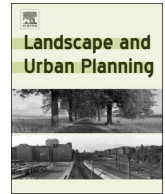




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Research Paper

## Can greenways perform as a new planning strategy in the Pearl River Delta, China?

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## ABSTRACT

The modern greenway movement in China originated in 2010 when Guangdong Provincial Government launched the Pearl River Delta greenway network. The PRD greenway planning has strategic objectives that respond to issues associated with urbanization in the region. This article presents a conceptual framework that explains the potential impact of several key factors in the planning context on the strategic uses of greenways. The framework is then applied to empirical research carried out in the PRD. The results show that greenway planning is a feasible strategy to promote rural economic development by attracting tourists and promoting the development of service sectors. In general, the PRD greenways function as a social strategy: they create new recreational spaces and provide public goods and facilities in both urban and rural areas. However, the results also show that many greenways lack landscape and ecological strategies and become primarily a transportation strategy that defines space for walking and cycling routes in urban areas. The emerging transportation-led greenways reflect the inconsistency of planning goals and outcomes, which is a compromise to both the centralized administrative system and the inadequacy of greenway resources. This article concludes that although strong leadership is necessary in greenway development, insufficient social participation can undermine the achievement of the goals and priorities of the greenway plan, particularly the ecological goals and functions. How to engage local agencies, interested groups, and affected stakeholders in the planning and decision-making process has become a big challenge for greenway planning in the PRD greenways.

## 1. Introduction

Greenways have a history of at least 3000 years, and include ceremonial avenues, boulevards, parkways, park belts, park systems, and green belts (Turner, 1998). The greenway movement arose as a response, driven by basic human needs, to urbanization (Searns, 1995). These needs include recreational activity and the conservation of spaces and habitats (Jongman & Pungetti, 2004). In America, greenways – defined as “linear open spaces,” “natural or landscaped trails,” and “strips and linear parks” – became a national movement (Little, 1990). The primary purpose of the first American greenways was to provide connections between human settlements and the natural environment (Fabos, 1995). In Europe, greenways were developed in two contexts and had distinct functions, namely to conserve ecological infrastructures by incorporating them into an ecological network (Jongman & Pungetti, 2004), and to provide safe and quiet routes through parks,

green spaces, and streets (European Greenways Association, 2000; Transport for London, 2014b). Because greenway resources are often concentrated in corridors, greenways are “strategic and spatially efficient for protecting and managing land” (Ahern, 2002, p. 2). In particular, protective, defensive, offensive or opportunistic strategies could be adopted in specific planning context (Ahern, 1995). In the international greenway movement, which started in the 1990s, greenways no longer had only beautification and recreational functions, but were also used to achieve multiple objectives in ecological and human dimensions (Gobster, 2014; Searns, 1995).

For over 2000 years, the historical landscapes that could now be considered greenway spaces in China were primarily linear landscapes with elements of trees and vegetation (Yu, Li, & Li, 2006). Most of these linear landscapes were related to production and protection, such as the protection of crops from the wind. The modern greenway movement in China started in 2010, when Guangdong Provincial Government

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launched the Pearl River Delta (PRD) greenway network as part of its urban-rural integration policy (Guangdong Provincial Government, 2010). Since the economic reform in the 1980s, the PRD has undergone a bottom-up rural industrialization process by attracting a large number of small-scale, labor-intensive industries. This process is also called the “small city and town dominated urbanization and foreign investment oriented industrialization” (Lin, 2001; Sit & Yang, 1997). The process has promoted a rapid growth in population and level of urbanization in the past three decades. Nevertheless, the PRD has been confronted with many economic and development issues, for example, increasingly intensified land use and a fragmented landscape, an unequal distribution of resources including public goods, the challenge of industry upgrading, and urban-rural disparities. Therefore, the primary purpose of the PRD greenway network was to mitigate the urban-rural disparities in terms of economic, environmental, and social dimensions. By 2016, over 12,500 km of greenways had been developed, and attracted increasing attention nationwide: thirty-one provinces in China have now planned or implemented provincial greenways, and over 163 cities are working on municipal greenways (Liu, 2017). In 2016, the Ministry of Housing and Urban-Rural Development published the planning and design guidance of greenways (Ministry of Housing and Urban-Rural Development, 2016), which means that the central government has recognized greenways as a new national policy.

The PRD Greenway Network provides an excellent case for national and international studies on greenways. As the leading project of the greenway movement in China, the PRD Greenway Network reflects some common issues of greenway planning in the specific Chinese context, such as unique institutional traditions, increasingly environmental, social and economic problems associated with rapid urbanization, and a lack of experience on greenway planning and implementation. While most greenway networks in China are still under construction and have not been incomplete, the PRD Greenway Network was already fully implemented and has led to a new greenway campaign (i.e. South Canton Historical Trail). Thus, it has provided valuable experience in greenway planning and implementation for other Chinese regions. In comparison with international greenways, the PRD greenways have some specific characteristics, not only because of their unique institutions and contextual issues, but also due to the high-density greenway network. For instance, the greenway density in Shenzhen reaches about 1.2 km/km<sup>2</sup>, which is much higher than 0.3 km/km<sup>2</sup> density in Singapore. As a dense greenway network in a densely populated area, the problems and experience of the PRD Greenway Network nevertheless have remained under-studied.

