从河滩到新城
——京西稻地河滩的水适应性历史与愿景
From Flood Land to New Urban Area:
Water Adaptation History and Visions for Daodi Flood Land in the West of Beijing

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摘要

稻地河滩位于北京市门头沟区境内，东临永定河，属京西永定河下游区域一片相对独立的洪积滩地，也是京西永定河沿线最大的一片河滩景观特征区域，蕴含了丰富的人－水互动历史信息，同时又面临典型的乡村城镇化趋势与问题。本文以稻地河滩为实证对象，以适应性作为研究视角，介绍了适应性的概念及基本研究框架，从空间尺度、时间尺度和参与者三个方面梳理了适应性的研究趋势，同时对研究区域的典型性进行分析，针对研究地域缺乏连续、准确历史数据的现状，运用空间制图、问题和解决方案树等参与式方法，对洪水、农业灌溉、水资源利用等方面的问题进行文献资料与实地验证相结合的证据收集与分析，在此基础上提出一系列面向未来的基于景观与文化层面的水适应性发展愿景，最后对适应性问题、自然系统和社会系统、消极适应和积极适应、有计划适应和无计划适应之间的结构性关系进行了进一步深入探讨，以期为类似地域的研究及适应性方法的应用提供借鉴。

关键词

水适应性；河滩；京西；参与式方法；空间制图；问题和解决方案树；景观；文化

ABSTRACT

Daodi Flood Land, located in Mentougou District of Beijing, is a relatively separate flood land in the lower reaches and on the east of Yonding River. This largest landscape character area in the west of Beijing along the river illustrates the history of human–water interaction and discloses the trends and problems of rural urbanization. Focusing on Daodi Flood Land, this paper expands the research on adaptation by introducing basic concepts and research framework, and reviews the research trends from spatial, temporal, and participant aspects. Considering the typical characters of the study area, this research employed participatory approaches, such as mapping and problem and solution trees, due to the lack of continuous and accurate data. Basing on literature review and field investigation on issues of floods, agricultural irrigation, and water resource utilization, water adaptive development visions for the study area were proposed from perspectives of landscape and culture. Finally, the paper further analyzes the structural relations between adaptation problems, natural and social systems, passive and active adaptations, and planned and unplanned adaptations, with the aim to provide reference for relevant studies and applications of adaptation approaches in other cases.

KEYWORDS

Water Adaptation; Flood Land; West Beijing; Participatory Approach; Mapping; Problem and Solution Trees; Landscape; Culture

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1 前言

适应性（adaptation）是“对实际或预期的气候及其影响进行调整的过程”，在人类系统中，适应旨在通过预期的、自主的和/或有计划的行动减缓或减轻有害影响或利用有利的机会。[1]1999年，巴里·斯米特等人首次提出了适应性研究的系统框架[2]，涵盖“适应什么”（适应客体）、“谁或什么来适应”（适应主体）和“如何适应”（适应过程及方式）等问题。其中，适应客体为气候变化及非气候的压力和条件，既包括负面响应也包括正面响应，既包括当前响应也包括预测响应①；适应主体指与人、社会和经济相关的部门及活动，受管理或未受管理的自然或生态系统，及其实践、过程与结构；适应过程为主体对客体进行适应的方式及适应策略的选择，分为自发性适应和计划性适应两类。

自20世纪末到21世纪初，适应性研究多集中于自然科学领域，主要针对温室气体排放、海平面上升等全球气候变化问题，采用定量研究的方法，通过基于指标的大尺度模型预测来提供不同目标或不同路径的适应性解决方案[3]；在空间尺度上多针对国家、区域及全球层面，在时间尺度上多以几十年甚至上百年为跨度，呈现一种“自上而下”的研究模式[4]~[6]，对更小尺度的“自下而上”的适应性问题关注较少。相比之下，适应性研究在社会科学领域的兴起主要集中在近十几年，原因包括两点：一是社会科学自身研究领域的拓展，如历史学科中历史气候学的兴起[7]、地理学科中文化景观研究的兴起等[8]，这些新学科视角为适应性研究提供了基础；二是人们愈发认识到适应性在很大程度上受到社会和文化因素（如价值观与知识局限[9]）的制约、地域性工程技术与政策的影响[10]、长时期社会过程的影响等[11]。这种转变也反映了适应性研究的新趋势（图1）。

水适应性（water adaptation）是适应性研究中的重要专项，可理解为“对实际或预期的水环境变化及其影响进行调整的过程”，简单来说，水适应性是人—水相互适应的过程及其表现[12]。从气候适应性的范畴来看，人—水相互适应具有突出的典型性及现实意义——截至21世纪初，约80%的世界人口面临各种形式的水安全问题[13]。此外，人—水矛盾在乡村区域更加突出：首先，水在乡村区域的生产与生活活动中发挥着关键作用，随着气候变化及区域发展影响的加大，水资源的时空分布不均问题日渐显著[14]；其次，部分乡村在区域城镇化发展背景下受到短期经济利益博弈的影响，长久以来形成的人—水适应性景观与文化往往很难得到保护与延续，从而可能导致新的人—水不相适应的问题[13]。

① 负面响应是对不利影响或弱点的反应，正面响应是对有利条件或机遇的反应；当前响应是对当下的、实际的条件的响应，预测响应是对预期条件、变化或后果的响应。

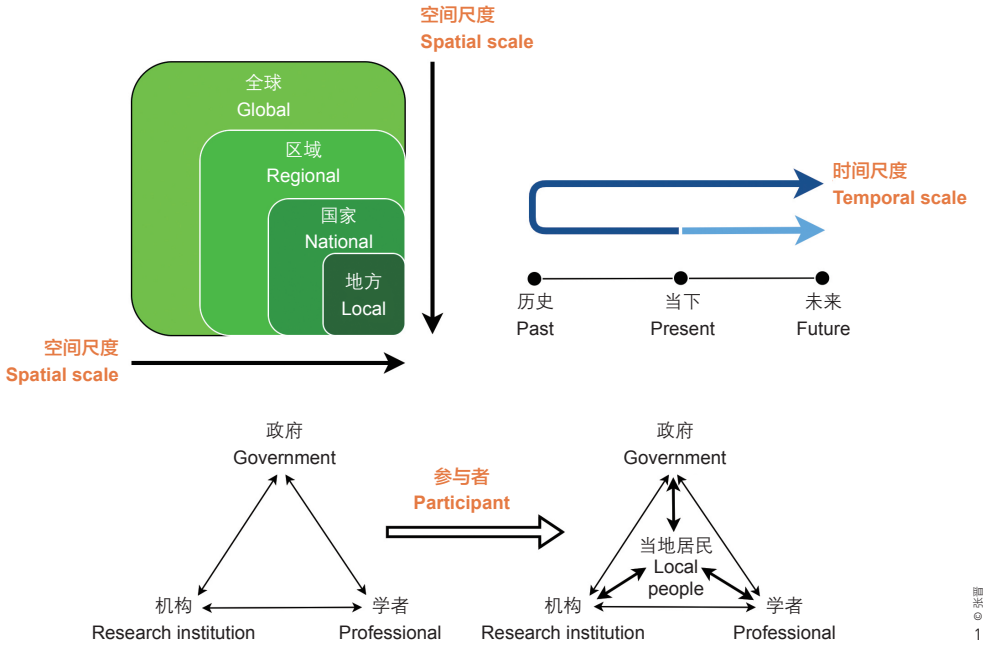
1 Introduction

Adaption is “the process of adjustment to actual or expected climate and its effects,” and in human systems, adaptation seeks to moderate or avoid harm, or exploit beneficial opportunities with proposed, spontaneous and/or planned actions.[1] In 1999, Barry Smit first proposed the systematic framework for adaptation research[2], which covers issues of “adaptation to what” (object of adaptation), “who or what adapts” (subject of adaptation), and “how does adaptation occur” (the process and form of adaptation). Objects of adaptation are climate-related stimuli or non-climate forces/conditions, and the existing or possible responses to which can be both adverse and active①. Subjects of adaptation include people, social, and economic sectors and activities, managed or unmanaged natural or ecological systems, or practices, processes or structures of systems. The question of how does adaptations occur refers both to the processes and the forms of adaptation, including autonomous adaptation and planned adaptation.

Around the turn of the 21st century, research on adaptation was mainly seen in natural sciences and often adopted quantitative methods to probe into global climate change problems such as greenhouse gas emission and sea level rise. For instance, some of the research provided multi-objective or multi-pathway adaptive solutions by utilizing large-scale modeling prediction with varied indicators[3]. At that time, such top-down research was largely conducted at national, regional, and global scales with long time spans from decades to hundreds of years[4]~[6], paying less attention to smaller-scale bottom-up issues. In the past one or two decades, the focus of adaptation research has shifted to social sciences as 1) the expansion of social sciences, such as the emergence of Historical Climatology in History[7] and Cultural Landscape in Geography[8], which provides new research perspectives; and 2) a profound understanding of the influence on adaptation by social and cultural factors (value and knowledge limitations[9]), regional engineering technology and policies[10], and long-term social development[11]. This transition also implies the new interests of adaptation research (Fig. 1).

Water adaptation, an important branch of adaption study, can be understood as the process of adjustment to actual or expected water environmental change and its effects, i.e. the process and manifestation of the mutual adaptation between humans and water systems[12]. In responding to the impact of climate change, this mutual adaptation is typically critical as nearly 80 percent of the world’s population are exposed to high levels of threat to water security[13]. Research has also shown that conflicts between human and water are severer in rural areas compared with urban areas. One reason is that great pressure from climate change and regional development aggravates the uneven temporal–spatial distribution of the water resource vital for rural production and living[14]. Another reason is that human–water adaptive landscapes and cultures formed over the long history can hardly be conserved or continued when competing with the massive urban development in rural areas for short-term economic profits, which has led to new types of human–water conflicts[13].

① Adverse response directs at adverse effects or vulnerabilities, while the active one is the response to advantages or opportunities. Existing response directs at current and actual conditions, while possible response is to anticipated conditions, changes or consequences.



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1. 适应性研究的新兴趋势。在空间尺度上，由全球、区域、国家层面的宏观预测逐步细化至具体的地域及问题。在时间尺度上，由未来模型预测转变为首先回溯历史、再结合当下展望未来的研究模式。研究的参与者由原来的政府、机构和学者主导转变为鼓励当地居民参与的模式。

1. Emerging interests of adaptation research. At the spatial scale, research objects shift gradually from macro-scale prediction at global, regional, and national scales to local areas and specific issues. At the temporal scale, research modes change from the modeling prediction of future conditions based on current situations to a combination of historical data study, current situation analysis, and future envisions. Regarding participants of the research, more and more local people are encouraged to contribute to the research, instead of governments, research institutions, and professionals, previously.

