Field Trip, Beijing)



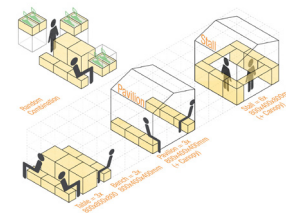
22 Outdoor classes
Biology and Botany (Communities on Xueyuan Road, Beijing)



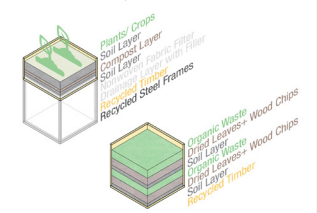
23 Tree planting
Based on online database (Arbor Day events, Beijing)



24 ECObox gardening
Building community gardens (ECObox, Paris)

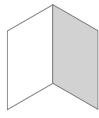


25 Waste recycling
Recycling measures combining with ECObox (ECObox, Paris)



Reviving inner-city neighborhoods

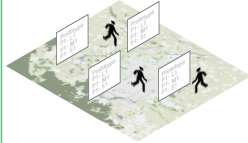
14 Pamphlet
With Urban Prototypes Collecting feedback (Billion Oyster Project, New York)



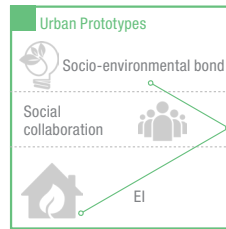
13 Online questionnaire
Broad reaching public consultation (Beijing-Zhangjiakou Railway Heritage Park, Beijing)



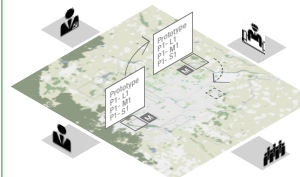
15 Interactive exhibition
Broad reaching public consultation (Greenwood Community Park, Los Angeles)



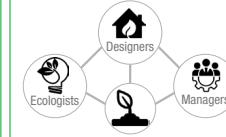
16 Urban Prototypes Cards
Linking tools across layers (Cross River Park, London)



17 Scenario Game
Public participation event With Urban Prototypes Cards (Cross River Park, London)



18 Interdisciplinary teamwork
For integrated design solutions (Shougang Park, Beijing)

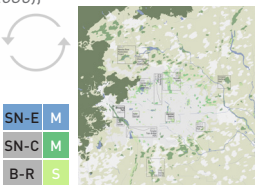


19 Community associations
Organizing productive activities (Communities on Xueyuan Road, Beijing)



Restoring EI components

1 Dynamic master planning
EI configuration based on BESP Renewal projects by replicating Urban Prototypes (Master Plan of Beijing (2016-2035))



2 Master plans
EI components Coordinating sub-projects (master plans of Shougang Park)



3 Urban Character Evaluation and Guidelines
Guiding sub-projects (Shougang Park, Beijing)



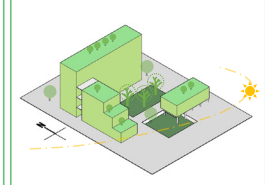
4 Community park
With multilayer planting and water features (Shougang Park, Beijing)



5 Community garden
With ECObox or greenhouses (Communities on Xueyuan Road, Beijing)



6 Green roofs and green walls
Renovating buildings into green buildings (Shougang Park, Beijing)



L 10 - 100 km | city-region

M 1 - 10 km | street-neighborhood

S < 1 km | human-building-site

In terms of environmental aspect, the toolkit retains master plans with EI configuration on city and neighborhood scales^[13], as well as Urban Character Evaluation and Guidelines to coordinate the sub-projects on EI components from scheme design stage to design development stage^[31]. Based on the scale and type of EI components, a group of nature-based solutions could be combined to restore the natural processes and enhance ecosystem services (referring to Shougang Park project). By removing impermeable embankment and restoring the marshes on floodplain, floodable river bank allows the natural fluctuation and recharges underground water. Bio-remediation purifies soil in brownfields and brings back greenery gradually^[8]. Grey infrastructures could be upgraded with multifunctional green corridor; sustainable drainage system, and continuous barrier-free slow traffic system accordingly, creating an infrastructure network and improving accessibility for citizens. Community parks, with multi-layer planting irrigated by reused rainwater could provide healthier places for diverse recreational uses^[38]. Community gardens managed by residents with ECObox could be more responsive to diversified users' needs of gathering events^[46]. Buildings, renovated with green roofs and walls, could catch rainwater and provide healthier gathering spaces^[35].