The academic debates on greenways are mainly attuned to the Western context, while only a few studies have illustrated the recent greenway movement in China. Some researchers highlight the special institutional arrangements of the PRD greenways. Xu and Yeh (2012) argue that the PRD Greenways are a result of restructuring and re-scaling governance, which transforms from an internally coherent transformed system to a contested terrain. Chung, Zhang, and Wu (2018) further point out that the PRD greenways are set of politically realistic and adaptive endeavors to the powerful land interests. Meanwhile, some scholars focus on the usage of greenways. Liu, Siu, Gong, Gao, and Lu (2016) use the geographic information system techniques to describe the distribution of physical activities in the greenway network of Shenzhen. Their studies show that greenways with dense residences, mixed land-use, advanced street network and large parks have positive effects on supporting physical activities. Nevertheless, scholars have not yet paid sufficient attention to the relationships between development issues, institutions structures, and land interests in the planning and implementation of greenways, and their impact on the functions of greenways. The policy goal of the PRD greenway network is to mitigate the urban-rural disparities in terms of social, economic and ecological dimensions. This suggests that the PRD greenway planning may have particular strategies to deal with issues within these dimensions. Therefore, the central question of our research is that: Can

greenways perform as a new planning strategy to address social, economic and ecological issues in the PRD?

To answer the mentioned question requires the formulation of a framework for understanding the relations between contexts and strategies. Based on both Western and Chinese literature, this article firstly develops a conceptual framework that interprets several key factors in the planning context that can affect the functions and strategies of greenways. This framework is original to link planning contexts and activities with strategies of greenways, which are rarely addressed in previous studies on greenways. Empirical research carried out in the PRD is then used to illustrate the framework's application.

## 2. Conceptual framework

### 2.1. Literature review on greenways

Greenways are networks of green corridors of various widths (Fabos, 1995), which are “open spaces connector linking parks nature reserves, cultural features, or historic sites with each other and populated areas” (Little, 1990, p. 1). They contain linear elements that are planned, designed, and managed for multiple purposes (Ahern, 1995), and routes that are reserved exclusively for non-motorized journeys (European Greenways Association, 2000). Greenways have various forms, which can provide different benefits, such as ecological, environmental, social and sometimes economic functions (Smith, 1993; Erickson, 2004a). The compatible or synergistic multiple uses is one of the theoretical bases of greenways; the others are the co-occurrence of natural and cultural resources in corridor areas, and the benefits of landscape connectivity (Ahern, 2004). Researchers have recognized the multiple benefits of greenways for the integration of abiotic and biotic resources (Ahern, 1995), social exchange (Bischoff, 1995), land protection (Ahern, 2002), and collaboration between stakeholders (Ryan, Fábos, & Allan, 2006). Greenways are seen as an overall conservation strategy, “a natural and cultural landscape matrix for which the whole is greater than the sum of the parts” (Zube, 1995, p. 22).

In the international movement, greenways are influenced by geographies, economics, culture, social and urban developments, and therefore have diverse forms (Toccolini, Fumagalli, & Senes, 2006; Weber, Boley, Palardy, & Gaither, 2017). In Europe, greenways developed into two distinct types, namely alternative transportation routes (Scudo, 2006) and ecological networks (Jongman, Kùlvik, & Kristiansen, 2004; Von Haaren & Reich, 2006). In urban areas, greenways are also used to maximize the potential of land, for example, reserving or creating urban open spaces, especially in metropolises that were facing problems of congestion and overcrowding (Tan, 2006). They are planning tools to preserve, restore, and create green spaces in rapidly urbanizing countries, such as Brazil (Frischenbruder & Pellegrino, 2006).

### 2.2. Institutional tradition and historical culture of greenways in China

In China, the historical greenways were linear landscapes alongside rivers, farmland, and transportation corridors (Yu et al., 2006). They had multiple functions, for example, urban beautification, shading pedestrians, protecting farmland, production and producing materials for defense (Luo & Wang, 1986). In contemporary China, several top-down approaches have been employed to preserve or create greenways, such as the Three North Greenbelt which was approved by the State Council and implemented by the State Forestry Administration (Yu et al., 2006).

Besides, the National Garden City Program and the Green Channel Project could also be seen as early efforts of the greenway movement. In 1992, the National Garden City Program was initiated by the Ministry of Housing and Urban-Rural Development. It stimulated the development of urban landscapes in many cities by establishing a standard for garden cities, covering greenery and environmental development, administrative leadership, and a maintenance system (Ministry of Housing

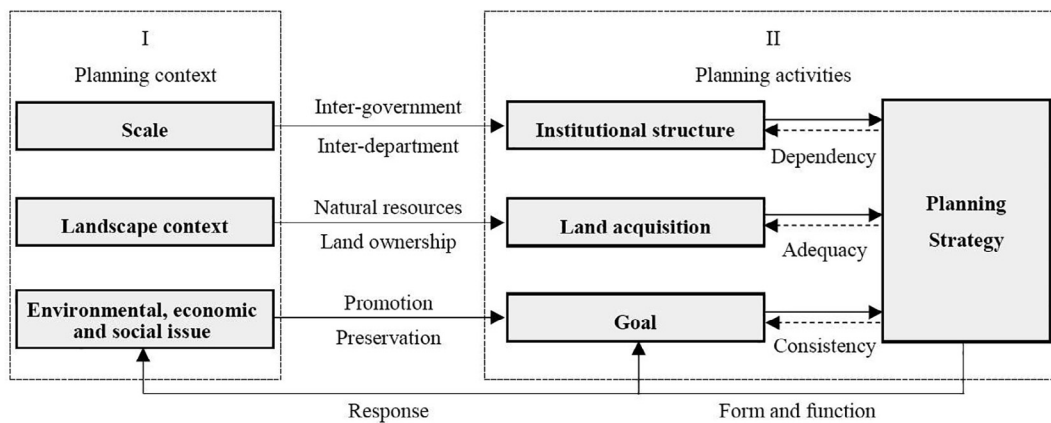


Fig. 1. A conceptual framework: greenways as a new planning strategy.

and Urban–Rural Development, 2000).