稻地河滩位于北京市门头沟区，属京西永定河自三家店出山后的一片相对独立的洪积滩地区域，面积约650hm^2。本文选取稻地河滩进行水适应性研究的主要原因为：首先，该区域在历史上是永定河流域最大的一处河滩，其空间范围与人居环境因河道历史变迁呈现出极为鲜明的动态变化特征——早在元朝（1271—1368）之前就已经形成了固定的人类聚居点并开垦出农田，于明朝（1368—1644）初步形成了供水和防洪设施，至清朝（1636—1912）已建成相对系统化的水利设施，为水适应性研究提供了重要的历史样本。第二，近代以来，该区域受河道水量锐减、区域产业调整和城镇建设等一系列因素影响，整体人居环境发生深刻变化，呈现了由兴盛走向衰败的变化过程，这一过程中所体现的一系列复杂关系——尤其是其中的“适应性限制”——为水适应性研究提供了难得的过程性样本。第三，近年来，永定河在城乡发展中的价值逐渐凸显，河滩地带作为永定河生态廊道的核心缓冲区域，是保障河道生态安全和承载山地区域生产生活的首要空间载体。该区域位于门头沟新城南部，是门头沟区域协同发展带、西山永定河文化带及长安街西延线三线交汇的枢纽，也是门头沟新城未来的重点发展区域，其所承载的生态及历史文化价值需进一步挖掘与重塑[15]。

在上述背景下，本文将适应性研究框架下的水适应性作为研究视角，以京西稻地河滩为研究对象，结合多种社会学研究方法，以期为景观适应性研究提供新思路。研究内容主要包括：1）全面梳理研究区域的水适应性历史；2）记录并分析各历史阶段的水适应性策略及限制因素；3）结合区域发展战略提出研究区域未来的水适应性发展愿景及策略。

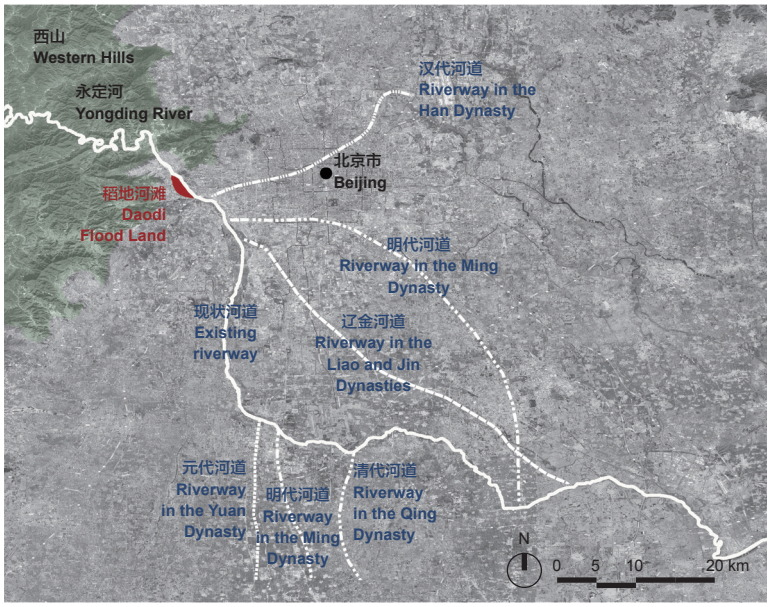
2 研究区域与方法

2.1 研究区域

稻地河滩位于永定河下游流域，其具体范围为西河与永定河主河道

This research focuses on the Daodi (rice cultivation area) Flood Land in Mentougou District of Beijing. Covering an area of 650 hectares, it is a relatively separate flood land in Yonding River basin after it flows through the mountainous area near Sanjiadian Village in west Beijing. The selection of this study area has three reasons. First, historically it was the largest flood land in Yongding River basin with distinct spatial and human settlement transitions due to waterway moves from side to side. Human settlements and farmlands already emerged on the flood land before the Yuan Dynasty (1271–1368); in early Ming Dynasty (1368–1644), the water supply and flood control facilities were initially shaped, and then developed into relatively systematic water conservancy facilities in the Qing Dynasty (1636–1912). Secondly, in modern China, the flood land settlement environment have dramatically changed when the water flow of Yongding River decreased sharply, regional industries restructured, and urban development accelerated. These challenges made the production on the flood land decline. The related complex causality (especially limits to adaptation) in an ideal sample for adaptation research. Thirdly, in recent years, Yongding River plays a more and more important role in urban and rural development: the flood land now acts as the core buffer zone in the Yongding River Ecological Corridor that guarantees ecological security of river course and supports production and living in mountainous areas. Moreover, the flood land is located in the south of Mentougou New Town and sitting on the hinge of Mentougou Regional Cooperative Development Belt, Western Hills–Yongding River Cultural Belt, and Chang’an Street West Extension Line, having great ecological, historical, and cultural values to be explored and celebrated[15].

In this background, this research takes Daodi Flood Land as the study area with multiple research methods adopted from Sociology to explore a new landscape perspective for water adaptation studies. The research includes 1) review of the



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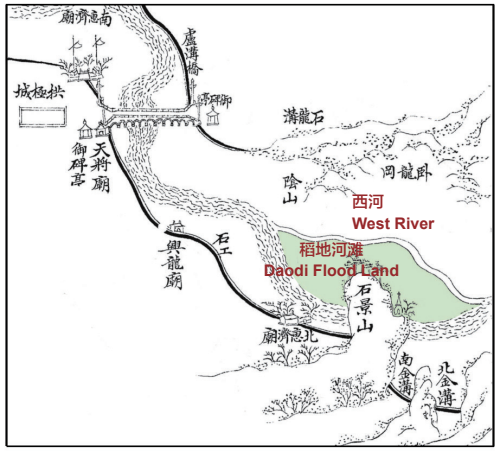

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2. 永定河河道变迁（自汉朝至今）
3. 永定河源流全图中的稻地河滩（来源：参考文献[20]）
4. 稻地河滩现状。图片拍摄自稻地河滩南端卧龙岗村山顶，图中的高层住宅是河滩未来城镇化图景的缩影。

2. Riverway changes from the Han Dynasty to the present
3. Daodi Flood Land in the ancient overview map of Yongding River basin (Source: Ref. [20])
4. Photo of the existing Daodi Flood Land taken from the top of a mountain in Wolonggang Village at the south of the flood land. The high-rise residential buildings will be increasingly constructed in future urbanization of this area.

之间所夹梭形河滩地。辽金时期（907—1234）潭柘寺的僧人在此引浑河（永定河旧称之一）水灌溉淤地种植水稻，形成寺产租地，由此得名“稻地”，古时亦名“下滩”[16]。

西河是历史上形成的永定河分支河道，长约20里[17]。据文献记载，西河至迟在元朝就已经产生，由永定河出山后的洪水冲刷而成，因而容易产生“断续不常”的情况（图2，3）[18]~[20]。自20世纪八九十年代开始，永定河水量减少，西河逐渐断流，原河道由于集沙量大成为集中采沙区，河道遗址被破坏殆尽。后加之门头沟新城实施大规模城市建设，如今仅保留了西河南段绿海运动公园及金安路以南的小股渠化河道，周边村落的居民也已大多迁至他处，仅原有村名得以沿用（图4）。

2.2 数据收集与分析

由于研究区域缺乏连续、准确的历史数据，研究采用参与式方法进行相关信息和数据的收集、整理与分析。参与式方法产生于20世纪90年代，是一种自下而上的研究方法[21]，可通过多种参与式工具的组


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water adaptation history of the study area; 2) records and analyses of the water adaptation strategies and limits; and 3) water adaptation proposals basing on regional development strategies.

2 Study Area and Research Methods

2.1 Study Area

Located along the lower reach of the basin, Daodi Flood Land is a shuttle-shaped area between the West River and the main channel of Yongding River. In Liao and Jin Dynasties (907–1234), monks from Tanzhe Temple drew water from the Hunhe River (old name of Yongding River) to irrigate the rice fields. Then the flood land was named “Daodi” or “Xiatan” (the lower beach)[16], where gradually became rented land owned by the temple.

The West River, historically a branch of Yongding River, was about 10-kilometer long[17]. According to documentary records, it was formed no later than the Yuan Dynasty by sediment deposition during floods and sometimes dried up (Fig. 2, 3)[18]~[20]. Since the 1980s and 1990s, as the water flows of Yongding River decreased, the West River has fully dried up. The waterway heritage has been damaged by sand dredging. In recent rapid urban development, only short canalized sections south to the Lvhai Sports Park and Jin’an Road of the West River remain. Most of residents from the original villages in the study area have been resettled, and the village names remain (Fig. 4).

2.2 Data Collection and Analyses

Due to the lack of continuous and accurate historical data about the study area, this research employed participatory approaches to information and data collection, processing, and analyses. Developed in the 1990s, participatory

合使用来了解复杂性问题[22]、分析不同专业从业者和利益相关者的理解与认知[23]、协助适应性规划及设计结果的生成[24]等。

数据的收集与分析主要分为两个阶段：首先是基于历史影像的空间制图，其次是基于适应性研究框架的问题和解决方案树（problem and solution trees，以下简称PAST）构建。

空间制图是一种融合了视觉思考与表达的方法，也是在景观特征研究中常用的基础方法之一[25]，强调以可视化的方式获取信息及探索、分析和整合空间数据[26]，挖掘场地内部隐性特征，构建和表达空间关系，从而形成空间认知[27]。制图者需要对大量的信息进行挖掘、过滤、处理，最终形成一套完整的、系统性的图示表达。从这一角度来说，空间制图融入了制图者的个人思考，因受其选择和判断影响而带有强烈的主观色彩。在相关参与式研究中，空间制图常被视为展示景观资源空间分布和实施针对性调研的基础[28][29]。研究在文献研究的基础上，首先通过美国地质调查局照片数据库获取了研究区域最早的1964年的黑白卫星影像，图中清楚地呈现了研究区域内的河流分支情况；而后通过谷歌地球获取了研究区域2002年与2020年的卫星影像，以确定研究区域的确切范围，并探究河滩受城镇化发展的影响和河流水量变化；最后在初步空间制图的基础上，采取样带行走②[30]的方法，与当地居民共同进行现场验证，以建立对场地空间及景观的认知。

PAST是一种借助图表制作进行研究的参与性工具，主要通过解构问题来确定问题产生的原因、评估问题的影响，以及确定当前和潜在的干预措施／解决方案[31]-[33]。本研究中PAST的构建与其他相关研究有两点不同：首先，“树”的内容以斯米特提出的适应性研究框架为基础，一是因为“树”与适应性研究框架之间在“问题—原因—措施”这一逻辑上相似，二是因为由此生成的PAST有助于进一步体现适应性研究的特点。其次，“树”采取纵向时间轴与横向问题轴相结合的形式，新增的纵向时间轴将不同时期的适应性问题与限制更加直观地展示出来，强调了历史与未来的关联及历史语境对解读社会动态变化的重要性，而这些历史信息又与人们对环境的感知与表达息息相关[9]。在“树”的构建过程中，首先根据前期文献资料研究和现场勘查情况，初步梳理研究区域内不同历史时期的水适应客体、适应主体、适应过程及方式，以及适应性限制及障碍；在此基础上，通过针对当地居民的开放式问题访谈进行补充与修正（表1）。开放式问题访谈的主要对象为现存侯庄子新村、卧龙岗村的村民，以及安置于新建小区的原部分村民，受访者年纪大多在50~80岁之间（图5）。采访在得到受访者的口头许可后进行，每次访谈的时长为10~20分钟，最终通过访谈记录的整理与归纳形成完整的水适应性PAST。

② 样带行走是参与式社会调查的方法之一，指针对场地内特定线路周边土地利用现状的精细化空间定位与描述。

approaches are bottom-up research methods[21] and can be combined to address complicated cases[22], help learn how local professionals and stakeholders perceive and understand a given issue[23], and assist assessment of adaptation planning and design[24].