As for social aspect, tools to engage users can support inclusive collaboration, besides interdisciplinary teamwork between professionals, developers, and officials. This co-design allows users to get involved in the vision of places from the beginning, where sharing knowledge is the key to promote public participation^[47]. This process demands urban designers to visualize concepts and make professional drawings more legible and understandable^[9]. It also should emphasize feedback collection, as communication happens mutually, and information is better carried by proper media and communication tools, such as pamphlet, website, and Apps. Investigating citizens' comments via online questionnaire is applicable for initial public consultation widely. Scenario Games and Urban Prototypes Cards^① could allow people to imagine certain places. In interactive exhibition, people can be guided to share more specific responses to certain scenarios, such as a walkable master plan (referring to Greenwood Community Park Project)^②. Such events are shaping an urban renewal project more responsive to people's desires and enhancing social cohesion of local communities^[39]. Community associations could vibrantly relate residents to each other, when organizing productive events together (referring to communities on Xueyuan Road).

Tools on the mental aspect shows another way of public participation, letting obliged collectives and individuals to co-build EI components and to participate into the maintenance after

occupation^[9]. This demands developing small tasks from urban scale to human scale, but coordinated with a big picture, like tree planting activities in Beijing^[43] and the "ECObox" case in Paris^③. Such material changes and new life patterns are based on people's environmental literacy. Green tour and outdoor classes, provided by local schools and urban designers, could serve as an entry point for citizens and students to observe wildlife, native species, and to learn how humans and nature interact in certain EI components, even to be trained to be monitors (referring to Biology Field Trip and Billion Oyster Project)^④. The data collected and findings could be stored in online databases and be shared with schools and scientists as a public asset.

4.3 Application of Urban Prototypes in Shougang Park

Prototype, in essence, relates not only to the future—testing new ideas, techniques, and incubate pilot projects, but also to the past—modelling successful practices for study and setting benchmarks of change. Urban prototypes often connect existing processes with new visions, the design of which is more about organizational form than material realities^[19]. It only takes a certain number of prototypes to adapt to different urban conditions. While considering infrastructure a set of relations and processes, the variable or mobile parts could also react to urban dynamics or climate change in time. Therefore, the application of this toolkit centers on Urban Prototypes that organizes tactics across two or three aspects, upon a type of EI component on a certain scale.

For Shougang Park project, five Urban Prototypes could be developed regarding five EI types:

- 1) community garden: small-scale urban agriculture in residential area;
- 2) green roofs: small-scale green open spaces;
- 3) green corridors: medium-scale green corridors connecting

