

Waterfront Space Renewal Strategy of Songhua River, Harbin Based on Recreation Opportunity Spectrum Theory

Taking the Binzhou-Dongjiang Bridge section as an example

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Abstract

Waterfront space is one of the most important recreation places in the city, and the rational allocation of its resources is significant to meet diverse recreation needs. Recreation Opportunity Spectrum (ROS) is a method for effective planning and management of recreation resources based on the environmental preferences of recreationists. This paper takes the waterfront space of the Binzhou-Dongjiang Bridge Section of the Songhua River in Harbin as the research object. Based on three elements of ROS including recreation environment, recreation activities, and recreation experience, the ROS of Songhua River waterfront space is summarized as recreation opportunity points, recreation activities, and recreation experience routes. Study the current recreation conditions of the waterfront space of Songhua River from the above three levels, summarize the current natural ecology and social humanity of the recreation opportunity points, and combine three types of recreation activities including social recreation, cultural recreation, and sports recreation. Based on the above, we divide recreation experience routes of the waterfront space into four types: natural Ecotype, leisure vitality type, historical style type, and abutment viewing type to update and provide a reference for the allocation of recreation resources and spatial renewal of waterfront space along the Songhua River.

Keywords

Recreation Opportunity Spectrum, the Songhua River, Waterfront Space, Renewal Strategy

1. Introduction

With the continuous improvement of China's national economic income level and the transformation of people's consumption concept, leisure has become an indispensable basic demand for residents. In December 2021, the Chinese government issued the '14th Five Year Plan for the Development of Tourism Industry', which pointed out that China will fully enter the era of mass tourism and promote urban leisure to a greater extent.

Waterfront space is one of the most diverse, ecologically sensitive, and economically active areas in the city. It is an attractive recreation space, which gathers a variety of recreation resources such as history and modernity, nature, and humanity, such as those along the Huangpu River in Shanghai and Qinhuai River in Nanjing. The current research on the recreation functions of waterfront spaces is relatively rich, focusing on four levels: the theory of recreation behavior, the evaluation of recreation needs, the analysis

of recreation network structure, and the allocation of recreation resources. The theory of recreation behavior studies the influencing factors of recreation behavior and environmental preferences among different recreation groups; In terms of evaluation of recreation needs, different groups such as children and students are surveyed to plan and design waterfront spaces based on recreation needs; In the aspect of recreation network structure analysis, it mainly analyzes the characteristics of its current recreation structure. For example, Bowen Xiang and others use the social network analysis method to study the waterfront recreation flow network and interpret the spatial structure of the waterfront recreation flow of the Huangpu River; At the level of recreation resource allocation, the main focus is on a comprehensive analysis of the above recreation behaviors and needs, combined with the recreation resources of the research object, to reclassify waterfront space resources. The recreation opportunity spectrum theory is one of the research methods proposed by the United States for the rational allocation of outdoor recreation resources. At present, the theoretical research of the recreation opportunity spectrum in China mainly focuses on the construction and application of the recreation opportunity spectrum of waterfront space, such as Chengxiu Zhang's construction of the recreation opportunity spectrum of Huangpu River waterfront public green space. Jing Qiao's recreation opportunity spectrum and landscape optimization of waterfront greenway in Hangzhou's main urban area.

Therefore, based on the theory of recreation opportunity spectrum, this paper analyzes the recreation characteristics of the waterfront space of Songhua River (Binzhou-Dongjiang Bridge section) from its constituent elements, explores the localization application of the theory of recreation opportunity spectrum, and provides a reference for the renewal of waterfront space planning along the Songhua River, to further enrich the theory and practice of recreation opportunity spectrum in waterfront space.

2. Methodology

2.1. The theoretical connotation of recreation opportunity spectrum

The recreation opportunity spectrum evolved from the demand for outdoor recreation, initially originating from the recreation land classification system proposed by the United States Outdoor Recreation Resources Survey Committee. Later, the National Forestry Administration of the United States determined six recreation opportunity sequences from urban to primitive areas based on the degree of development: primitive, semi-primitive without motor vehicles, semi-primitive natural areas with motor vehicles and access roads, rural, and urban. Designed to provide different environments and experiences based on the different recreation activities of outdoor enthusiasts. As an important component of urban recreation space, waterfront space is distinguished by different types of recreation environments in terms of opportunity sequence, enabling each type of environment to provide different recreation opportunities and achieve the full utilization of recreation resources.