Since 1998, the National Greening Committee, the State Forestry Administration, the Ministry of Transport, and the Ministry of Railways have issued a series of documents on the Green Channel Project, which focuses on the greenery alongside railways, highways, and rivers on the national level. In 2000, a national official document stated that 60% of railways, national highways, rivers, and canals should have greenery corridors by 2005, and that 100% should by 2010 (National Greening Committee Office, 2000). This project finally created greenery alongside 1,943,300 km of highways, 34,300 km of railways, and 50,700 km of waterways (National Greening Committee Office, 2011).

From the National Garden City Program to the Green Channel Project, there have been continuous policy efforts in creating urban greeneries. A top-down institutional structure has been established, including the National Greening Committee in the central government and municipal departments at the local level. Consequently, urban greeneries have been institutionally developed, managed and evaluated. Both urban greeneries and institutional structures become important resources for the PRD greenways.

### 2.3. The definition of the Pearl River Delta greenways

The PRD greenways were a part of the international greenway movement. Starting in the 2000s, several Chinese scholars introduced the international greenway movement to China (e.g., Liu & Yu, 2001; Tan & Zhao, 2007). In January 2010, a video on international greenways was shown at a Guangdong provincial meeting. Later, the Guangdong provincial government used greenways on the east coast of the United States, the Ruhr area of Germany, and Singapore and Japan as valuable references for the PRD greenway planning.

There are several definitions of the PRD greenways in the official documents. In this article, we use the definition given by Yang Wang, who was the Guangdong Provincial Party Secretary, the initiator, and the most influential leader of the PRD greenway development. In a speech Yang Wang delivered to municipal leaders in February 2010, he adopted and combined several classic definitions (Flink & Searns, 1993; Little, 1990) to explain the official document: “Greenways are linear green open spaces alongside natural and transportation corridors, combining avenues, non-motorized routes, and cultural tourism routes. More specifically, greenways are: a nonpolluting commuter route, a walking or bicycle trail, a means to promote stream-water quality or to preserve wildlife habitat, a method to buffering land uses such as residential development or agriculture activity, or a way to safeguard a watershed or the historic character of an area” (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, p. 4).

### 2.4. A conceptual framework to understand greenways as a new planning strategy

Planning is a governance activity occurring in the complex and dynamic institutional environments, shaped by wider economic, social and environmental forces that structure specific interactions (Healey, 2003). In the field of urban planning, scholars have increasingly paid attention to how planning strategies and activities are developed to address key issues in a specific planning context (e.g. Healey, 2007; Louis, 2015). As mentioned by Leung (1985), three features are crucial in evaluating a planning policy, including: the consistency of values, objectives, strategies and outcomes, the adequacy of social, economic and other resources, and the dependency of the political and practical condition. However, studies on greenways have often paid attention to one specific aspect such as landscape, usage or institutional structures. There is a lack of studies on the linkages and interactions between contextual factors and planning activities. Therefore, we developed a conceptual framework that integrates the planning context and the planning strategies, in order to understand whether greenways perform as a new planning strategy to deal with social, economic and ecological issues in the PRD (see Fig. 1). The planning context has three key elements (scale, landscape context, and ecological, economic, and social issues), and the planning activities have four key elements (institutional structure, land acquisition, goals, and planning strategy). The mentioned key elements of the planning context and the planning activities are widely discussed in studies of greenways (e.g., Ahern, 1995; Erickson, 2004a; Linehan, Gross, & Finn, 1995).

First, greenways at the regional scale require special institutional structures to coordinate the diverse actors and policies involved. In addition to policy orientation and coordination, the implementation and the management orientation are also crucial to greenway planning (Ahern, 1995). Strong centralized leadership is necessary throughout the process, in order to acquire land and sufficient funds, and for intergovernmental and interdepartmental cooperation (Erickson, 2004b; Von Haaren & Reich, 2006). Effective institutional structures are absent from many Western greenway practices (Erickson, 2004b; Ryan et al., 2006). In China, top-down activities have been often adopted in landscape planning. For instance, the Three North Greenbelt and Green Channel Project was effectively developed under the centralized administrative system. However, there was a lack of a scientific basis and public participation of the project (Yu et al., 2006).

Second, an in-depth understanding of the landscape context is a precondition for land acquisition. The landscape context refers to the predominant land cover of the area concerned and the predominant trends in land use change, for example urban development of forest or agricultural land (Ahern, 1995). It reflects different kinds of land use, which require specific means to obtain access to the greenway resources. In America, land acquisition often fails due to the conflict

between public and private interests in land (Linehan et al., 1995; Little, 1990). Users' and residents' perceptions therefore received continuous attention (see Gobster, 1995; Gobster & Westphal, 2004; Weber et al., 2017). In China, particular attention needs to be paid to the dual urban-rural land system. Rural land is collectively owned, whereas urban land is owned by the state and managed by the relevant municipality (Lin, De Meulder, & Wang, 2011). A village, as a collective, can possess, use, and benefit from the ownership of land, but does not have the right to dispose of it, whereas a city can requisition a village's agricultural land and other collective land for new developments, including greenways. In rural areas and small cities, it is easy for local governments to acquire collective lands such as farmland, which is often cheap and available, for the construction of public infrastructure and facilities. Nevertheless, it is much more difficult to requisition collective land of villages or "villages in the city" in big cities (e.g. Shenzhen with limited land resources), due to costly compensations and relocation programs (Hao, Sliuzas, & Geertman, 2011). This suggests that land requisition can become a major barrier for greenway development in urban contexts and influences greenway planning strategies and effects.