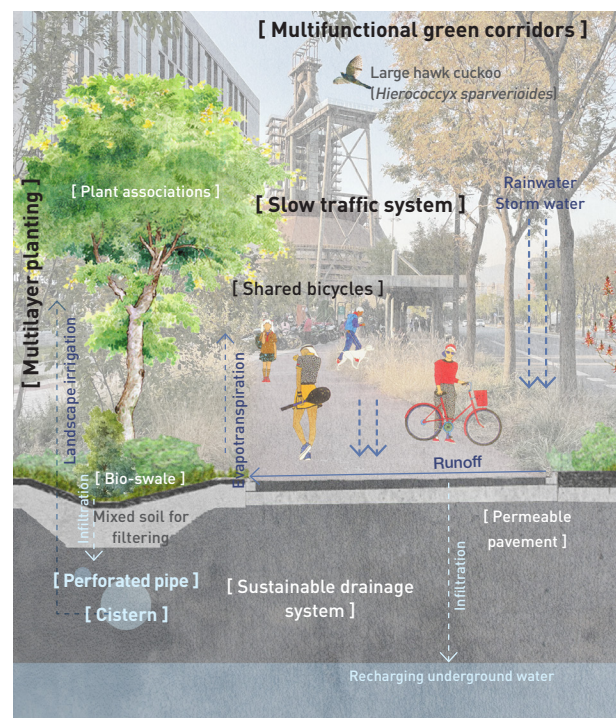
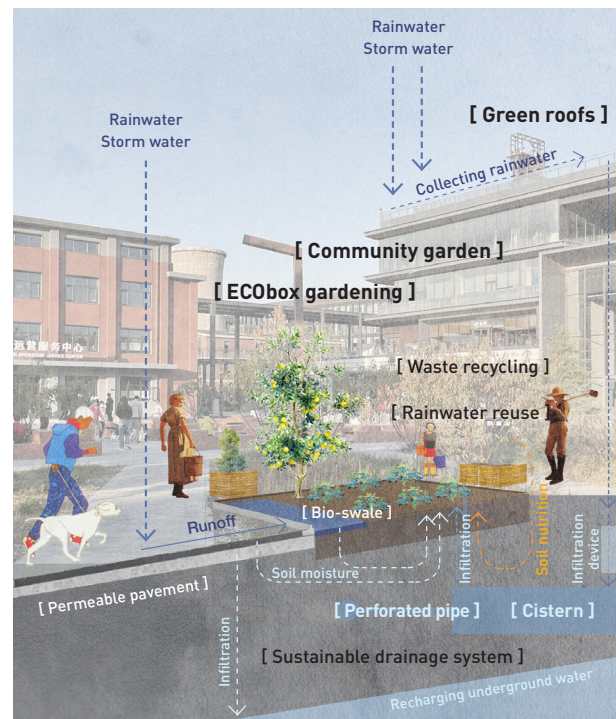
① In the case of Cross River Park in Thames Gateway of London, urban designers held a Scenario Game workshop, where stakeholders and users resolved conflicts together and visioned desirable futures, each of which is composed of several prototype cards. Each card with a serial number usually visualizes a certain issue and possible change. These cards are accumulated through years of practice and research by CHORA, making professional knowledge accessible to the participants, thus making the workshop more productive [source: Ref. [19]].

② Designers from Sasaki have held several interactive exhibitions in order to define the vision for Greenwood Community Park, Los Angeles. During early stages, people were invited to make collages with small pictures to show their desirable futures. During the final public meeting, a 7.2 m × 6.6 m in walkable master plan made stakeholders feel like going through the park so that they could give specific comments [source: Ref. [47]].

③ ECObox is a mobile module easily made by recycled materials with user-guide. People may use it simply as a seat, or to grow vegetables and compost organic waste, as a type of urban agriculture. Boxes could be assembled to transform vacant space into a temporary garden for gathering events, namely ECObox gardening. Such activities continued after the curation of urban designers from atelier d'architecture autogérée and became self-managed by residents themselves in Paris (source: Ref. [48]).

④ In the case of Billion Oyster Project in New York, designers from SCAPE made an "Oyster Gardening Manual" and trained, local young people to monitor the growth rate and healthy status of oysters that form living breakwaters; the data have been continuously uploaded to a website and shared with other schools and scientists (source: Ref. [9]).

6. An example page of Urban Prototypes pamphlet: community garden
7. An example page of Urban Prototypes pamphlet: green corridor