2.2. Elements of recreation opportunity spectrum

From the connotation of the recreation opportunity spectrum, it generally consists of three elements: recreation environment, recreation activities, and recreation experience. According to the characteristics of small recreation scale, equal emphasis on nature and humanity, and the linear distribution of waterfront space, this paper summarizes the connotation decomposition elements of recreation opportunity spectrum into three parts: recreation opportunity points, recreation activities, and recreation experience routes, to put planning and renewal strategies for the waterfront space of Songhua River according to the theory of recreation opportunity spectrum.

2.2.1. Recreation opportunity point

In the existing theoretical research on the recreation opportunity spectrum, the recreation environment is generally divided into the natural environment, social environment, and management environment. The 'Recreation Opportunity Points' defined in this article for urban waterfront spaces are special recreation environments. Based on the historical, ecological, and other attributes of waterfront spaces, a comprehensive evaluation of recreation spaces is conducted from different levels, which facilitates the recommendation of recreation activities for recreation spaces with different levels of development. Recreation opportunity points are generally divided into two types. One is based on the characteristics of user activities. For example, Chengxiu Zhang divides the waterfront space environment of Huangpu River into three types: natural recreation, fitness and leisure, and humanistic experience; Another is based on the degree of development, such as Jinxuan Qin coupling from the ecological and social perspectives, dividing the waterfront space of the Grand Canal into three levels: high, moderate, and low. In this paper, the recreation opportunity points in the waterfront space of Songhua River (Binzhou-Dongjiang Bridge Section) are divided into two categories: natural ecology and social humanity to comb the current recreation opportunity points.

2.2.2. Recreation activity

Recreation activities generally differ based on the recreation motivations of tourists, such as residents and foreign tourists. Junli Qin referred to narrow recreation activities as recreation activities, which are divided into five categories: social recreation, cultural recreation, sports recreation, informal outdoor recreation, and outdoor overnight leisure tourism. The first three are mostly small-scale and short-term recreation activities, while the latter two are tourism activities with longer time and distance; According to the new division method and the characteristics of small-scale and short journeys of waterfront space, this paper summarizes the recreation activities of Songhua River waterfront space into three categories: social recreation, cultural recreation, and sports recreation (Table 1).

Table 1. Types of Recreation Activities. Source: References [18]

Recreation type	Activity Example
social recreation	Dine in restaurants, shop and entertain in shopping malls, accompany family and friends, etc
cultural recreation	Go to exhibitions, music festivals, museums, etc. to enjoy and watch competitions or programs; Shop activities such as visiting famous people's former residences, characteristic historical blocks, commercial blocks, etc
sports recreation	Participate in or enjoy sports and fitness activities such as swimming, gymnastics, dance, walking, running, cycling, etc

2.2.3. Recreation experience routes

Recreation experience is the sensation generated by various recreation activities in the environment, so different recreation activities will generate different recreation trajectories, which is the 'Recreation Experience Route' proposed in this article. In terms of the connection of recreation routes, Mingjing Ding has based on the distribution of cultural nodes and the current traffic conditions in the cultural routes of Fuyang City. Therefore, this paper constructs the Songhua River (Binzhou-Dongjiang Bridge Section) waterfront space recreation experience route based on the distribution of recreation opportunity points, the types of recreation activities, and the current traffic conditions.

2.3. Relationship between three elements

According to the above element analysis, the construction of recreation experience routes is Co-determination determined by recreation opportunity points and recreation activities. The recreation opportunity points show the resource allocation of physical space elements, while recreation activities start from the user's experience needs so that the formed recreation experience routes meet the dual needs of physical space and spirit. Therefore, this paper proposes the idea of constructing the recreation opportunity spectrum of Songhua River (Binzhou-Dongjiang Bridge Section) waterfront space as follows: explore the current recreation opportunity points, investigate the recreation activities of users, and finally form four types of recreation experience routes based on the spatial distribution and activity characteristics of the first two (Figure 1), to construct the theoretical framework of the recreation opportunity spectrum of Songhua River waterfront space.