Third, issues associated with urbanization determine the goals that greenways are intended to achieve. The literature shows that greenways are usually created in response to specific ecological or social issues. For example, the increasing number of animals killed by automobiles was a primary reason to create the statewide Florida Ecological Greenway Network – an ecologically functional habitat system to mitigate the impact of roads on the habitat of species (Smith, 2004). In Singapore, an increasing need for recreational space on the heavily built-up island led to the development of greenways to connect and improve open spaces (Tan, 2006). In the PRD, the greenways are intended to mitigate the urban-rural disparities, such as economic and environmental problems, a lack of public facilities in rural areas, and a lack of recreation spaces in urban areas (Ma, 2012; Xu & Li, 2010). The ecological, economic, and social issues thus influence the purpose of PRD greenways, which is to protect the regional ecology, improve urban livability, promote economic development, and perform a social function (Ma, 2012).

Finally, according to Ahern (1995), greenway planning can occur in four principle strategic contexts – namely protective, defensive, offensive, and opportunistic strategies – which are classified according to the attitude (proactive or reactive) and the supporting landscape (sustainable or isolated). However, these planning strategies are also about the specific goals of the greenway. In China, planning is a key driver of rapid economic growth, but it has limitations in achieving a more sustainable and just urban future (Wu, 2015). The PRD greenways aim to promote urban-rural integration and equal development in the region by providing public facilities and facilitating economic transformation in rural areas (Xu & Li, 2010). Therefore, besides the mentioned landscape and ecological strategies, attention should also be paid to the potential economic and social strategies of Chinese greenways.

As a result of the interrelated forces of institutional structure, the land acquisition and the planning goals, planning strategies should be evaluated for their applicability and effects on the social, economic and ecological issues. Leung (1985) argues that there is a logistic need to investigate whether there is relevance and causality between objectives, strategies and outcomes. There is also an economic need to evaluate whether the planning arrangements are necessary and sufficient. Most importantly, the key for the applicability of policy is the dependency of collective recognition, which determines the political and practical support.

### 3. Methods and data collection

This research employs mixed methods, including documentation, semi-structured interviews, questionnaires, observation, and mapping. There are three major research steps.

First, a review of planning documents helps us to identify several key actors in the planning process. With the support of local universities and governmental agencies, we conducted semi-structured interviews with 12 key actors (greenway planners, officials, researchers, etc.) to understand the institutional arrangements at different levels in 2014 and 2016. Each in-depth interview lasted about 1–3 h. The contents of the interviews covered development issues in the PRD, the governmental arrangement for greenway planning, planning activities, the implementation effects, and the roles of and relationships between key actors (see Appendix).

Second, in order to understand the social and economic functions of greenways, we conducted several periods of in-depth fieldwork case studies in four major cities in the PRD in April–August 2014, December 2014–January 2015, and November 2015–April 2016. The cases were Biology Island, Baiyun Lake and Liantang Village in Guangzhou, Bay Park and Fenghuang Mountain Forest Park in Shenzhen, Honghua Lake in Huizhou, and Songshan Lake in Dongguan. These seven places are popular leisure and tourism spots, and have both economic and social functions. We first investigated the cases through observations and photographs to record the activities and landscape around greenways. Then we employed semi-structured interviews and questionnaires to acquire the opinions and experiences of the stakeholders. In Liantang Village, we set up three survey booths to distribute questionnaires to local residents and tourists. We invited interested users to the booths and informed them about the content of the questionnaires. The completion rate was estimated at about 80%, because the number of questionnaires that respondents refused or failed to complete was not counted. In Biology Island and Donghao River Greenway in Guangzhou, we distributed questionnaires and helped the respondents to complete them on site; here, the estimated completion rate was about 60%. By the end of the survey, we had a total of 889 completed questionnaires from rural greenway users (477 completed by villagers and 128 completed by tourists in August 2014) and urban greenway users (284 completed by urban residents in April 2014). The questionnaires concerned such matters as the characteristics of the respondents, their opinions on greenways, and the effect brought about by greenways (recreational behavior, income, etc.), and thus provided an understanding of the greenway function from the perspective of users.

Third, Shenzhen city and Zengcheng district of Guangzhou were used as the core cases to reflect the environmental and ecological issues and recreational functions of greenways in the PRD. On the one hand, Shenzhen is now one of the leading municipalities in greenway development: By 2015, it had created 2377 km of greenways (Urban Management Bureau of Shenzhen Municipality, 2015), representing 25% of all greenways in the PRD. On the other hand, Zengcheng is used as a comparative case, which was the first area that implements greenways in China. Through field investigation in August 2014, 367 km of greenways and the land use in the 1000-m corridor area along the greenways were identified. We redrew the maps of the greenways in Shenzhen and Zengcheng and developed a GIS database, based on collected plans, documents, and photos, to understand the routes, categories, administrations, and forms of greenways at the municipal scale. To evaluate the environmental and recreational functions, we categorized the greenways according to their relation to the road system and the natural environment.

## 4. Empirical research in the Pearl River Delta

### 4.1. Planning context

#### 4.1.1. Scale

The PRD greenways are located in one of the world's most densely populated and most dynamic economic regions (See Fig. 2). Due to rapid urbanization and industrialization, which started in the 1980s, the built-up area of the PRD grew from 4500 square kilometers in 2000 to nearly 7000 square kilometers in 2010 (World Bank Group 2015).