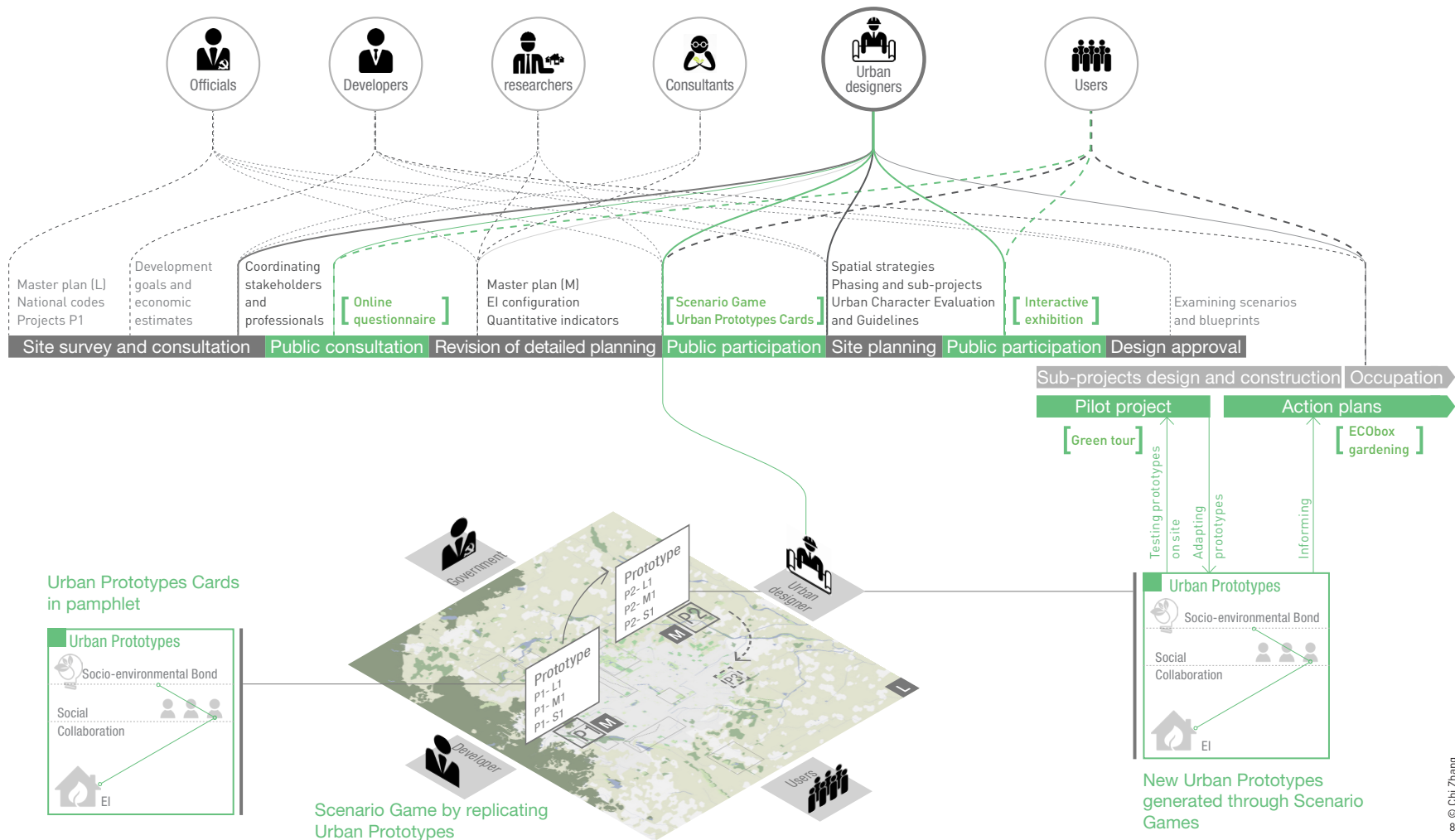


parks and communities;

- 4) lake park: medium-scale blue-green open space;
- and 5) floodable river bank: part of large river corridor.

It is to conceptualize previous practices, connect them with new tools, and conceive how to integrate the nature and (newly proposed) human processes. The pamphlet makes the knowledge

more understandable to the public, such as that about how nature-based and engineering solutions are restoring ecological processes and how social actions related to them (Figs. 6, 7). It could be shared with users who explore the site and engage in the transformation, as well as collecting their feedback for new programs and action plans after occupation. The planting and



8. Open-ended regeneration process for future urban renewal projects

maintaining tasks could be shared by local volunteers with knowledge and skills. Local school teachers could lead students to monitor those native plants and animals and share data online. This will also build strong emotional bonds between inhabitants and the co-built communities.