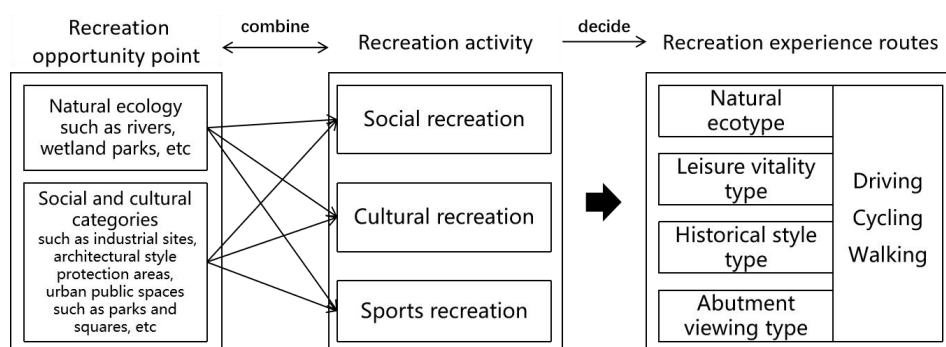


Figure 1. Relationship between Recreation Opportunity Points, Recreation Activities, and Recreation Experience Routes. Source: drawn by authors.

3. Songhua River (Binzhou-Dongjiang Bridge Section) waterfront recreation space renewal planning

3.1. Research scope

This paper takes the waterfront space of the Songhua River (Binzhou-Dongjiang Bridge Section) as the research scope (Figure 2). Songhua River is the mother river of Harbin, which witnessed the development history of Harbin from barbarism to civilization. With the construction of the Middle East Railway, the waterfront space along the Songhua River has gradually accumulated and been enriched, forming the foundation of today's riverside landscape.

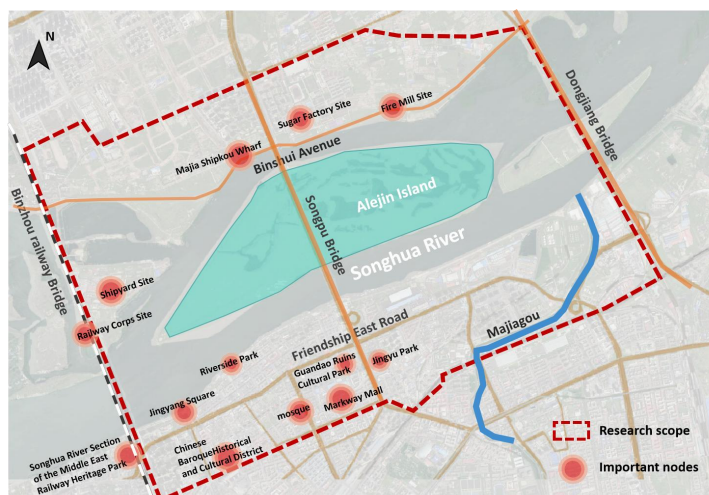


Figure 2. Schematic Diagram of Research Scope of Songhua River (Binzhou-Dongjiang Bridge Section). Source: drawn by authors.

3.2. Analysis of the connotation elements of recreation opportunity spectrum in Binzhou-Dongjiang Bridge Section

3.2.1. Analysis of current recreation opportunity points

The research scope mainly includes the mainstream of Songhua River, Majiagou, an important inland river in the Harbin urban area, and three natural ecological recreation opportunities in Alejin Island National Wetland Park, which are the important ecological foundation of the Songhua River waterfront space (Figure 3).