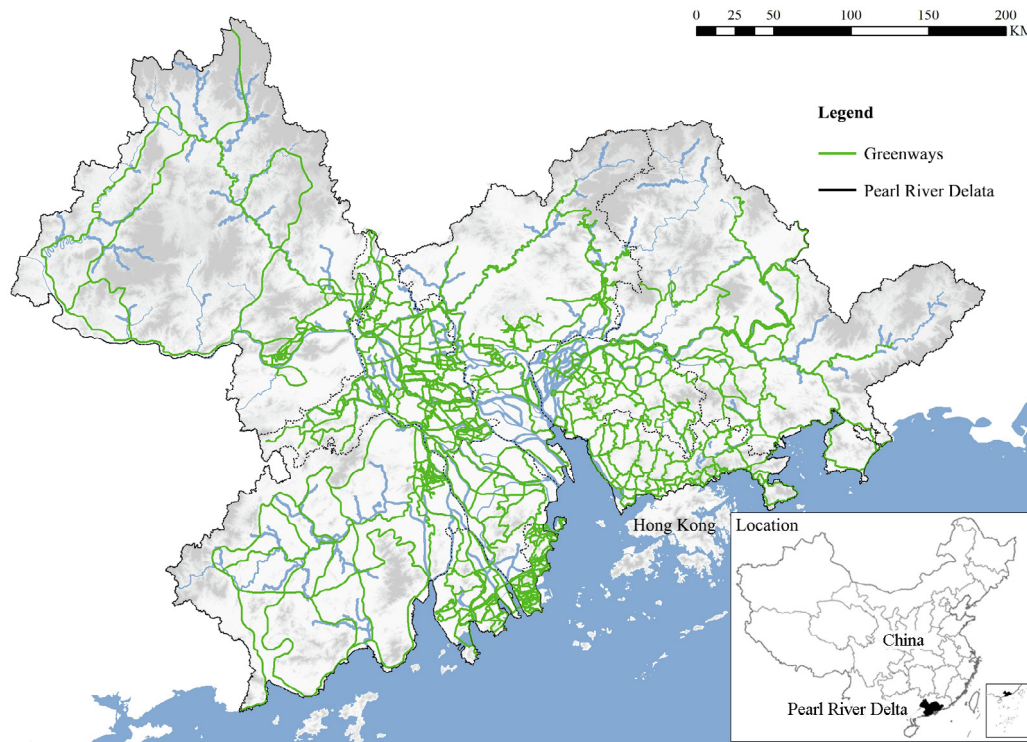


Fig. 2. The Pearl River Delta Greenway Network.

The PRD is now the world’s largest metropolitan area in terms of both size and population (World Bank Group, 2015). It has a total area of 54,754 square kilometers and comprises nine cities and 46 districts and counties that are physically separate but functionally networked. It provides housing for over 56 million people and produces 7.5% of China’s GDP (Statistics Bureau of Guangdong Province, 2015).

4.1.2. Landscape context

There are two main types of landscape context in the PRD cities (Table 1): large forests and built-up areas. Land acquisition is very difficult, particularly in the densely built-up areas that are occupied and managed by various stakeholders. Meanwhile, the rapid urban expansion has led to severe environmental issues and there is an urgent need for environmental protection.

4.1.3. Ecological, economic, and social issues associated with urbanization

The rapid growth in population and level of urbanization in the PRD during the last three decades (Table 2) have resulted in several challenges of sustainable development (See Table 3).

First, there has been an increase in intensified land use and

Table 1

The land cover of the Pearl River Delta cities, in square kilometers (2007–09). Data Source: The Second National Land Resource Investigation (2007–2009).

| City      | Developed land | Forest | Arable land | Population per square kilometer |      |     |      |
|-----------|----------------|--------|-------------|---------------------------------|------|-----|------|
| Dongguan  | 1057           | 51%    | 345         | 17%                             | 126  | 6%  | 3328 |
| Foshan    | 1265           | 48%    | 741         | 28%                             | 379  | 14% | 1871 |
| Zhongshan | 604            | 47%    | 302         | 24%                             | 127  | 10% | 1735 |
| Shenzhen  | 852            | 47%    | 586         | 32%                             | 32   | 2%  | 5311 |
| Zhuhai    | 419            | 36%    | 388         | 34%                             | 181  | 16% | 944  |
| Guangzhou | 1594           | 25%    | 2569        | 41%                             | 868  | 14% | 1774 |
| Jiangmen  | 913            | 12%    | 4657        | 60%                             | 1530 | 20% | 467  |
| Huizhou   | 850            | 8%     | 6792        | 65%                             | 1408 | 13% | 405  |
| Zhaoqing  | 799            | 6%     | 10,505      | 76%                             | 1421 | 10% | 265  |

Table 2

Pearl River Delta general population and land-cover statistics, 1980–2010. Data sources: (a) Statistics Bureau of Guangdong Province. (1995), 1995; (b) Statistics Bureau of Guangdong Province, 2014; (c) Department of Land and Resources of Guangdong Province, 2006; (d) Department of Land and Resources of Guangdong Province, 2011; (e) Zhang, 2013.

|   | 1980                | 1990               | 2000               | 2005               | 2010                |
|---|---------------------|--------------------|--------------------|--------------------|---------------------|
| Population (millions)                                   | 18.28 <sup>a</sup>  | 23.70 <sup>b</sup> | 42.90 <sup>b</sup> | 45.47 <sup>b</sup> | 56.13 <sup>b</sup>  |
| Urban residents (millions) <sup>b</sup>                 | n/a                 | 16.97              | 29.81              | 35.16              | 46.46               |
| Registered household population (millions) <sup>b</sup> | n/a                 | 23.72              | 25.64              | 27.63              | 31.06               |
| Unregistered migrants (millions)                        | n/a                 | n/a                | 17.26              | 17.84              | 25.07               |
| Arable land (square kilometers)                         | 10,797 <sup>a</sup> | 9435 <sup>a</sup>  | n/a                | 7830 <sup>c</sup>  | 6165 <sup>d</sup>   |
| Built-up area (square kilometers)                       | n/a                 | 2813 <sup>e</sup>  | n/a                | 8264 <sup>c</sup>  | 10,420 <sup>d</sup> |