Data collection and analyses were conducted first by mapping based on historical images and then by developing problem and solution trees (PAST) based on the adaptation framework.

Mapping is a basic method used in the research on landscape character[25] that combines visual appraisal and expression, and emphasizes the exploration, collection, analysis, and integration of spatial data[26]. Mapping is used to shape spatial perception through exploring the implicit characters of the site, and establishing and representing the spatial relations[27]. In the process of mass data mining, filtering, and processing to create a panorama, the author will inevitably project his/her own understanding about the space onto selections and decisions. Relevant participatory studies have demonstrated that mapping can provide the basis to reveal the spatial distribution of landscape resources and to support specific investigations[28][29]. Mapping in this research, based on literature review, includes discovering how the river branched in the study area via the earliest black-and-white satellite image photographed in 1964 sourced from the database of United States Geological Survey; delimiting the study area by analyzing the site's satellite images in 2002 and 2020 accessed from Google Earth, and investigating the impacts brought by urban development and water flow change; and then verifying the collected data by transect walks②[30] together with local residents to establish a more comprehensive understanding of the study area.

PAST is usually used to probe into the causes of a given problem, evaluate the effects, and explicate existing and suggested intervening measures/solutions[31]~[33] in form of graphs through participatory approaches. The PAST in this research is innovatively built on the basis of Smit's adaptation framework with both horizontal and vertical axes. One reason is that PAST corresponds with the core components of Smit's framework, i.e. problems, causes, and solutions, and can help highlight the characteristics of the framework; another is that the added vertical axis indicates the adaptation problems and limits over time, reinforcing the relation between the past and the future in analyzing social changes, within which the historical data suggest people's perception and expression of the environment[9]. In developing the PAST, the first step is to identify the adaptation objects, subjects, processes and forms, and limits and barriers to adaptation in different historical periods via literature review and field investigation; secondly, these information would be cross-checked and improved by open-ended interviews with local residents (Table 1). The interviewees, aged between 50 and 80, were local villagers from New Houzhuangzi Village and Wolonggang Village, and those now relocate in some newly-built residential neighborhoods (Fig. 5). Each interview was conducted under the interviewees' oral permission and took 10 or 20 minutes. Finally, a full version of the PAST was built upon the interview records.

② Transect walk, a participatory method for social investigation, involves walking along specific route that traverses the site to locate and record the surrounding land use.

表1：研究区域实地考察开放式访谈问题总结

Table 1: Open-ended interview questions for field investigation in the study area

对于洪水的认知：

- 您是否经历或者听说过研究区域的洪水灾害?
- 您知道研究区域内有哪些防洪排涝的基础设施或者人为措施?
- 您觉得研究区域现在或者将来还会受到洪水威胁吗？为什么?

Understanding of floods:

- Have you experienced or heard of any flood in the study area?
- Do you know of any infrastructure or measures for flood control adopted in the study area?
- Do you think the study area is or will be threatened by floods? Why?

对于农业系统的认知：

- 您知道“稻地河滩”名称的由来吗?
- 您是否了解研究区域历史上的农业种植区域与景观风貌?
- 您是否了解研究区域历史上的农田灌溉设施?
- 您认为研究区域的农业种植为何消失?

Knowledge of agricultural systems:

- Do you know the origin of the name "Daodi Flood Land"?
- Do you know the historical agricultural planting area and landscape of the study area?
- Are you familiar with the history of farmland irrigation facilities in the study area?
- Why do you think agricultural cultivation practice in the study area has disappeared?

对于区域水资源的认知：

- 您可否对研究区域历史上永定河与西河的水量与景观风貌进行描述?
- 您是否了解当前研究区域的生产生活用水来源?
- 您是否了解研究区域的水资源紧张问题？您觉得主要原因是什么?
- 您觉得有哪些措施可以缓解研究区域的水资源紧张问题?

Cognition of local water resources:

- Could you describe the water flows and landscape characters of Yongding River and the West River in the history of the study area?
- Do you know the current water source for production and domestic use in the study area?
- Are you aware of water shortage in the study area? What do you think is the main reason?
- What measures do you think can be taken to alleviate water shortage in the study area?

对于研究区域未来发展的认知：

- 您是否了解研究区域未来的城市发展定位?
- 您认为研究区域现阶段建设的主要问题是什么?
- 您希望研究区域未来城市的风貌是什么样的?
- 您认为研究区域在未来的城市建设中是否应该体现与永定河、西河及传统农业景观的紧密关系？您觉得有哪些方法可以建立这样的关系?

Understanding of the future development of the study area:

- Do you know the future urban development orientation?
- What do you think are the main problems in current urban construction?
- What do you think are the prospects of this area?
- Do you think the study area should link closely with Yongding River, the West River, and traditional agricultural landscape in future urban construction? What approaches can build this close relationship?

上述两个阶段的数据收集与分析历时两年（2020~2021年），其中空间制图中的样带行走与PAST构建中的开放式问题访谈于2020年9~10月与2021年5~6月集中开展。

3 研究结果

3.1 基于空间制图的景观特征区域识别与特征描述

在历史上，研究区域是一片较为独立的景观特征区域（landscape character area），对该区域特征的描述主要通过空间制图完成。这一过程中的主要工作为划定研究区域及分析区域内景观特征类型[25]。

从1964年的黑白卫星影像（图6—1）来看，城子村以南此时可见若干大小不一的河滩地。为探究上述河滩地是否全部为历史上记载的区域，研究采访了侯庄子村侯家后人。采访得知侯庄子村位于古时该

Data collection and analyses of mapping and PAST were conducted from 2020 to 2021. Transect walks for mapping and open-ended interviews for PAST developing were done in September and October in 2020 and May and June in 2021.

3 Research Results

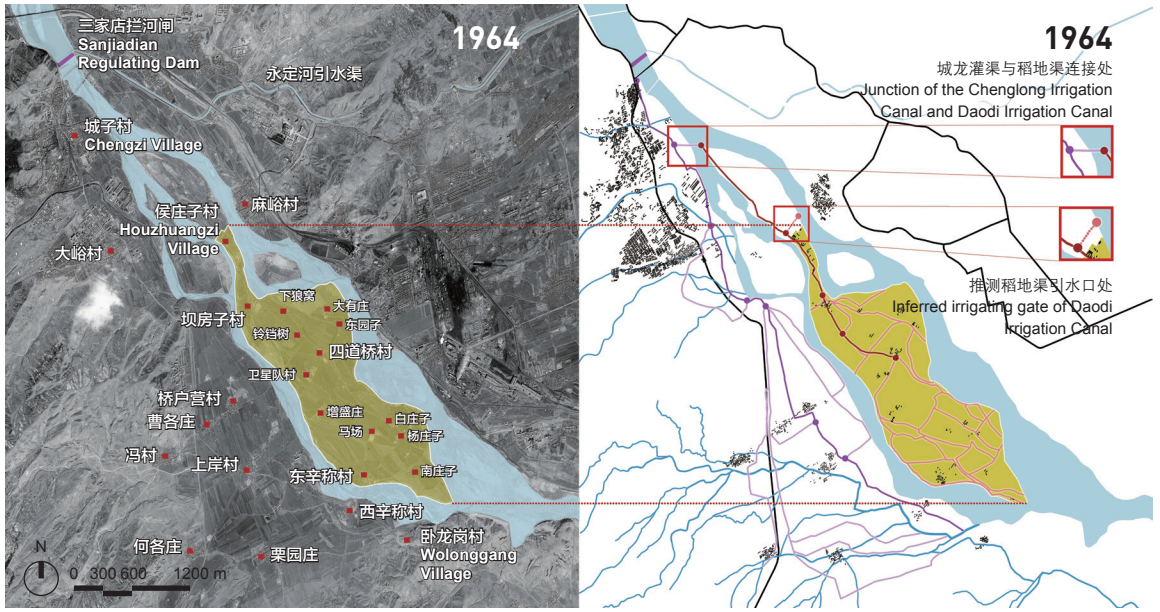
3.1 Landscape Character Area Identification and Description by Mapping

In history, the study area was a distinctive landscape character area. It was characterized in this research by mapping, including delimiting the study area and analyzing its landscape characters[25].

As can be seen in the black-and-white satellite image of 1964 (Fig. 6–1), several flood lands in different sizes were located to the south of Chengzi Village. Due to

5. 开放式问题访谈
5. Photos of interviews with open-ended questions

5 © 刘辰



稻地河滩范围
Daodi Flood Land
永定河水系
Water system of Yongding River
外围主要汇水通道
Main peripheral catchment channels
主要乡村聚落
Main rural settlements
城龙灌渠主干渠
Main canal of Chenglong Irrigation Canal
城龙灌渠支渠
Branch canal of Chenglong Irrigation Canal
稻地渠主干渠
Main canal of Daodi Irrigation Canal
稻地渠支渠
Branch canal of Daodi Irrigation Canal
主要交通线路
Main transport line

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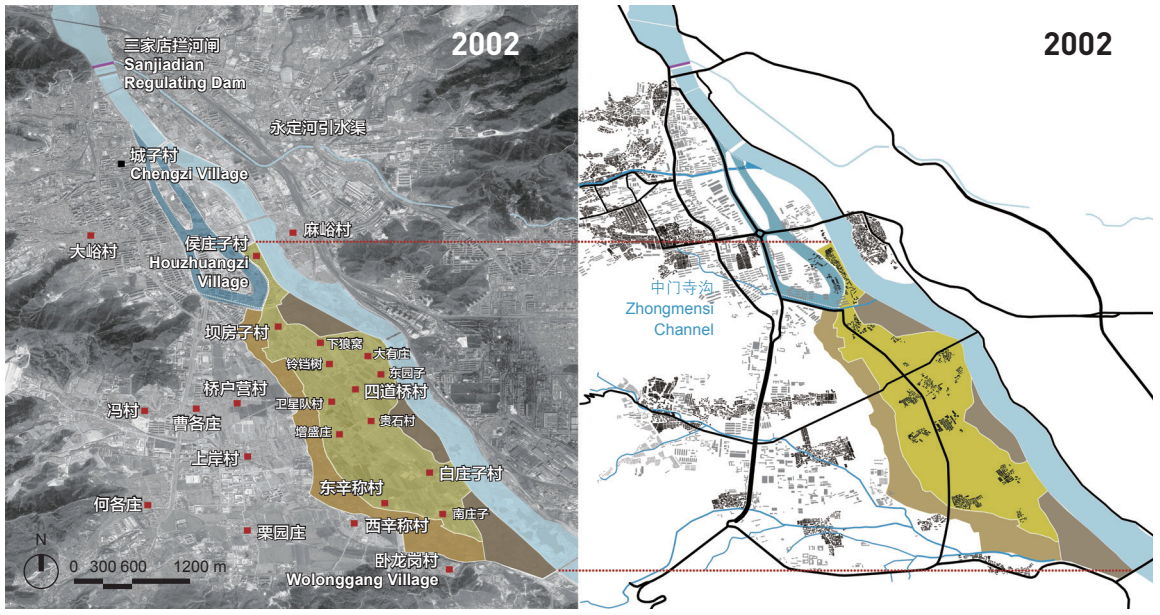
6-1