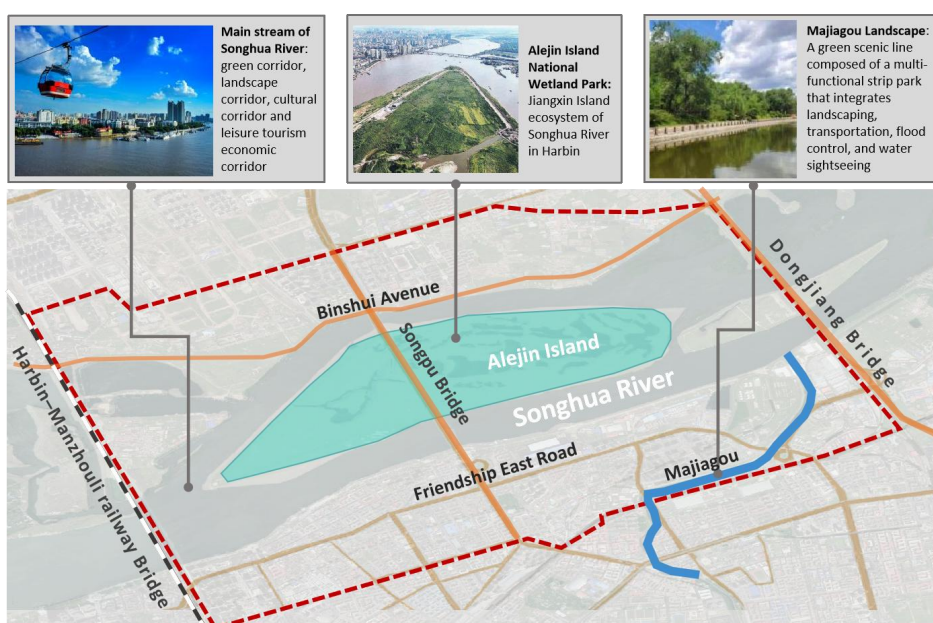


Figure 3. Natural Ecological Recreation Opportunity Points in the Study Area. Source: drawn by authors.

Social and cultural leisure recreation opportunity points mainly focus on industrial sites and distinctive architectural features (Figure 4). Songhua River is a long cultural river with unique historical and cultural characteristics. The construction of Harbin began with the construction of the Middle East Railway, the shipping function of the Songhua River was developed, and terminals and residential areas gradually emerged. Later, Daoli District and Daowai District built many commercial and industrial areas [22]. With the successive construction of the Songhua River highway bridge and the formation of the urban waterfront spatial pattern, the corresponding industrial historical relics and industrial landscape have also been preserved today.

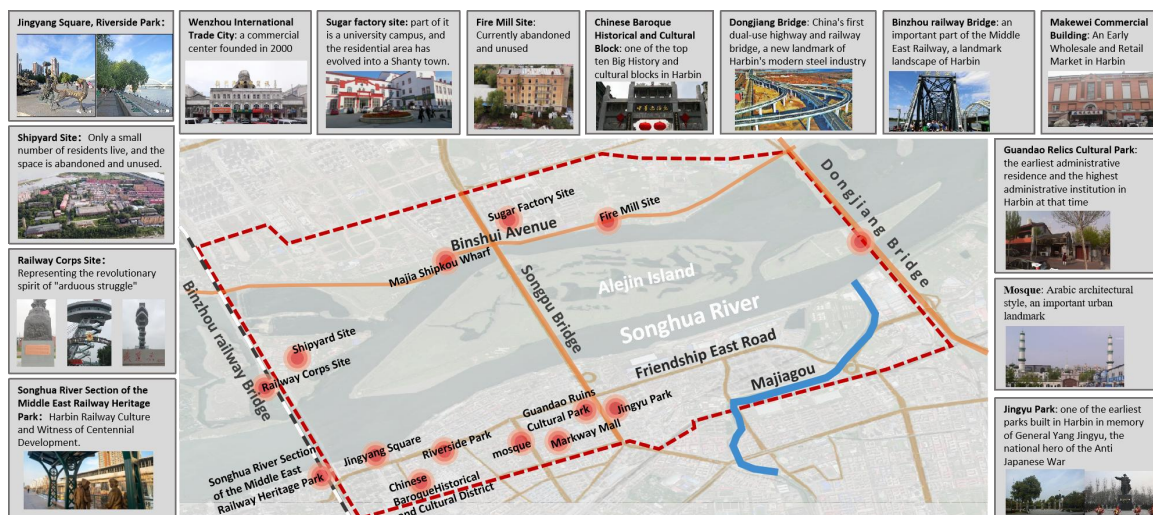


Figure 4. Social and cultural Recreation Opportunity Points in the Study Area. Source: drawn by authors.

3.2.2. Analysis of types of recreation activities

This article uses the observation method of recreation behavior to investigate the recreation activities within the research scope. It is found that most of the recreation activities are for urban residents, and their activities are distributed around residential areas and in environments with good natural conditions, such as riverside pedestrian paths and squares, urban parks, etc. Recreation activities are mainly focused on sports and exercise; Tourists are generally concentrated in "internet celebrity check-in points" such as Zhonghua Baroque Street and Binzhou Railway Bridge, and recreation activities mainly include visits, photos, and meals. Therefore, based on the classification of recreation activities in the previous text, the main recreation activities in the waterfront space within the research scope were summarized (Table 2).