Table 3

The projected length of regional, municipal, and community greenways in the Pearl River Delta by 2015, in kilometers. Source: Department of Housing and Urban–Rural Development of Guangdong Province. (2011), 2011, 2014, pp. 322–325.

|                           | Provincial greenways |                       |                 | Municipal greenways | Community greenways |
|---------------------------|----------------------|-----------------------|-----------------|---------------------|---------------------|
|                           | Ecological greenways | Countryside greenways | Urban greenways |                     |                     |
| Guangzhou                 | 103                  | 230                   | 255             | 551                 | 971                 |
| Shenzhen                  | 148                  | 135                   | 52              | 500                 | 730                 |
| Zhuhai                    | 13                   | 156                   | 56              | 411                 | 440                 |
| Foshan                    | 45                   | 208                   | 163             | 710                 | 860                 |
| Huizhou                   | 54                   | 221                   | 114             | 705                 | 566                 |
| Dongguan                  | 75                   | 84                    | 66              | 565                 | 747                 |
| Zhongshan                 | 0                    | 82                    | 100             | 264                 | 320                 |
| Jiangmen                  | 120                  | 235                   | 36              | 832                 | 383                 |
| Zhaoqing                  | 221                  | 155                   | 43              | 930                 | 248                 |
| Pearl River Delta (total) | 779                  | 1506                  | 885             | 5468                | 5265                |

fragmented landscapes, particularly in urban areas. Over 40% of the arable land disappeared between 1980 and 2010, and the area of built-up land tripled. In the cities in the central area of the PRD, the landscape has changed dramatically: Between 1998 and 2003, the area of built-up land increased by 8.9%, while that of farmland decreased by 5.9% (Fan, Wang, & Wang, 2008).

Second, economic transformation has become an urgent issue in the region. The PRD has a high proportion of industry, especially in comparison to Western megacity regions (Savitch, Gross, & Ye, 2014). However, a large percentage of the industries are labor-intensive and based on foreign capital. An increase in the price of industrial land and the fierce competition from other regions, combined with many internal factors (e.g., an increase in labor costs), have forced many factories to relocate, or to plan to relocate, to other Chinese regions or other developing countries (Narayanan & Lau, 2014). New strategies are required for economic transformation and the promotion of new economic opportunities.

Third, there is the problem of inequality in access to public goods and facilities. Most of the developed infrastructure and facilities have catered to investment and consumption, and fewer public goods have been provided for ordinary urban residents and villagers (Eng, 1997). Previous policies also restricted the use of bicycles and encouraged motorized vehicles, which led to the rapid decline in bicycle traffic from 30% of the total traffic in 1980 to 8% in 2005 (Xiong, 2015; Yuan, 2015). Moreover, due to the *hukou* system – which registers people as either urban or rural citizens (according to their birthplace) and regulates their access to services accordingly – a large number of people (over 250 million in 2010; see Table 2) in the PRD are unregistered-household migrants and thus institutionally excluded from public services in cities and villages (Lin, Hao, & Geertman, 2015).

Finally, the unequal economic development and distribution of strategic resources have resulted in an increase in urban-rural disparities, particularly regarding income. For example, in 2009 the average per capita income (PCI) of the residents of Liantang Village in the Zengcheng district of Guangzhou (personal communication with the head of the village committee of Liantang Village, August 27, 2014), was only 15% of the average PCI in Guangzhou (Guangzhou Municipal Statistical Bureau, 2010). The historical separation of the city and the countryside led to urban development and the neglect of rural areas; it is therefore common for rural areas to have poorer facilities (roads, parks, etc.) compared to urban areas. Since 2002, urban-rural integration has become a subject of national policy, which emphasizes the coordination of urban-rural industries and institutions (Wu, Liu, & Cheng, 2012).

The PRD is confronted with many development issues, for example, increasingly intensified land use and a fragmented landscape, an unequal distribution of resources including public goods, the challenge of industry upgrading, and urban-rural disparities. In such a context, greenways are recognized as a planning strategy that can provide low-cost public goods, integrate multilevel governmental resources, and coordinate urban-rural development (interview with Xiangming Ma, chief planner of the Guangdong Urban & Rural Planning and Design Institute, July 3, 2014).

## 4.2. Planning activities

### 4.2.1. Goal

According to the Outline Plan of the PRD Greenway Network 2012, the main goal of the greenway planning is to address the ecological, social, and economic issues associated with rapid urbanization, that is, to improve the ecological environment, enhance the quality of life, and promote economic development (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, p. 250). Meanwhile, the regional greenway network was to be completed within three years and become the province's flagship project (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, p. 1).

However, the three-year timeframe was over-optimistic, as the greenway plan lacked detailed action plans, particularly from the ecological perspective.

### 4.2.2. Land acquisition

Land acquisition in Western countries is beset by conflicts between public interests and private rights (Little, 1990). Greenways are opposed by local stakeholders, because of the associated regulations and the potential impact of tourism. In the PRD, land acquisition has also a strong influence on greenway planning, in which planning decisions are primarily determined by the cost of land acquisition rather than the ecological or social need.

China has a dual urban-rural land use system, whereby land is owned by either the state or collective villages. In urban areas, the state owns most of the greenway resources, including parks, forests, and rivers, which are respectively managed by the municipal departments of landscape, forest, and water resources. The top-down institutional structure is very helpful for promoting the close cooperation between various departments on sharing greenway resources. However, these resources are fragmented and isolated by the densely built-up areas, which the state leases to various private actors, state-owned enterprises, households, and other stakeholders. It would take a considerable amount of money and time to reclaim the connecting green corridors in the built-up areas.