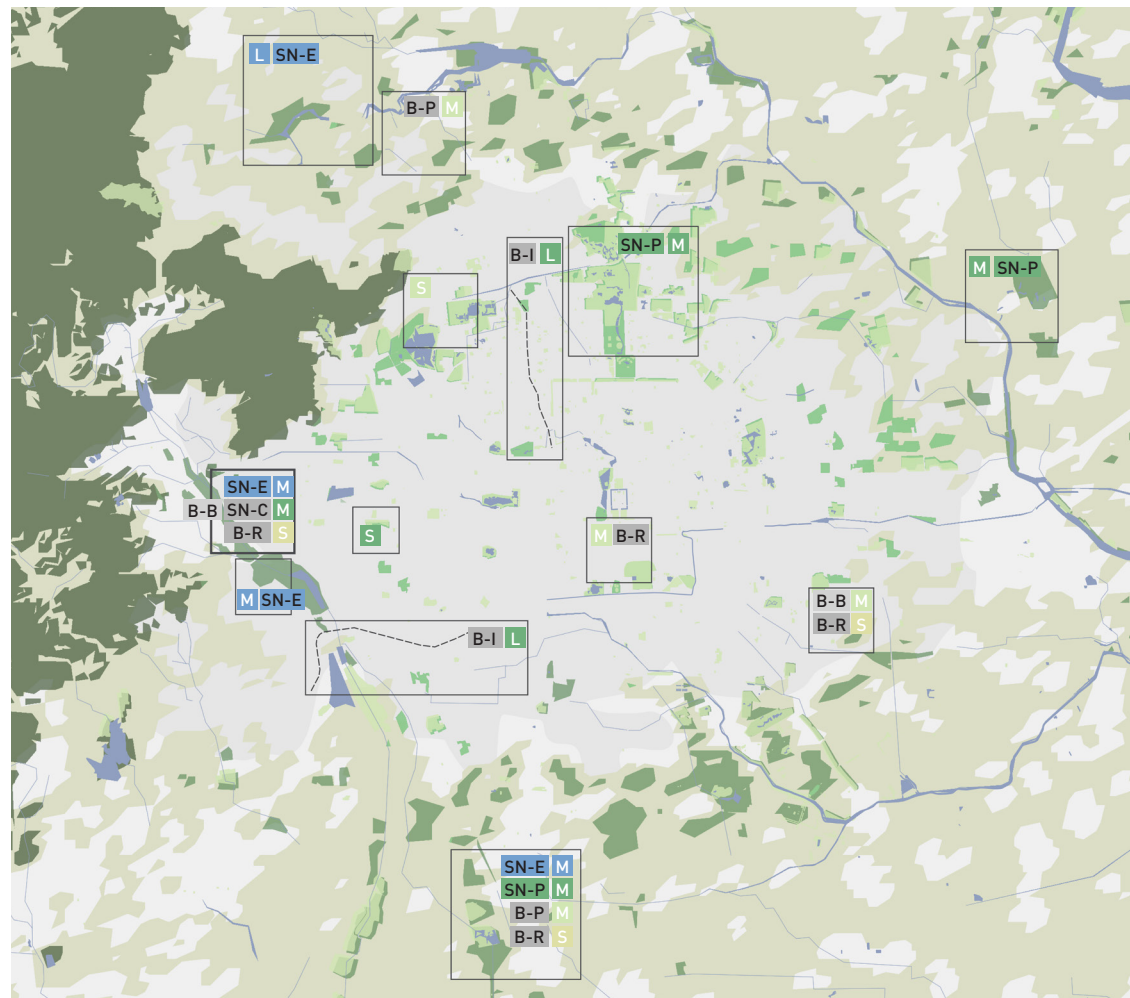
4.4 Replication and Dynamic Master Planning

A renewed process (Fig. 8) for future projects further explores the replication of Urban Prototypes and the engagement of users. It locates multiple participation tools to facilitate communication at specific stages. During site survey, urban designer can collect big ideas with the broad-reaching tool—online questionnaire. With Scenario Games in site planning stage, all stakeholders—users, developers, and officials—are able to share their prospects by remixing urban prototype cards in the pamphlet, and negotiate

with each other. Interactive exhibition could gather comments more effectively on certain scenarios from targeted groups. The findings could be experimented through a pilot project, such as “green tours,” which engages users in the way they chose from the pamphlet, to test their ideas and collect feedback. The successful programs will inform broader action plans, as well as forming new prototypes to add into the pamphlet.