Table 2. Types of recreation activities within the research scope. Source: made by authors.

Recreation type	Activity Example	Recreation subject	Activity Example
social recreation	Dine in Russian restaurants, coffee shops, and other entertainment places; accompany family and friends for walks and exchanges, such as Jingyang Square, Riverside Park, Jingyu Park, etc.	Urban residents and tourists	
cultural recreation	Visit the Chinese Baroque Historical and Cultural District for sightseeing; Appreciate and watch art programs such as cross talk and duets at exhibitions, music festivals, museums, etc; Visit celebrities' former residences, mosques, and special Shinise catering enterprises such as Laodingfeng, Zhangbaopu, etc; Visit and tour industrial sites such as Binzhou Railway Bridge, Alejin Island, and Shipyard Community.	Mainly tourists	  
sports	Sports and fitness activities such as swimming in the Songhua River, walking	Mainly urban	

recreation in the park on the riverside bridge, kite residents
flying, square dancing, running on the
riverside trail, cycling, etc.

3.2.3. Division of recreational experience routes

According to the research on the current recreation opportunity points and recreation activities, the recreation experience routes within the research scope are divided into four types of recreation experience routes: natural ecotype, cultural vitality, historical style, and abutment viewing (Table 3). Natural ecotype and abutment viewing recreation routes provide leisure and natural experience; Cultural vitality and historical style provides a sense of freshness and happiness in experiencing unique cultures.

Table 3. Classification of Recreation Experience Route Types. Source: made by authors

type	Spatial characteristics	Main Features	Activity content
natural Ecotype	With ecological landscapes such as wetlands and parks as the theme, various activity streams such as experiencing nature and exercising are interspersed.	ecological environment	Running, cycling, hiking, nature education, etc
leisure vitality type	Provide various forms of entertainment with cultural, leisure, commercial, and other leisure activities as the theme.	Leisure venues	Culture, Business, Leisure and Fitness
historical style type	Featuring distinctive preservation of buildings, historical sites, and the environment, we aim to create a regional-themed activity route.	Historical sites	Culture, Expo, Commerce, Tourism, etc
abutment viewing type	Connect with the special landscape area on the pedestrian bridge, including space on the pedestrian bridge, walkway space, etc	Specific viewing platforms	Subjective scenery platform on the bridge and connecting space under the bridge

3.3. Renewal of waterfront recreation space planning of Songhua River

This study cites the pastoral poet Tao Yuanming's poem 'Returning to the Past', which states that 'supporting the elderly to rest in the flow, and constantly looking forward to the scenery', and sets the design theme as 'enjoying the riverside and relaxing in the north and south'. The purpose is to use the resources of the waterfront space to create recreation experience routes through recreation opportunity points and recreation activities so that the recreationist can 'walk in the park every day, look at the distance from time to time, and provide a leisurely and comfortable roaming experience', to enjoy traveling along the Songhua River and rest outside the road and in Songbei.

3.3.1. Planning of recreation opportunity points

The focus of updating recreation opportunities lies in the improvement of facilities. This article categorizes them into comprehensive and service-oriented types. Comprehensive recreation facilities are

created based on different recreation experience routes (Figure 5). Among them, the natural ecotype is a public space with ecological protection as the basic goal and ecological landscape as the main feature, which is conducive to running, cycling, hiking, natural education and other activities, such as Alejin Island, Guandao Relics Park, etc; Leisure and dynamic buildings mainly focus on urban parks and open green spaces, with appropriate cultural, leisure, commercial and other functions, such as off road traditional commercial markets, Markway commercial buildings, etc., with complete service facilities, gradually achieving quality goals while meeting basic goals; The historical style type takes the Chinese Baroque historical and cultural blocks as the core station, connecting with unique urban historical buildings and blocks such as mosques and Guandao Cultural Heritage Park, which is conducive to cultural, expo, commercial, sightseeing and tourism activities; The viewing type of abutment is mainly based on the reconstructed river crossing bridge and some riverside hydrophilic platforms, with a good view angle as the setting basis, combined with landscape structures, recreation, commercial and other facilities, to create a public space that can experience the best landscape on both sides of the Songhua River.