Therefore, at the beginning of greenway planning, the regional actors already recognized the importance of land acquisition. According to an article published in Southern Weekly (one of the official Guangdong Communist Party newspapers), there were two primary challenges for greenways development, namely of the collaboration between different levels of government and the acquisition of land resources (He & Guo, 2010). Municipal governments usually spend their limited land quota in projects that could generate revenue, rather than non-profitable projects like greenways (Chung et al., 2018). Consequently, they refuse to acquire land in built-up areas, but utilize resources that are state-owned and over which there is a public right of way, such as corridors alongside motorized roads, rivers, and reserved areas. In this way, local governments can “avoid consuming local construction land quota as far as possible” (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, p. 315).

In rural areas, the municipal or district government has to negotiate with each village separately. Some villages oppose greenways, because they fear interference and additional regulations, and most important, they do not believe that greenways will bring them benefits. For example, the village committee of Shatou Village in Zengcheng (a district of Guangzhou city) at first refused to allow a greenway to enter the village (interview with public authorities in Zengcheng Urban Planning Bureau, June 30, 2014). In order to get the village's support, the district government funded the construction or upgrading and maintenance of village infrastructures, such as trails, sanitation facilities, and landscaping. The government also provided grants to villagers to cultivate ornamental vegetation and create recreational spaces (right-hand photo in Fig. 3) (interview with public authorities in Zengcheng Urban Planning Bureau, June 30, 2014). For example, a part of the greenway passes through a lychee orchard, resulting in the creation of a small lychee market for the orchard owners, a recreational space for villagers, and a scenic spot for tourists (left-hand photo in Fig. 3). This approach of offering public facilities, governmental grants, and other economic benefits does not change the land ownership, but it does encourage villages to cooperate with the city government (interview with the head of the village committee of Liantang Village, August 27, 2014).

### 4.2.3. Institutional structure

The Provincial Party Committee Secretary established the Guangdong Greenways Construction Committee to promote, assign, and supervise greenway development. Every month, the committee publicly ranked municipalities according to the length of greenway



Fig. 3. Collectively owned lychee orchard and lotus ponds as a shared landscape in Zengcheng, Guangzhou (Source: photos by the first author).

developed in the previous month, the total length of greenery developed, and the number of service stations, demonstration projects, and intercity connecting points (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, pp. 60–63). This process is also called as “the centralized planning regulation”, influenced by “a massive top-down state regime” (see Xu & Yeh, 2012).

However, the implementation of the PRD greenways was widely decentralized. According to our interviews with greenway offices from several public authorities in provincial, municipal and town governments, assignments and plans were subcontracted to district, township, or town governments, which in turn subcontracted them to sub-district offices and bureaus of landscape, water resources, forest, and transportation (See Fig. 4). For example, in Shenzhen there are over 50 governmental units working on the 2265 km of greenways (Urban Management Bureau of Shenzhen Municipality, 2015). Although these units have different administrative functions, they now perform additional greenway tasks related to investment, development, management, and maintenance in their own jurisdictions.

Influenced by the institutional structure, a three-tier greenway network was established, whereby the provincial greenways are the primary intercity connections, and the municipal and community greenways are at the inner-city and the inner-community level, respectively. In addition, the greenways making up the network are also classified as urban, countryside, or ecological greenways. As a result of intergovernmental competition, the municipal and community

greenways now dominate the official plans (Department of Housing and Urban-Rural Development of Guangdong Province. (2011), 2011, 2014, p. 322–325).

### 5. Greenways as a new planning strategy

#### 5.1. Greenways as a social strategy: compensatory public goods

Villages and urban-rural fringes have a huge number of low-income villagers and marginalized rural migrants, and they lack sufficient public spaces and facilities (Lin & De Meulder, 2012). Greenways bring with them government money for parks, street greenery, bicycle routes, and public bikes. From this perspective, the PRD greenways have a social function, providing compensatory public goods for less developed areas in both urban and rural areas.

One of the basic social benefits of the PRD greenways is to provide new bicycle and pedestrian routes in areas where there are pedestrian-vehicle mixed flows or inaccessible. For example, in Shenzhen’s Xingye Road and Xingping Road, the greenways were implemented as new sidewalks, providing pedestrians and bicyclists with a certain level of protection (Fig. 5). The improvement of bicycle routes has facilitated the widespread use of public bikes in both urban and rural areas and the possibility to travel by bike arose rapidly in China (See Fig. 6). For example, a recent report shows that in Shenzhen, there are over 530,000 shared bicycles and cycling and their percentage of the total

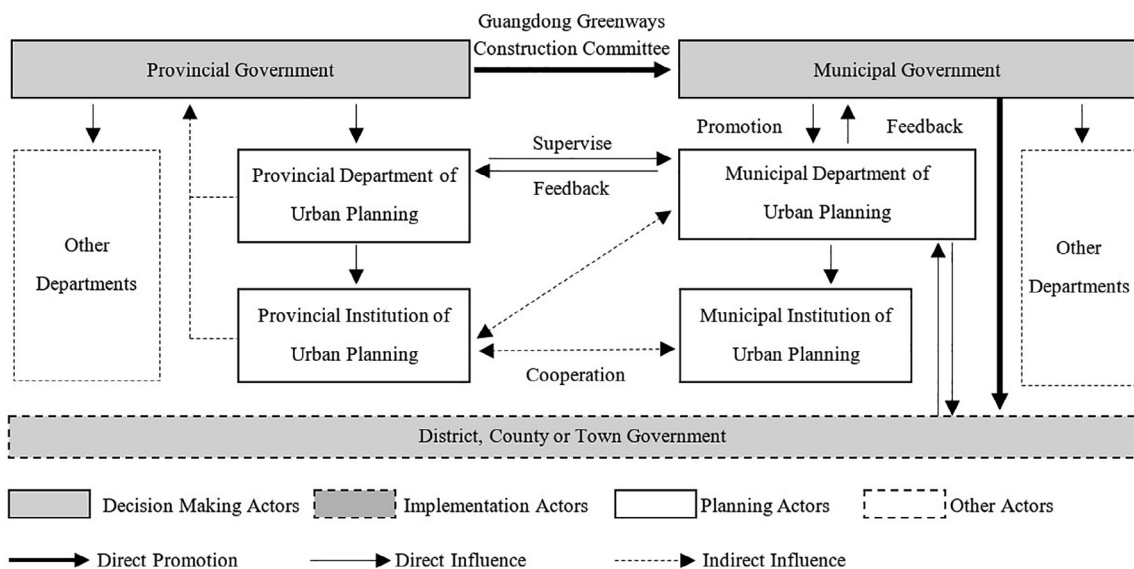


Fig. 4. Institutional structure of the Pearl River Delta greenways.