稻地河滩范围
Daodi Flood Land
永定河水系
Water system of Yongding River
外围主要汇水通道
Main peripheral catchment channels
未搬迁合并村落
Unchanged villages
搬迁合并村落
Relocated and combined villages
西河故道
Previous riverway of the West River
西河故道采沙区
Sand dredging area along the previous riverway of the West River
永定河故道采沙区
Sand dredging area along the previous riverway of Yongding River
主要乡村聚落
Main rural settlements
主要城市聚落
Main urban settlements
主要交通线路
Main transport line

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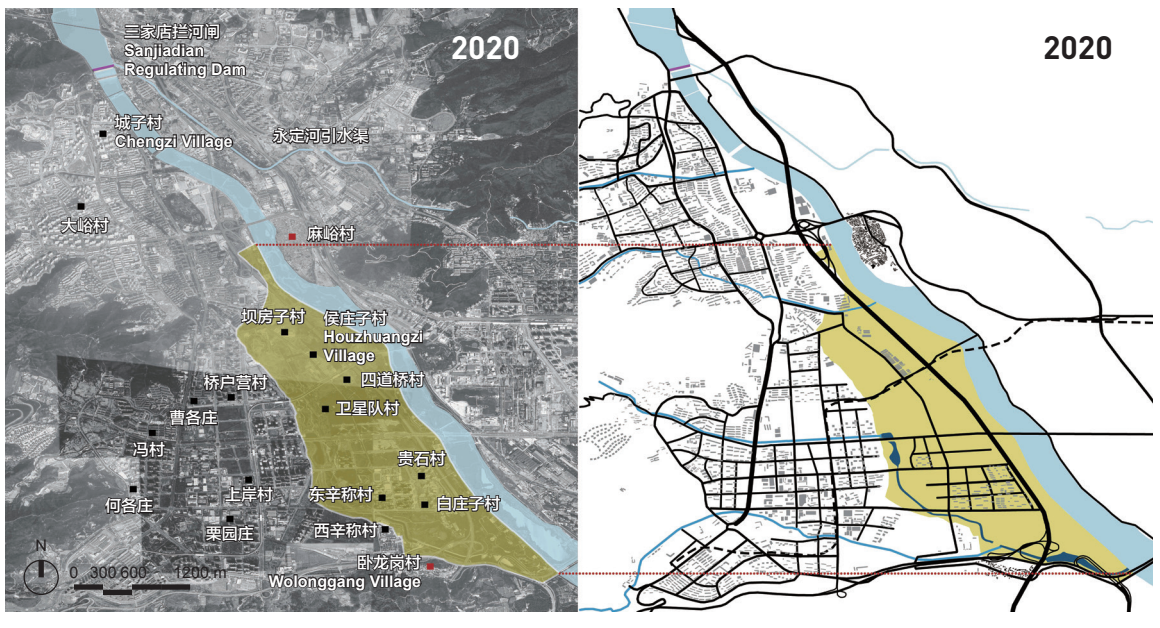
6-2



稻地河滩范围
Daodi Flood Land
永定河水系
Water system of Yongding River
外围主要汇水通道
Main peripheral catchment channels
西河现状河道
Existing riverway of the West River
未搬迁合并村落
Unchanged villages
搬迁合并村落
Relocated and combined villages
主要乡村聚落
Main rural settlements
主要城市聚落
Main urban settlements
主要交通线路（黑色虚线为地铁S1号线）
Main transport line (black dotted line
means Beijing Subway Line S1)

© 张晋
6-3

区域的最北端，潭柘寺曾出资在村中修建稻地渠灌溉河滩之上的庄园地产。由此可确定侯庄子村所在位置应为古时该区域的北侧起点。从2002年的卫星影像图（图6—2）来看，西河在中门寺沟（位于河滩西北侧）以北的河道已完全被城市建设所覆盖，以南的河道基本保留，但已完全变为采沙区③[16][34][35]；由于新河堤的修建，永定河主河道中的部分被划入河堤以外，全部成为采沙区。研究区域的形态虽随上述河道的变化而改变，但整体仍保留了较易识别的特征，同时河滩上的村落也基本得到保留（各村落规模较1964年大大增加）。从2020年最新的影像图（图6—3）及河滩土地利用现状（图7）来看，西河原有的采沙区已恢复为绿地与水道，研究区域的东、西、南岸也基本固定下来，而原有村落由于新城建设几乎全部重新安置。

在上述景观特征区域识别的基础上，样带行走主要选取了研究区域东西边界处的两条路线——永定河西岸的现状河堤路（路线一）和西河西侧的现状滨水小路（路线二）——同时开展开放式问题访谈，调研结果如图7所示。就路线一而言，永定河西岸大部分已实施绿化工程，但整体建设较为简单，且由于被西六环路分隔，滨水绿地与研究区域虽然距离较近但联系较弱；尽管如此，受访者对于绿地的建设仍抱有积极态度，同时指出自2020年春季上游进行生态补水后，沿线绿地曾多次出现受淹情况。在路线二中，现状河道与居民活动区域相隔较远，人流较少，除绿海运动公园之外，其他区域基本只进行了简单绿化；而受访者对西河历史所知甚少，仅提到近十几年来河道水量锐减，并将原因归结为降水减少和周边城市建设阻碍了雨水的下渗。

3.2 基于文献资料的PAST构建

3.2.1 历史轴中的典型阶段与事件

本研究中PAST的构建强调历史轴的置入，同时须提前搭建PAST的初步框架。初步框架中的历史轴以研究区域形成初期为起点，共分为7个阶段（图8）。

③ 由于上游官厅水库的修建，永定河下游于20世纪70年代开始逐步断流，而稻地渠于1982年停止使用，因此可推断西河的断流时间应在20世纪七八十年代。1993年，北京市实施了永定河河堤整治工程，采用了“废西河道、扩东河道”的整治方案，原西河河道逐步废弃（来源：参考文献[20][34][35]）。

③ From the 1970s, the lower reaches of Yongding River began to dry up due to the construction of Guanting Reservoir in the upper reaches. Given that Daodi Irrigation Canal was disused in 1982, it is reasonable to infer that the West River dried up between the 1970s and 1980s. In 1993, the embankment regulation project in Beijing proposed to abandon the West River and expand the main channel of Yongding River, for which the West River gradually falls into disuse (Source: Refs. [20][34][35]).

6. 1964年、2002年和2020年的稻地河滩情况概览。左侧卫星图主要体现村落分布，右侧分析图主要体现水系、交通与村镇肌理。

6. Overviews of Daodi Flood Land in 1964, 2002, and 2020. Left satellite images mainly show the distribution of villages; right analysis diagrams mainly indicate the river systems, transport lines, and village textures.

the lack of historical data, this research interviewed descendants of the Hou Family in Houzhuangzi Village to verify the boundary change of the study area. The authors were told that Houzhuangzi Village was located at the northernmost end of the study area in ancient times, when Tanzhe Temple funded the construction of Daodi Irrigation Canal for the village; and the location of Houzhuangzi Village should be the north end of the study area in ancient times. According to the satellite image in 2002 (Fig. 6–2), the river course of the West River to the north of Zhongmensi Channel (in the northwest of the flood land) was replaced by urban construction, and the reserved river section to the south of the channel was transformed into sand dredging areas③[16][34][35]. Moreover, due to the construction of the new embankment, part of the main channel of Yongding River was used as sand dredging areas. Although morphologically changed as the river course changes, the study area keeps its own landscape characters that are easy to identify, while most of the villages within are also reserved with larger area than in 1964. From the latest satellite image of 2020 (Fig. 6–3) and the existing land use of the flood land (Fig. 7), it could be found that sand dredging areas along the West River were restored into green spaces and waterways. At this stage, the east, west, and south borders of the study area are identified, when most of the previous villages are relocated due to new town construction.

To corroborate the landscape character area identification, transect walks chose two routes in the study area—existing embankment on the east bank of Yongding River (Route 1) and existing waterfront path on the west side of the West River (Route 2). Open-ended interviews were conducted during the walks and final results were summarized in Figure 7. For Route 1, the west bank of Yongding River has been simply landscaped and this green space can hardly connect with the study area as they are separated by an expressway. Despite this, interviewees were still satisfied about the effects of the green space and recalled that Route 1 had been flooded for many times since the upstream ecological water supply for Yongding River implemented in the spring of 2020. For Route 2, the existing West River is less visited as being far away from residential areas and the landscaping work in this area is poor, except the Lvhai Sports Park. The most impressive event for the interviewees was the decline of river flows in the past decade and it might be caused by precipitation reduction and the increased impervious surface in urban construction.

3.2 PAST Upon Literature Review

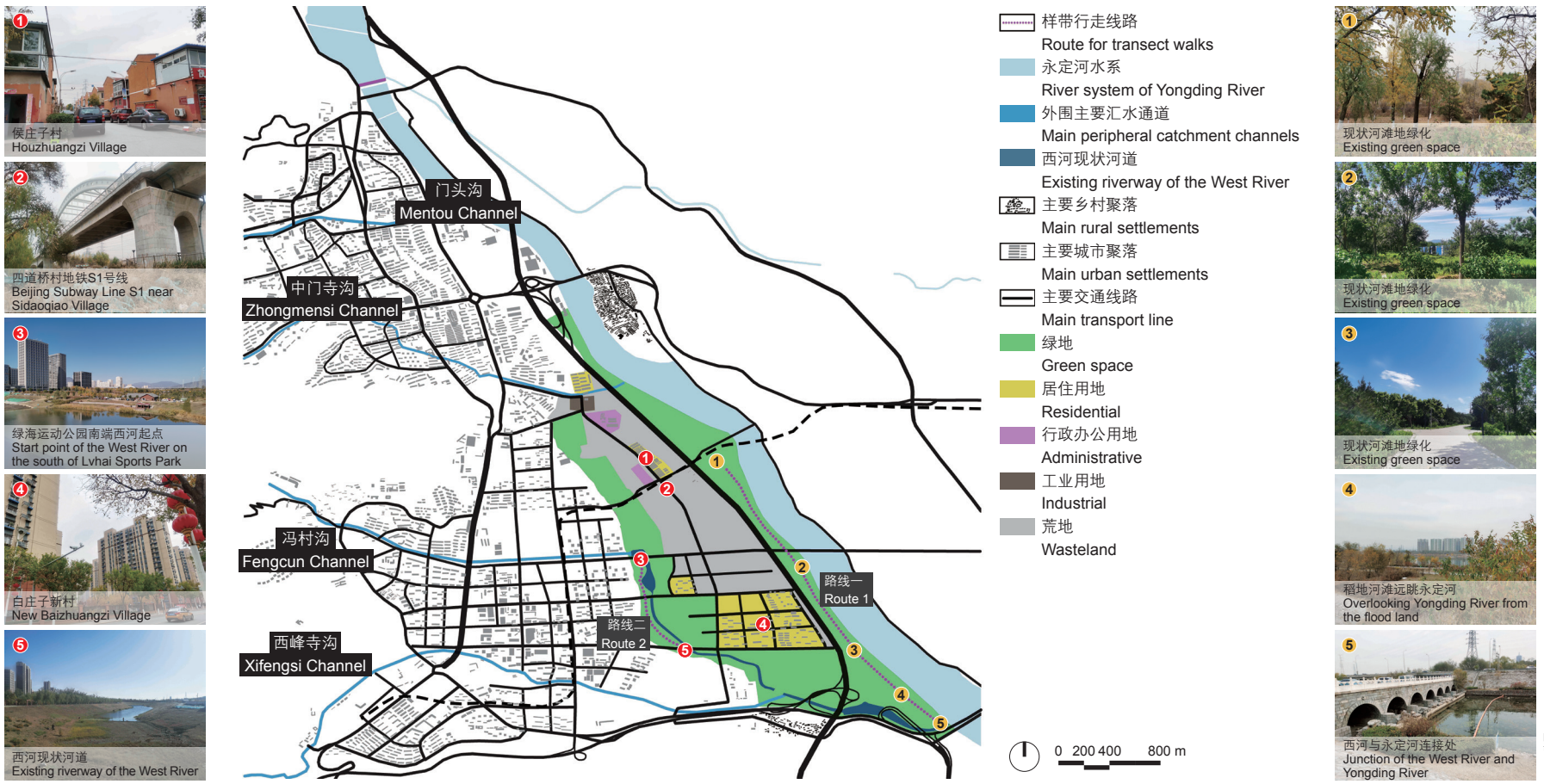
3.2.1 Typical Phases and Events in the Time Axis