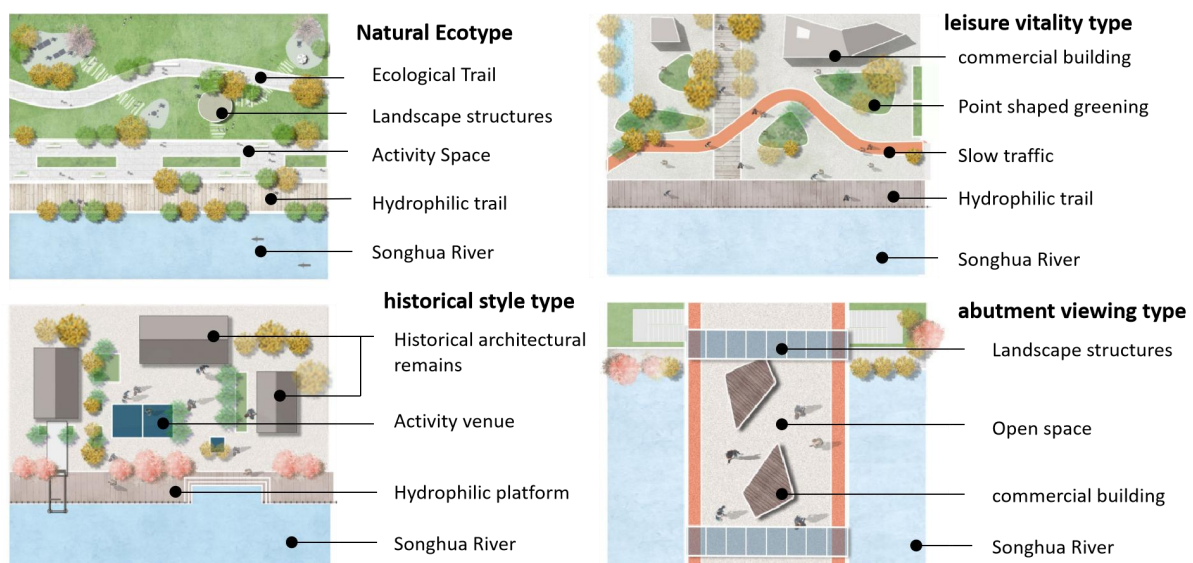


Figure 5. Schematic diagram of comprehensive facility space. Source: drawn by authors.

The service type is mainly based on the infrastructure needed for recreation, such as toilets, changing rooms, drinking water places, depositories, telephone booths, etc. Small post stations are distributed at the junction of slow-moving, cycling, and other transportation systems in various parts, the middle part and the space connecting with bus stops to provide citizens with short rest, transfer, and other functions (Figure 6).

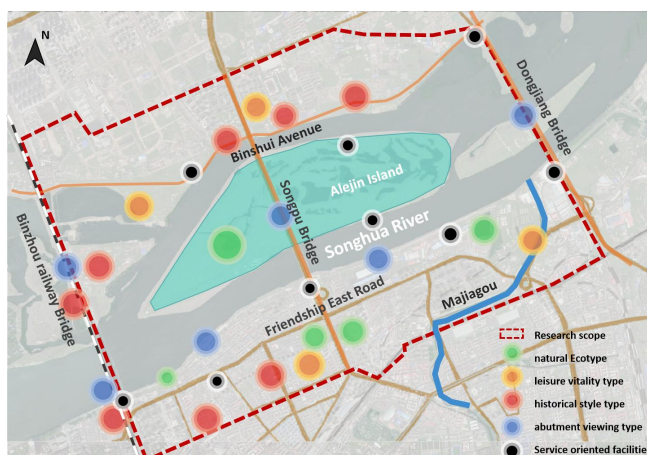


Figure 6. Schematic diagram of facility point distribution. Source: drawn by authors.