As new projects replicate Urban Prototypes, they are adapted to different environmental and social conditions. Every renewal project could be an “incubator” of Urban Prototypes, also a “document” afterwards. Mapping them together makes “dynamic master planning” (Fig. 9). It reforms the tradition of government making exemplar or showcase like Shougang Park into an iterative, open-ended city-making process, which is more responsive to needs of various stakeholders, as well as urban dynamics and climate

Urban Prototypes based on EI types



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9. Dynamic master planning through replication of Urban Prototypes

changes. This confirms the potentials of neighborhood-scale projects in linking multi-scale actions^[9]. They will serve as a ground where mega initiatives on infrastructures meet daily life of citizens, so as to support the green vision of Beijing.

5 Conclusions

This study mapped Beijing's green vision and inner-city renewal projects through a theoretical lens with three interrelated themes. A critical evaluation on Shougang Park revealed the high effectiveness of top-down planning in restoring EI components and boosting ecosystem services. It is also impelling in forging a collaboration with officials and developers coordinated by urban designers and negotiating with economic goals. But gaps have been identified in users' engagement and building the socio-environmental ties

concerning individuals' eco-actions.

To merge such gaps, a new practice mode, collaborative ecological regeneration, is proposed, claiming the role of urban designer to facilitate the co-evolution of nature and human systems. It is supported by a toolkit including adaptable strategies on three aspects, to care for EI components, form inclusive social collaborations, and rebuild socio-environmental bonds. Then the proposed application to Shougang Park centers on Urban Prototypes that combine strategies with new tools from social and mental aspects. In the format of a pamphlet, such urban prototypes demonstrate possible ways to integrate human cooperation with biological partnership to be tested on site. The prototypes are adaptive to different urban conditions and could be replicated among central city, by an open-ended city-making process and dynamic master planning.

Thus this new mode of ecological practice could be explored over time in the context of Beijing, or China, in broader terms. While adapting the toolkit with trials and errors, one project after another, urban designers can develop the capacity of coordinating multi-scale actions and landscapes. It is promising to find a ground where individual actions can be integrated into the long-term established top-down city-making mechanism, and even create a feedback loop where practice inspires policy.

In terms of limitations, this study has not investigated all the renewal projects in Beijing. Future research could also include the samples from other cities in China, so as to build a more comprehensive collection of Urban Prototypes. Then it could link the urban design processes discussed in this article to architectural systems that explore specific prototypes and grey-green hybrids with aesthetic delights, in reference to the “ethico-aesthetic paradigm”^[7].

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协作式生态更新 ——采用适应性工具包重塑生态基础设施并以北京市实践为例

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摘要

在全球可持续生态城市建设浪潮中，北京以“和谐宜居之都”为目标，基于生态安全格局制定《北京城市总体规划（2016—2035）》，并在中心城区实施了一系列生态基础设施改造项目。本研究基于生态都市主义理论，指出这些城市更新实践是联系城市绿色愿景与个人日常行为的关键。本文构建了一个包含环境生态、社会生态和心理生态三个维度的理论框架，并设定了生态更新实践的三重评价要点：修复生态基础设施、激活社区、重建社会-环境共生关系。本文据此评估北京首钢工业遗址公园项目的城市更新过程，发现其中有机会构建景观与公众参与活动、市民环保行动的关联。本文提出改进的实践模式——“协作式生态更新”，强调结合中尺度景观更新与市民参与，并提供包含三个维度上设计策略的适应性工具包，在修复中小尺度生态基础设施的同时，可形成包容性社会协作平台并提升个人环境意识。其中的关键工具“城市原型”既能联系不同维度上的策略，又可将实践经验概念化，进而应用于构建新策略。作为示范，本文将之应用于北京中心城区实践，展示出这种新的实践模式的开放式城市更新过程，在适应不同城市条件与利益相关者需求的过程中形成新的城市原型，可有助于逐步构建北京的绿色未来。

关键词

城市更新；
生态基础设施；
协作式生态更新；
包容性社会协作；
社会-环境共生关系；
城市原型；
公众参与；
首钢工业遗址公园

文章亮点

- 城市更新实践有助于将北京的绿色城市愿景与城市居民个人日常行为协调统一
- 协作式生态更新过程有助于构建一系列激活自然群落和社区的纽带
- 适应性工具包提供修复生态基础设施、激活社区、重建社会-环境共生关系的设计策略
- “城市原型”工具有助于协同中尺度景观更新与公众参与

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