Two main tasks in completing the PAST were imbedding the time axis and creating a preliminary framework. Starting with the age when the study area was initially formed, the time axis consists of 7 historical phases (Fig. 8).

3.2.2 Typical Problems and Impacts in the Problem Axis

(1) Floods

Floods, as to many other flood lands, is the primary water adaptation problem



7. 稻地河滩现状分析
7. Existing condition analysis of Daodi Flood Land

3.2.2 问题轴中的典型问题与影响

（1）洪水

与其他河滩地相似，洪水是历史上困扰研究区域水适应性的首要问题之一，自滩地形成至20世纪60年代，人水博弈持续了700余年。

洪水问题的成因涉及区域与场地两个尺度：首先，自金元定都北京以来，永定河所在的京西山地区域就开始为大规模城市建设及居民生产生活提供所需建材与能源，这导致了区域内森林植被和地层结构的持续性破坏[36]~[40]，沿线生态环境恶化成为研究区域乃至整个流域产生洪水问题的区域性原因。其次，研究区域地处永定河进入山前平原地带的出山口位置，在雨季极易发生洪水的漫流，因此河流出山口的场地区位是造成该区域洪水问题的直接原因。然而，研究区域对洪水的适应历史却呈现出十分温和的姿态，历史上采取的相应适应性措施主要包括两种方

④ 北京城位于永定河以东的平原地区，因此历史上官方主导的永定河防洪重心在永定河东岸（来源：参考文献[23]）。

to the study area throughout the history. Conflicts between human and water continued from the birth of the flood land to the 1960s, lasting for over 700 years.

There were two main causes of floods. At the regional scale, since Beijing became China's capital in the Jin and Yuan Dynasties, mountainous areas in the west of Beijing near Yongding River provisioned building materials and energy demanded for production and living, which resulted in long-term damage to the forests and stratigraphic configuration[36]~[40]. The ecological degradation primarily led to flood problem to the study area and even to the whole river basin. At the site scale, the location at the gully where the water from Yongding River flows through mountains to plains made the study area prone to floods in rainy seasons. However, the adaptation strategies to floods in the study area were comparatively moderate, mainly by unofficial embankment construction and high site selection. For the first strategy, historical records evidence that early in Ming Dynasty, the locals began to resist floods by spontaneously constructing embankments, which were normally seen in the east side of the study area④[16][23]. Regarding the second strategy, terrain of the study area was higher in the middle and lower

④ The urban area of Beijing is located in the plain on the east of Yongding River, for which in history the official flood control actions were implemented against the east bank of the river (Source: Ref. [23]).

式：一是村民在局地自发修建防洪堤坝——据考证，这一措施自明朝即开始出现，主要位于研究区域临永定河一侧④[16][20]。二是聚落选址对洪水的避让，研究区域整体地势中间高四周低，历史上的聚落基本都分布于河滩的中心区域，择高选址以避免洪水威胁[16][41]。

永定河及研究区域所处地理位置较为特殊，极易受大规模洪水威胁，上述两种方式并不能普遍应对这类洪水。但实际有关该区域大规模洪水灾害的历史记载较少，其原因主要是永定河在山前平原出山口漫流所形成的众多分支河道起到了分水与降低流速的作用，有效疏解了瞬时的大规模洪水，将整体性洪水拆解为多条河道的局部性洪水。因而研究区域的洪水适应性是以多条自然河道分洪为前提的（图6—1）。

（2）农业灌溉

在研究区域中，依托于水资源的农业灌溉与洪水问题相伴而生并长期共存，是该区域历史上最具代表性的水适应性问题之一，同时也造就了该区域主要的水适应性景观。研究区域的农业生产肇始于辽朝的潭柘寺寺产租地[42]，至明朝规模逐渐扩大，大面积的水稻种植彻底改变了该区域的景观样貌；至清朝，该区域局部变为皇室专属产粮区，区域内大部分土地变为耕地[43]；至20世纪60年代，在恢复性政策的刺激下，粮食产量与水稻种植面积均达到历史最高值，之后逐年下降[16][34][35]。

20世纪60年代以前，研究区域内的村落因粮食生产呈现“庄园式”特点，即分散布局的小型聚落各自独立管理大片集中农田（图6—1），因此相互独立的农田之间如何建立整体、高效的灌溉系统成为该区域农业水适应性的核心问题。针对这一问题，历史上先后由民间和官方主导修建了两条系统性水利灌溉渠道——稻地渠和城龙灌渠。稻地渠是区域内最早的系统性灌溉设施，至迟修建于明朝，由潭柘寺出资修建，引永定河水灌溉农田，详细流经线路已不可考。城龙灌渠修建于清末，用于引永定河河水灌溉研究区域周边土地。1956年，三家店拦河闸修建致使下游河道断流，为解决稻地渠水源缺乏问题，由官方主导连接城龙灌渠主干渠与稻地渠，统一由三家店水库供水[34][35]。稻地渠的修建是研究区域农业水适应性历史上的标志性事件，结束了该区域缺乏系统性灌溉设施的历史，标志着农业生产走向成熟，具有较高的历史与文化价值。

（3）水资源利用

自20世纪60年代末，研究区域的水适应性问题发生了急剧转变，原因主要包括以下两点：一是出于防洪、灌溉、发电等综合需求考虑，自20世纪50年代开始，永定河门头沟段及上游段先后修建了近10座大型水库，导致下游水量急剧减少；二是永定河干流沿线各村落分散式塘坝

in the surrounding, for which villages were built in the middle of the flood land to prevent floods[16][41].

Due to the special topography to the river, the study area was easily threatened by large-scale floods, which could hardly be controlled by these two strategies. However, according to historical records, flood disasters seldom happened in this area. It is mainly because Yongding River branched into several courses after arriving the plain that divert and slow down water flows; instead of instantaneous large-scale floods, small-scale floods in different courses occurred in rainy months. Thus, adaptation to floods in the study area largely depends on flood diversion by natural rivers (Fig. 6–1).

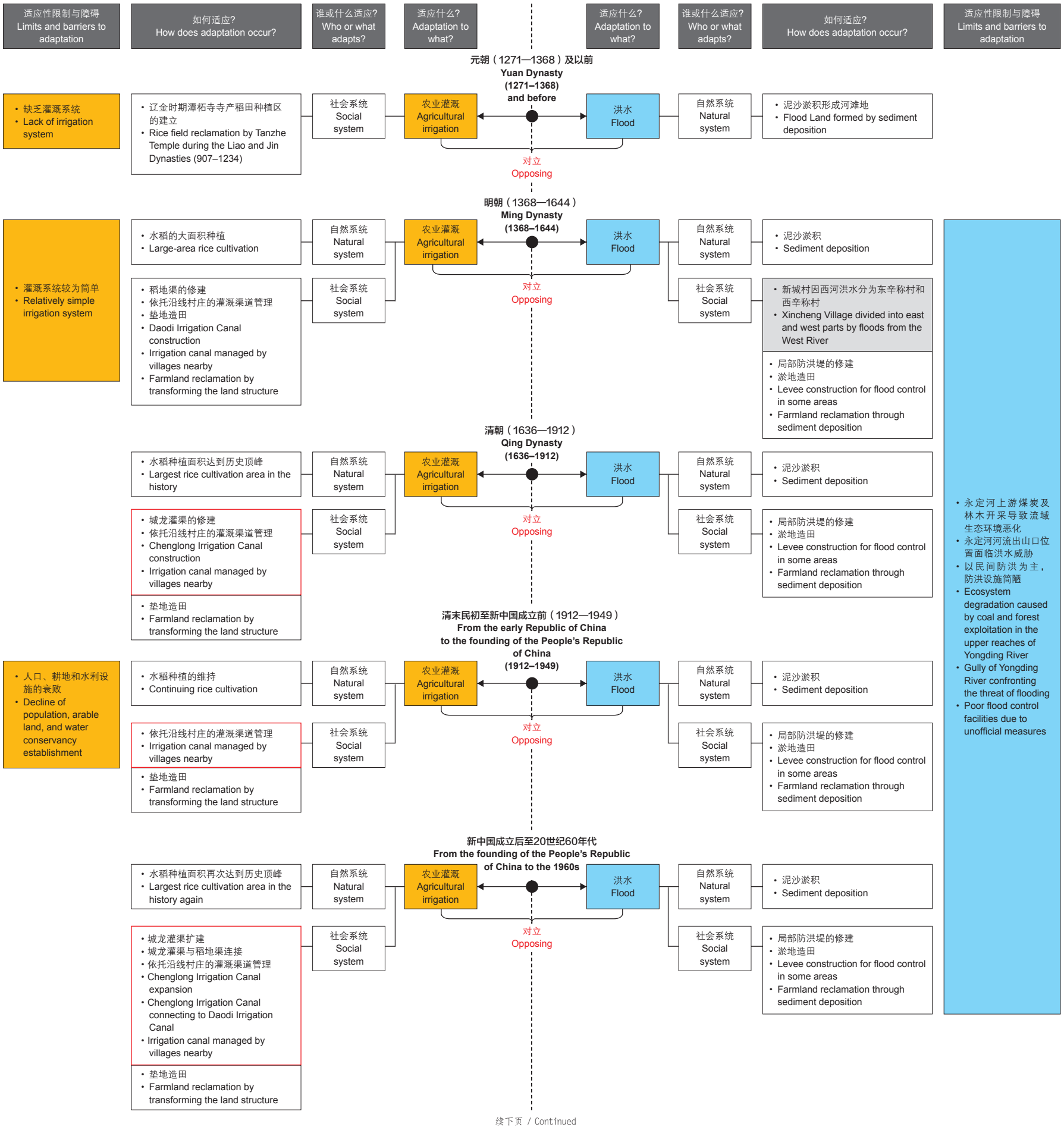
(2) Agricultural irrigation

In the study area, agricultural irrigation and other water-resource-related issues are also typical to the local water adaptation. Meanwhile, agricultural irrigation also created the water adaptive landscape in this area. Historically, agricultural activities started on the rented land owned by Tanzhe Temple in the Liao Dynasty[42]. Till the Ming Dynasty, the expanded area of agricultural production, especially for rice cultivation, completely transformed the landscape of the study area. By the Qing Dynasty, when grain production in some farmland became exclusive for the imperial family, most of the land on the flood land was arable[43]. In the 1960s, the grain yield and rice-planting area reached a record high due to policy stimulus, but then declined year by year[16][34][35].