3.3.2. Recreation experience route planning

The natural ecotype experience route takes the Songhua River as an important path to connect, connecting the post station spaces such as Alejin Island and Riverside Park, fully considering the relationship between bicycle traffic and pedestrian traffic, so that the two slow traffic systems can coexist and share; With Majiagou, Makiwei Commercial Building and other commercial and entertainment post station spaces as the core, the leisure and dynamic experience line is connected by the current slow traffic system, set up a rich level of inland waterfront landscape, and fully develop commercial resources based on meeting the landscape demand; The historical style experience route revolves around shipyard ruins, Chinese Baroque, and mosques, with a focus on walking, emphasizing the walking experience of traditional neighborhoods; The bridge abutment sightseeing experience line is dominated by Harbin–Manzhouli railway Bridge, Songpu Bridge and Dongjiang Bridge. The river bridge platform is reasonably used to arrange various activities, which are aimed at sightseeing, leisure, and various small businesses, as well as the media to contact other activities (Figure 7).

In addition, two types of recreation activities are proposed: traveling and enjoying oneself. The tour is mainly by car and bike, with a travel distance of about 1-2h. It penetrates from the surrounding area of the city to the scenic spots along the riverside. It is a combined recreation line of the city and the riverside, giving a glimpse of the urban scenery of Harbin; Changyou mainly consists of cycling and slow walking, with a travel distance of about 0.5 to 1.5 hours. It gradually penetrates from the riverside to the city, extending the historical landscape of the city and combining it with waterfront commercial, rest, park spaces, etc. to achieve a pleasant play.

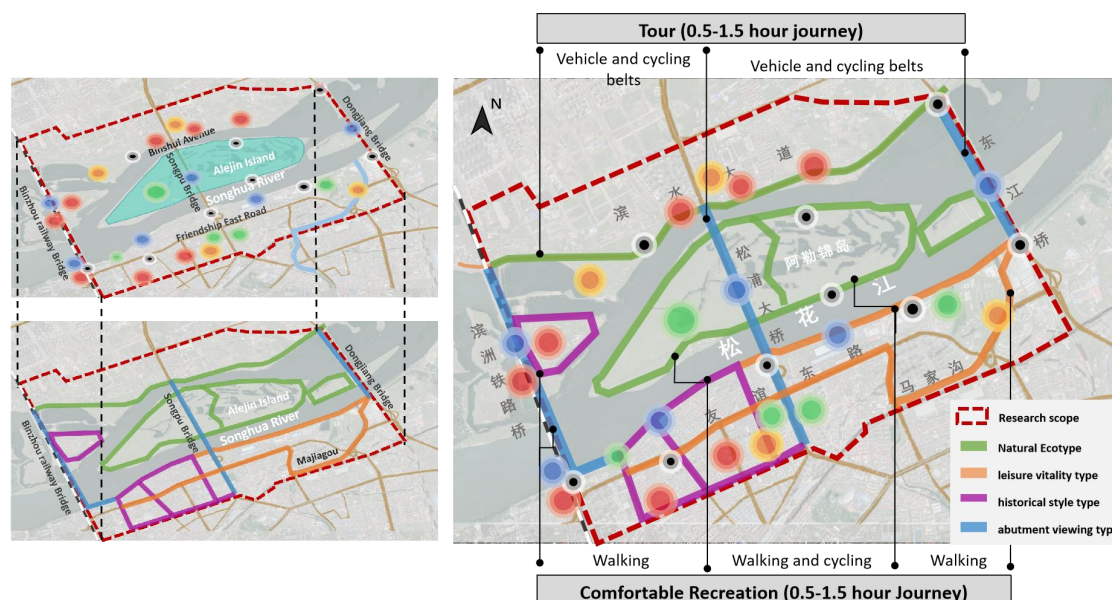


Figure 7. Schematic diagram of recreation experience route planning. Source: drawn by authors.

4. Conclusion

Based on the connotation of recreation opportunity spectrum theory, this paper refines its three elements of recreation opportunity points, recreation activities, and recreation experience routes, and accordingly studies the recreation function of the waterfront space of Songhua River (Binzhou-Dongjiang Bridge Section). By exploring potential recreation opportunity points and discovering different types of

recreation activities, the recreation experience routes are divided into four types: natural ecotype type, leisure vitality type, historical style type, and abutment viewing type. It also plans and updates the recreation opportunity points and recreation experience routes of the waterfront space of the Songhua River (Binzhou-Dongjiang Bridge Section), trying to provide a reference for the design of waterfront recreation space along the Songhua River. However, this article also has shortcomings in the survey of recreation activities, lacking quantitative data support and neglecting potential recreation activities. Future research can combine online text data and in-depth interview data, and use technical methods such as online text analysis to deeply study human recreation behavior and activities.

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