Before the 1960s, grain production in the study area separated villages into small scattering settlements like manors, each managing a large area of farmland independently (Fig. 6–1). Therefore, two irrigation canals were constructed, both diverting water from Yongding River, to establish an integral and efficient irrigation system between independent farmland, which improved the agricultural water adaptation. Daodi Irrigation Canal was the earliest systematic civil water infrastructure built by Tanzhe Temple no later than the Ming Dynasty to irrigate farmland in the study area. Unfortunately, the specific canal course is untraceable today. The official one, Chenglong Irrigation Canal, was constructed in late Qing Dynasty to irrigate farmland around the study area. In 1956, the main canal of Chenglong Irrigation Canal was formally connected with Daodi Irrigation Canal so that they could receive water from Sanjiadian Reservoir, alleviating the water shortage caused by the construction of Sanjiadian Regulating Dam[34][35]. Historically, the construction of Daodi Irrigation Canal is of significant historic and cultural values. Being a milestone of agricultural water adaptation in the study area, the construction of the both irrigation facilities marks the beginning of the local's well-developed agricultural production.

(3) Water resource utilization

Since the end of the 1960s, the challenges in water adaptation in the study area sharply shifted. The first main reason is the rapid decrease of downstream water flow caused by the construction of nearly 10 large reservoirs in the Mentougou reach and upper reaches of Yongding River since the 1950s, for flood control, irrigation, and power generation purposes. Second is the mass construction of



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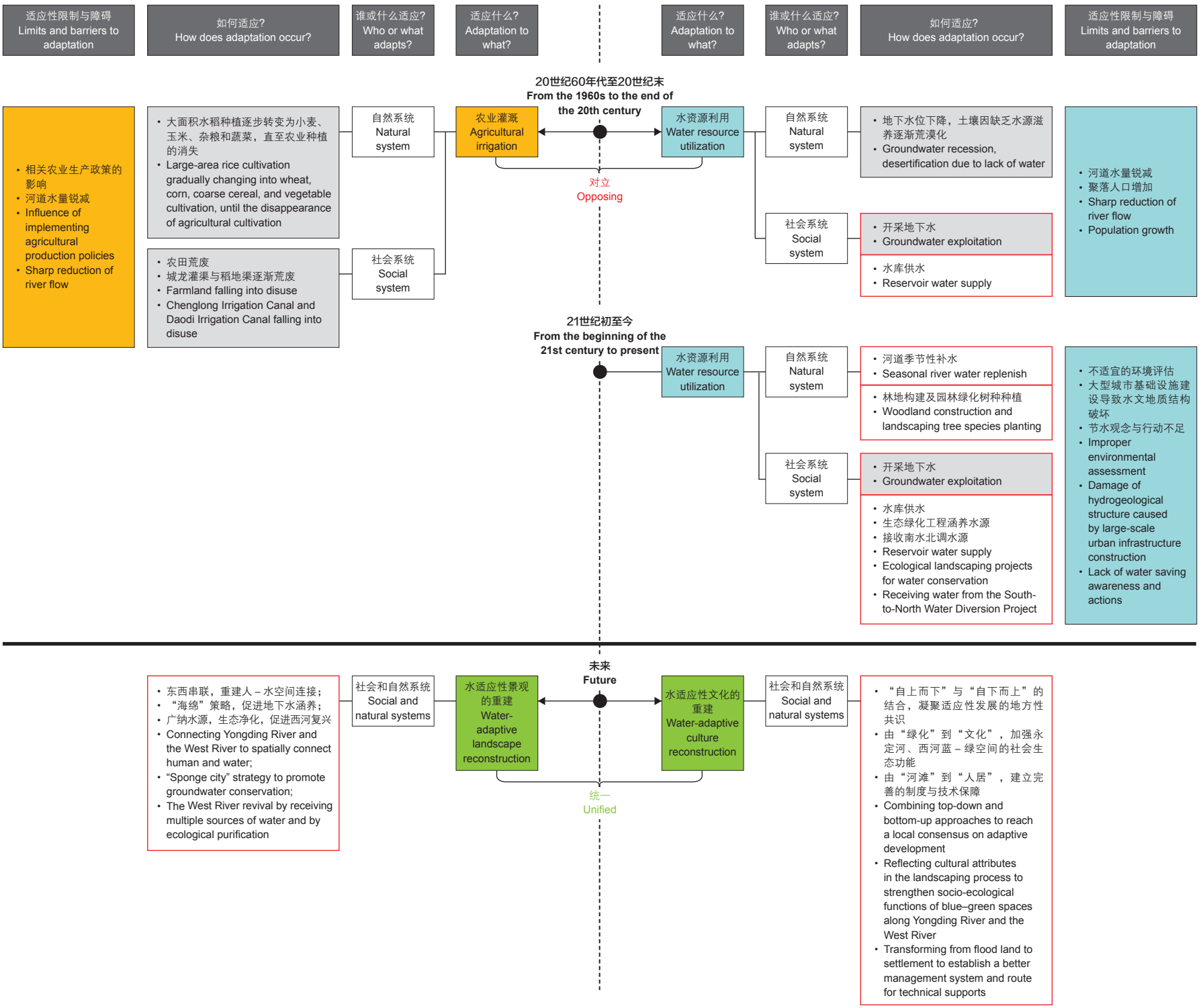

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8. 稻地河滩的水适应性PAST。图中“适应什么”“如何适应”及“适应性限制与障碍”中涉及内容均以颜色区分。“如何适应”部分进一步通过颜色进行分类：消极适应（浅灰色图底）；积极适应（白色图底）；计划性适应（红色图框）。消极适应指适应主体在面对具体适应性问题时的被动反应，且此类反应将进一步对适应性问题及适应主体本身产生不良影响，如水资源利用问题中自然系统的土壤荒漠化、社会系统中的地下水超采等，而积极适应则恰好与之相反。所谓有计划适应主要是指由社会系统中官方主导下的适应及其结果，带有强烈的“自上而下”的政策属性；无计划适应则指非官方的社会和自然系统的适应。

8. PAST on water adaptation for Daodi Flood Land. Problems of “adaptation to what,” “how does adaptation occur,” and “limits and barriers to adaptation” are differentiated by colors. Regarding items of “how does adaptation occur,” the passive adaptation is shown in light gray boxes and active adaptation in white, among which the planned ones are marked with red frames. Passive adaptation means the subjects’ passive response to specific adaptation problems, which may in turn have adverse impacts on both the problems and subjects. Regarding the problem of water resource utilization, this type of adaptation may include soil desertification and over-exploitation of groundwater in the natural system. Active adaptation means an opposite response of the passive one. Planned adaptation is the top-down action with results led by government in the social system, while unplanned adaptation includes nonofficial adaptation by both the social and natural systems.

的大量建设，进一步减少了区域内地表径流向河道的汇集。在这一背景下，由于聚落人口的急剧增加，生产生活用水需求激增，不得不通过超采地下水来进一步满足用水需求。据统计，仅永定地区在20世纪七八十年代就开挖深井或机井70余眼[35]，地下水位大幅下降使得河滩地因水源的进一步匮乏而逐渐荒漠化[44]。

面对水资源枯竭导致的恶性循环，自21世纪初开始，官方主导下的区域及地方层面的积极措施开始实施，包括针对永定河下游的河道生态补水、河道沿线绿化工程、通过改扩建水厂设施接收南水北调水源等，有效缓解了水资源困境与生态环境的进一步恶化。

3.3 基于现场验证的PAST构建

3.3.1 有关洪水与防洪的实地证据

针对洪水问题，当地居民对于研究区域洪灾的最后印象集中于20世纪50年代，但洪灾发生次数较少且均未对区域内村庄造成重大损失；受访居民多次提到永定河及西河的水量变化，指出在20世纪30年代左右，永定河与西河的水量比较大，基本处于全年有水状态；60年代左右水量开始减少，后逐渐变为常年无水的状态。这些与文献记载及研究者推断基本吻合。

针对防洪设施问题，年纪较大的受访者（80岁以上）提到研究区域的防洪设施主要为毗邻永定河西岸河滩地区域村落自发修建的防洪堤坝，且“谁受灾严重谁的堤坝就修得越多”；堤坝多采用铁笼填装石块的建造方式，与传统印象中的沿河平行修建不同，这些堤坝由河滩区域顺水流方向斜伸入河道之中，但之后逐渐废弃消失。这直接补充了研究中民间防洪堤坝修建的具体细节。

此外，当地居民还提到利用永定河水泥沙含量大的特点进行淤地的方法。由于研究区域东侧毗邻永定河的区域地势较低、土层较薄，沿河村落居民为了增加种植面积，便通过在河边垒土埂向内灌水淤泥的方法，不久便可形成较厚的种植土层，同时抬高的地基也发挥了防洪堤坝的作用。

3.3.2 有关农业变迁的实地证据

多数受访居民对研究区域早期大面积水稻种植的景象印象较为模糊，仅年龄较大的受访者了解该区域作为潭柘寺寺产租地的水稻种植历史，他们同时提及自20世纪50年代后水稻种植面积逐渐减少，至六七十年代种植作物已基本变为麦子和玉米，70年代以后基本只种植蔬菜，此后农田基本荒废，这与文献记录也是吻合的。当地居民认为受当时农

scattered small-scale reservoirs in villages along the main channel of Yongding River, which blocked the runoff catchment into the river. Moreover, the rapid increase of rural population brought about larger amount of production and domestic water consumption, resulting in over-exploitation of groundwater. Statistics reveal that more than 70 deep wells or motor-pumped wells were dug in the 1970s and 1980s in Yongding area alone[35]. Serious groundwater recession caused the gradual desertification of the flood land due to exacerbated water resource shortage[44].

In response to this vicious cycle, since the beginning of the 21st century government has implemented regional and local strategies, including ecological water supply for lower reaches of Yongding River, riverfront landscaping projects, and water plant expansion to receive water by the South-to-North Water Diversion Project. All these actions have effectively alleviated water resource shortage and ecological environmental deterioration.

3.3 PAST Upon Field Investigation

3.3.1 Field Investigation on Flooding and Flood Control

For most interviewees, the latest impressive floods in the study area happened in the 1950s. But the consequent disasters were few and not damaging to villages on the flood land. Many of the interviewees recalled that the water flow of Yongding River and the West River declined gradually from around the 1930s to the 1960s—from abundant to depleted all the year round. These results are basically consistent with literature records and the authors’ inference.

Regarding flood control facilities, the statement by senior interviewees (over 80 years old) provided detailed supplementary information to civil flood control infrastructure in the study area, which were mainly dams built by villages adjacent to the flood land on the west bank of the Yongding River; “the more severely damaged, the more dams constructed.” In addition, different from the traditional way that elevates the riverfront, these dams were built with gabions inserted aslope in the waterway downstream. Gradually, these dams were abandoned or eliminated.

In addition, interviewees also mentioned the method of silt accumulation for farmland construction which utilized the high silt concentration in Yongding River. The east side of the study area adjacent to Yongding River was in a lower terrain and thin soil layer. By diverting the river water into the constructed low bank, a thicker soil layer was quickly formed which allowed for both agriculture and floods prevention.

3.3.2 Field Investigation on Agricultural Changes

Most of the interviewees, except the elderly ones, were not familiar with the history of large-scale rice planting in the study area. The senior interviewees mentioned the rice cultivation history of the flood land managed by Tanzhe Temple; since the 1950s, the rice planting area decreased and gradually was substituted by wheat and corn planting in the following one to two decades;

业生产政策的影响，原有的集体化种植模式消失，个人种植意愿逐渐降低，相应水利灌溉设施也无人维护，农田因此逐渐荒废。而对于研究者总结的河道水源锐减造成的农业变迁的原因，当地居民感受不深，可见对于当地居民而言，政策对于农业发展的影响较于水量变化更为关键。

对于研究区域最为重要的农业灌溉设施稻地渠（图6—1），部分年龄较大的受访者将之称为“大渠”，当春秋两季需要用水时，泄水坝关闭，渠水就流向下游灌溉田地；夏季雨多时，泄水坝开启，主渠渠水向东流回永定河；在20世纪60年代时水量较多，每年春天由各村或各大队出人修缮清理。稻地渠通过分级设渠、分时控水的建造与管理方式缓解了灌溉及生活用水问题，具有极高的历史价值。

部分受访村民还提到了与前文中“淤地”相对应的另一种体现了河滩区农业智慧的做法——“垫地”，即先下挖出一块平地，将石块置于最下层，再上置泥沙，土层厚度约20cm左右（足够种植水稻即可）。

3.3.3 有关水资源与区域发展的实地证据

据部分年纪较大的受访者回忆，20世纪七八十年代时，研究区域中几乎村村打井，称为“大口井”或“轱辘井”，后逐渐改为机井。而对于现阶段的生活用水来源问题，受访者认知不一，部分居民认为主要来源于三家店拦河闸的放水，部分居民认为主要来源于机井开采地下水，而对于文献记载中的南水北调水源绝大多数居民并不了解，少数居民甚至抱有怀疑态度，体现出受访者对于用水来源问题关心较少，同时也反映了现阶段生活用水仍能满足基本要求，但未来随着区域内城镇化的不断发展，用水方面仍存在较大隐患。

对于现阶段永定河的生态补水问题，部分居民提出永定河的生态补水主要用于补充地下水，对于生产生活用水的补充效果不大——当地居民对于这一问题的认知与研究者的预期差异较大。

对于现阶段西河的水源问题，当地居民指出共有两个来源：一是来自于水厂处理后的中水，二是来自西侧山体的汇水，水量较小，部分河段常年处于无水状态。因此水源仍是现阶段制约西河恢复的关键因素。

after the 1970s, only vegetables were planted there with the farmland becoming abandoned. These are also consistent with literature records. Interviewees held that agricultural production policies between the 1950s and 1970s turned the collective cropping pattern into household-based systems, for which individuals could hardly be motivated to do farm work. Worse, the neglect of irrigation facility maintenance accelerated the disuse of the farmland. However, few of interviewees realized that the agricultural changes happened due to the sharp decline of river water flows, which implies that for local people, policies had greater influence on agricultural development than water resource distribution.

Regarding the Daodi Irrigation Canal, some senior interviewees called it the “great canal” (Fig. 6–1). In the past, the sluice gate at upper reach in the canal was closed in springs and autumns, ensuring the irrigation of the farmland downstream; when in rainy summers, the sluice gate opened to recharge Yongding River. In the 1960s, the canal was repaired and dredged by villagers each year. During that time, Daodi Irrigation Canal had remarkably alleviated the shortage of irrigation and domestic water through the construction and management of graded canals and seasonal water control.

Some interviewees talked about the wise approach of “soil layer elevation” used on the flood land: similar to silt accumulation practice, locals dug out a piece of flat soil, placed stones at the bottom, and put silt on it. A soil thickness of about 20 cm is enough for rice growth.

3.3.3 Field Investigation on Water Resources and Regional Development

According to some senior interviewees, building manual well was pervasive in the study area in the 1970s and 1980s. These wells, i.e. “large open wells” or “wheeled wells,” then gradually were transformed into motor pumps. Interviewees’ held different opinions on current domestic water sources: some by sluicing from Sanjiadian Regulating Dam, and some by the groundwater pumped from wells for the rest. Most interviewees knew less about the water sourced from the South-to-North Water Diversion Project as recorded by literature—some even were unconvinced about it. This reflects that the interviewees were less concerned about the domestic water sources. In other words, at present the locals’ daily water use demand is basically met. However, under the rapid urban development, challenges concerning water utilization remain in the study area.

Speaking of the current ecological water supply project for Yongding River, some interviewees stated that this strategy may facilitate the region’s groundwater recharge, but little help surface water supplement for production and living uses. This awareness is quite different from the authors’ expectation.

For interviewees, currently the treated water from plants and the catchment from mountains west to the river are two sources for the water of the West River. However, both sources cannot provide abundant water for the river’s base flow, and some reaches still suffer from drying up all the year round. Therefore, water source is still the key factor restricting the restoration of the West River.

4 稻地河滩的水适应性愿景

研究区域的水环境和生产方式不断变化，在过去，洪水与农业灌溉是主要的水适应性问题，未来区域内的水资源管理、永定河及西河等重要水系结构的复兴、地域历史文化的传承等将成为新的水适应性问题。综合空间制图与PAST中的分析，本文提出如下从景观与文化视角出发的水适应性策略。

4.1 水适应性景观的重建

研究区域的传统水适应性景观风貌当前已基本消失，其重建并不意味着要恢复某种“景观遗迹”，而是要形成一种呼应历史并与未来人—水互动相适应的、新的河滩地城市景观形态。水适应性景观的重建主要包括三点策略：

1）东西串联，重建人—水空间连接。目前，由于永定河一侧六环路的建设及西河一侧河道护坡的设置，两条河道与稻地河滩之间的空间联系已十分微弱，因此建议通过架设空中连廊及河道护坡改造等方式，打通人—水之间的“最后一公里”。

2）通过“海绵建设”促进地下水涵养。京西浅山区是北京市重要的地下水回补区，稻地河滩作为该区域最后的一片大规模有待城市开发地带，需在建设过程中避免对水文地质结构的二次破坏，同时在建设后有序促进区域地下水的涵养。因此，建议在未来城市建设中利用稻地沙质土层的径流下渗优势，通过“海绵建设”策略，通过多尺度绿色下渗界面的置入促进地下水涵养（图9），与河道生态补水形成互补。

3）广纳水源，生态净化，促进西河复兴。西河的复兴是研究区域地表水系结构复兴的最后一环，现阶段仅冯村沟以南河段实施了恢复（图7）。因此建议进一步恢复冯村沟至中门寺沟之间河段，将中门寺沟、冯村沟、西峰寺沟三条排洪渠的山间汇水作为雨季重要的补充水源，将水厂中水作为非雨季补充水源，在此基础上对恢复后的西河河道进行水体自净功能的生态化改造，增强其可达性与景观功能。

4.2 水适应性文化的重建

文化是一个地域的人们通过长时间生产生活实践所创造出的所有集体观点、行为与物质实体的集合[45]，同时又反向影响着上述观点、行为与物质实体的演变。从这一角度来说，适应性实际上是文化实践的一部分，其过程与结果本身便是一种适应性文化的体现。文化的重建也主要包括三点策略（图8）：

1）“自上而下”与“自下而上”的结合，凝聚适应性发展的地方性共识。由上文中通过参与式方法对当地居民价值认知的收集结果来看，大多数居民对于研究区域的适应性历史与未来的认知不足。因此建议通过有计划的、自上而下的政策宣传与科普教育，在社会和生态层面形成针对河滩区域保护和发展的地方性共识；同时强调自下而上的多方参与，鼓励当地居民更多地参与区域发展的协作之中，在人—水互动的未来图景中提升价值认同与现实意义[46]，这也将有助于缓解未来区域政策与地方利益的博弈对适应性的影响[47]。

4 Water Adaptation Visions for Daodi Flood Land

Water environment and production modes in the study area change continuously. In the past, water adaptation problems concerning floods and agricultural irrigation were prominent. Now emerging challenges center on the issue about water resource management, river system restoration for Yongding River and the West River, and the revitalization of local historical and cultural identities. According to the mapping and PAST results, this research proposes the following water adaptation strategies from perspectives of landscape and culture.

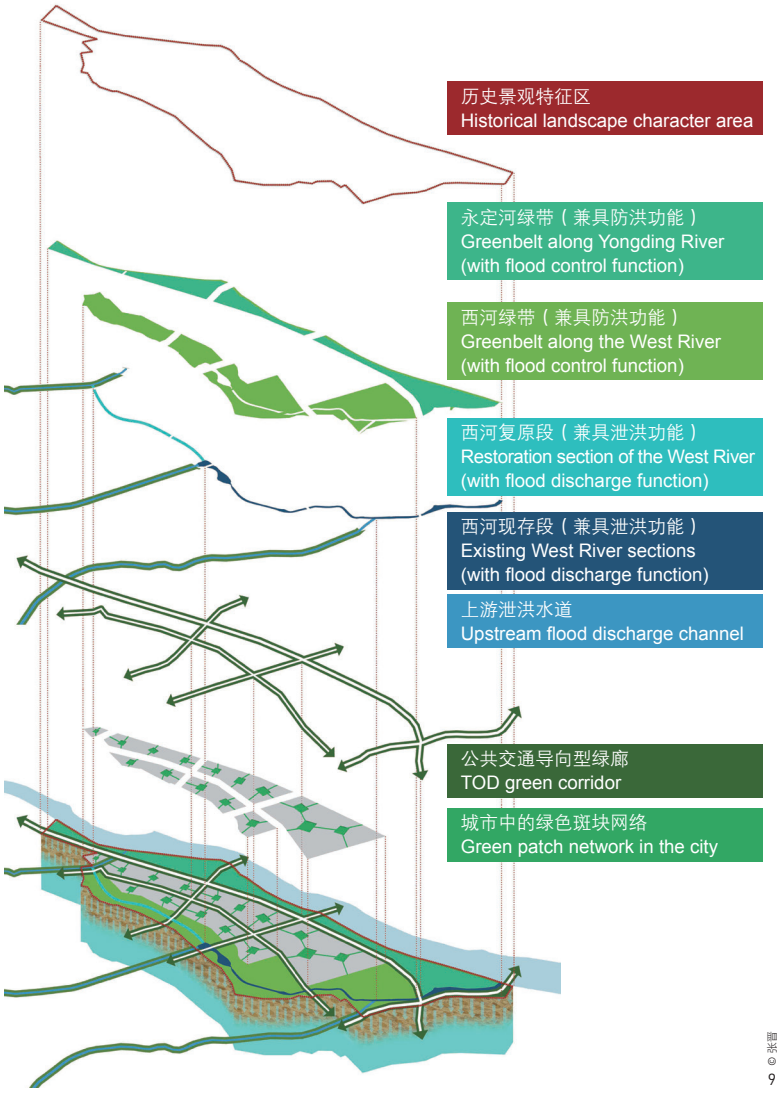
4.1 Reconstruction of Water Adaptive Landscape

Till now, traditional water adaptive landscape in the study area had vanished. The reconstruction of the landscape does not mean to restore certain sites of “landscape heritage”; instead, it is to shape a new urban landscape on the flood land to highlight its historical identity and encourage human–water interaction. Three strategies are listed as follows.

1) Connecting Yongding River with the West River to enhance the spatial connection between human and water. In dealing with the separation between the two rivers and Daodi Flood Land, caused by the expressway near Yongding River and embankment along the West River, it is suggested to introduce elevated corridors and enhance the access of the existing embankment.

2) Promoting groundwater conservation through sponge city construction. Daodi Flood Land, located in the lower mountain area in the west of Beijing that is crucial for groundwater recharge, is the last large undeveloped area on the flood land. It requires protection of the hydrogeological structure from a secondary damage during construction, after which groundwater conservation should be implemented under specific guidelines. Considering the sandy soils on the flood land that can accelerate runoff infiltration, Sponge City construction in this area may create multi-scale green infiltration interfaces to better conserve groundwater (Fig. 9), which would function together with ecological water supply.

3) West River revival by increasing water sources and enhancing ecological purification. Revival of the West River is the eventual vision in this surface water system reorganization in the study area. By now, only the reach to the south of Fengcun Channel has implemented river restoration (Fig. 7). Thus, it is suggested to move forward to restore reaches between Fengcun Channel and Zhongmensi Channel, while taking catchment from mountains that flows into Zhongmensi Channel, Fengcun Channel, and Xifengsi Channel as an important supplementary water source during rainy seasons, and utilizing the reclaimed water treated by sewage plants in dry seasons. Next, ecological transformation strategies aiming at water self-purification of the restored the West River can be implemented, while enhancing its accessibility and landscape services.



图表来源 © 9

2）由“绿化”到“文化”，加强永定河、西河蓝—绿空间的社会生态功能。在严格保护永定河及西河蓝—绿空间、延续研究区域独特历史景观特征区域的基础上，增强绿地的防洪、排涝功能；同时对区域内人水博弈历史、传统农业与水利景观进行展示性重建，传承历史文化景观特色。

3）由“河滩”到“人居”，建立完善的制度与技术保障。适应性发展是应对变化的制度上的能力[48]。目前，永定河流域沿线已基本普及了河长制制度，实行市、区、镇、村四级管理，但具体管护内容主要针对河道水体本身（涉及垃圾渣土、违法排污、违法建设、水面漂浮物、黑臭水体等方面），对河道水源的补给、地下水源的补给、与河道密切相关的重要生态景观及人居环境系统等方面的关注度不足。因此，建议制定专项保护制度与法规，通过政府与非政府组织合作进行技术开发与商业实践，为河滩地的保护与开发提供长效支撑。

9. 构想的稻地河滩水适应性景观空间模式图。相应策略包括建立稻地河滩历史景观特征区；建设永定河绿带，兼具区域防洪缓冲区功能；恢复西河历史河道，梳理现有泄洪水道，形成区域泄洪通道网络；依托线型公共交通导向型绿廊与点状绿色斑块促进雨水涵养。

4.2 Reshaping Water Adaptive Culture

Culture is the collective outlooks, behaviors, and entities created by local people through long-term production and living activities[45]. It in turn influences the evolution of these outlooks, behaviors, and entities. In this regard, the processes and results of adaptation in essence are part of cultural practices, i.e. adaptive culture. This research proposes three strategies for the reconstruction of water adaptive culture (Fig. 8).

1) Combining top-down and bottom-up approaches to reach a local consensus on adaptive development. Interview results of mapping and PAST development showed that local residents did not pay much attention to the adaptation history and future of Daodi Flood Land. Thus, the research suggests to increase the public awareness through top-down public educational programs on policy interpretation, helping find a local consensus on flood land protection and development from social and ecological perspectives. Meanwhile, bottom-up collaborations among multi-stakeholders also encourages residents' participation to local development. In realizing the visions for a better human–water interaction, local people's recognition of water adaptation and its realistic significance will be emphasized[46]. In future, these strategies can also alleviate the impact of probable conflicts between regional policies and local interests on adaptability[47].

2) Reflecting cultural attributes in the landscaping process to improve socio-ecological functions of blue–green spaces along Yongding River and West River. Specific strategies include strengthening flood control and drainage functions of green spaces while ensuring strict protection of blue–green spaces and continuous conservation of the historic landscape character area; and reshaping historical and cultural landscapes by demonstrating human–water tension and traditional agricultural and water conservancy practice.

3) Transforming from flood land to settlement by establishing better management system and technical support for Daodi Flood Land. Adaptive development requires enhancement of institutional capacity to better respond to changes[48]. By now, the river chief system has been widely adopted along Yongding River basin at city, district, town, and village levels. However, this management system supervises mainly pollution and administration problems such as waste and muck dump, illegal wastewater discharge, illegal construction, floating pollutants, and dark and stinky water, neglecting water resource supply, groundwater recharge, and other important aspects that closely impact the riparian ecology, landscape, and living environment. Therefore, it needs to formulate effective special protection framework and regulations of the flood land via governmental and civil cooperation in technical and commercial development.

9. Spatial diagram of the envisioned water adaptive landscape in Daodi Flood Land. Strategies include constructing a historical landscape character area; constructing a greenbelt along Yongding River with both flood control and buffer zone functions; restoring the historic riverway of the West River and identifying existing flood discharge channels to form a regional-scale network for flood discharge; and promoting rainwater conservancy by TOD green corridor and dotted green patches construction.

5 讨论

在上述研究结果的基础上，本章节将主要对PAST中相应内容所反映出的结构性关系进行补充说明：

5.1 适应性问题之间的关系

在稻地河滩的水适应性历史中，就适应性问题而言，往往呈现阶段性对立的情况（图8），即要么一方对另一方的积极适应性发展构成直接威胁（如洪水与农业灌溉），要么一方对另一方的消极适应性衰退产生加速作用（如水资源利用与农业灌溉）。这反映的其实是单一发展路径下的结构性矛盾，也往往是适应性研究中所面临问题的普遍状态。因此在对于适应性问题的认知上，要明确适应的目的并不是彻底解决适应性问题之间的矛盾，而是提高适应的能力、抵御“不适应”带来的风险，在此基础上通过问题的重构，构建多元化发展路径，避免零和博弈的局面。

5.2 自然系统与社会系统之间的关系

适应性研究框架明确将自然系统和社会系统作为适应性的两大主体，这两者同样具有结构性矛盾。从历史维度来看，适应性的主导权大致呈现由自然系统向社会系统过度的特征，而在这一过程中，社会系统的主导权是以忽视甚至是破坏自然系统本身适应规律为代价的。这涉及到适应性研究中经典的“可塑性”（plasticity）和“有限性”（limit）[49]议题，即任何一个系统的适应性行为不可能无限地适应各种条件变化，一旦超过极限就会引发不可逆的过程，而一旦社会系统的适应完全代替了自然系统的适应，将导致不可挽回的后果。因此应更加强调对自然系统本身适应性规律及行为的重视，有意识地将社会系统的适应与自然系统的适应相协调，保证二者的共存。

5.3 消极适应与积极适应、有计划适应与无计划适应之间的关系

从对研究区域水适应性过程的梳理来看，消极适应与计划性适应主要对应社会系统主导的城镇化高速发展时期，这在适应性的相关实证研究中是一个普遍现象[25][50]，但这种对应关系并不完全成立。例如，在应对水资源问题时，官方同时采用了超采地下水的消极适应与沿线生态绿化工程的积极适应。其原因主要在于PAST中适应性限制和障碍所体现出的复杂性博弈。因此，由消极适应向积极适应的转变仍然要强调社会系统与自然系统的协调共生[51]；与此同时，鉴于各类适应性限制与障碍的复杂性，应强调计划性适应的合理应用，为社会系统与自然系统的协调共生提供保障。**LAF**

5 Discussion

In addition to the above results, the research also summarizes the structural relations between different components of the PAST as follows.

5.1 Relations Between Objects of Adaptation

In the water adaptation history of Daodi Flood Land, the objects of adaptation usually see conflicts with each other in two ways (Fig. 8): one object threatens the active adaptation development of the other (e.g. flood versus agricultural irrigation), or one object accelerates the passive adaptation development of the other (e.g. water resource utilization versus agricultural irrigation). Such conflicts varied at different stages. These commonly-seen conflicts in adaptation reflected the structural tension caused by the single purpose of individual adaptation objects. Therefore, it is necessary to understand that adaptation is not to completely resolve conflicts between objects, but to enhance the adaptive capacity and mitigate related risks. By deconstructing the objects of adaptation, this research proposes to build a diversified adaptation development path to avoid turning it to a zero-sum game.

5.2 Relations Between Natural and Social Systems

According to the adaptive research framework, natural and social systems are two significant subjects of adaptation, which also undergo structural tension. Historically, the society replaced the nature as the dominator of adaptation, during which the adaptation laws intrinsic in the natural system have been neglected or overturned. This concerns the classic issues of “plasticity” and “limit”[49] in adaptation research, i.e. no system can infinitely adapt to any condition or change. Once a system faces conditions that change beyond its limits to adaptation—for instance, if the social system totally substitutes the natural system—there will be risks of irreversible effects. Thus, it is crucial to respect the intrinsic laws and working patterns of the natural system to reconcile its adaptation with the social system.

5.3 Relations Between Passive and Active Adaptation, Planned and Unplanned Adaptation

From the review of the water adaptation history in the study area, passive adaptation and planned adaptation happened mainly during rapid urban development dominated by the adaptation of social system. Although commonly seen in relevant empirical research[25][50], such correspondence was invalid sometimes. For example, the government would took both passive adaptation (over-exploitation of groundwater) and active adaptation (ecological restoration of riverfronts) to deal with water resource problems, due to the complicated limits and barriers to adaptation under rapid urban development. Therefore, the transition from passive adaptation to active adaptation requires the coordination and symbiosis between social and natural systems[51]. Moreover, wise utilization of planned adaptation can facilitate this coordination and symbiosis against the complex limits and barriers. **LAF**

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