Fig. 5. Street views before (left, 2011) and after (right, 2014) the implementation of the greenways in Shenzhen's Xingye Street (above) and Xiping Street (below) (Source: map.qq.com).



Fig. 6. Public bikes in racks next to a community greenway in Yantian District, Shenzhen (Source: photos by the first author).

traffic has increased from 8% to 10.7% (Transport Commission of Shenzhen Municipality, 2017).

Another basic social benefit is to provide recreational spaces, especially in those areas where there is a lack of public facilities. As Liu et al. (2016) revealed, greenways are now important spaces for physical exercise. During our field investigation in August 2014, we found that greenways had strongly promoted outdoor leisure activities in villages. In Liantang Village, for example, 42% of the 127 local villagers we interviewed chose “outdoor exercise” as the primary reason why they used nearby greenways. When asked “How often did you engage in outdoor leisure activities five years ago?”, 31% chose “almost never”, compared to only 7% when asked “How often do you engage in outdoor leisure activities now?” (questions 8–10 in Table 4).

Since 2016, the social function of greenways has been strengthened, because greenways are now performing as a special means of “Targeted” Poverty Alleviation policy (*jingzhun fupin*). In the new greenway scheme –“South China Historical Trails (*nanyue guyidao*)”, both historical heritage protection and rural poverty alleviation are emphasized. The provincial government announced that, the 1360

poverty-stricken villages along the planned trails would enjoy higher priorities in public budgets (Guangdong Provincial Government, 2017). Moreover, Guangdong government set up a special fund of CNY 500 million (USD 75 million) for maintenance of historical trails and construction of infrastructure.

In the PRD, greenways are viewed as a sign of policies shifting from growth-oriented development to a slower but more balanced mode (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, p. 2). The network form of greenways contributes to decrease the inequity of government investment between central and peripheral areas, and between urban and rural areas. To some extent, greenways act as special compensations to those places that received less government funds and to those people who did not have access to recreational resources.

## 5.2. Greenways as an economic strategy: rural economic transformation

Greenways play an important role in the economic transformation of some rural areas in the PRD, through increasing job opportunities in the tertiary sector. Due to a close proximity of beautiful natural resources, these greenways have attracted a large number of local residents and tourists and thus contributed to local economies in many ways. For example, our fieldwork in Xinan Village, which is close to the Jinzhong reservoir in Zhongshan city, reflects that bicycle rental is becoming an important source of income for the village. Around the entrance of Jinzhong greenway, there are over 40 villager-owned bicycle rental stores (right in Fig. 7). There are thousands of bicycles in the stores and the rent of one bicycle for a day ranges from CNY 10 (USD 1.5) to 20 (USD 3). The interview (February 6, 2016) with a manager of a bicycle rental store show that a store can earn monthly income about CNY 1000 (USD 149) in off-season and over CNY 5000 (USD 746) in peak seasons.

Another interesting case is Liantang village of Guangzhou. Villagers benefit from tourism restaurants and supported policies. Since 2010, the greenways of the village have attracted over 400,000 tourists every year, so 30 villager-owned restaurants have been opened to cater the tourists (See Fig. 8). This results in changes in the village's economy and an increase of the villagers' income. According to our interview with seven managements of six restaurants along the main street of the village, most of the owners were once migrant workers in the city. This



**Table 4**  
The questionnaires used in Zengcheng, Guangzhou.

| Part 1: Tourist questionnaire (478 copies)  |   |
|---|---|
| Question  | Response  |
| 1 Where do you come from?   | Zengcheng (i.e., local): 32%<br>Other districts in Guangzhou: 31%<br>Dongguan: 17%<br>Shenzhen: 6%<br>Foshan: 2%<br>Other cities in Guangdong: 10%<br>Other Provinces: 2% |
| 2 What is your primary purpose of greenway use? a) natural environment b) outdoor exercise c) group recreation d) family leisure activity   | Natural environment: 37%<br>Family leisure activity: 28%<br>Outdoor exercise: 24%   |
| Part 2: Resident questionnaire (127 copies)   |   |
| Question  | Response  |
| 3 What was your family's annual per capita income five years ago? a) < 10,000 b) 10,000–50,000 c) 50,000–100,000 d) > 100,000   | < 10,000: 52%<br>10,000–50,000: 37%<br>> 50,000: 11%  |
| 4 What is your family's annual per capita income now? a) < 10,000 b) 10,000–50,000 c) 50,000–100,000 d) > 100,000   | < 10,000: 38%<br>10,000–50,000: 37%<br>> 50,000: 26%  |
| 5 What was the primary source of your household income five years ago? a) farming & cultivation b) self-owned tourism restaurant c) work outside the village d) private industries                            | Self-owned tourism restaurant: 2%<br>Work outside the village: 53%<br>Farming & cultivation: 33%<br>Self-owned tourism restaurant: 23%                                    |
| 6 What is the primary source of your household income now? a) farming & cultivation b) self-owned tourism restaurant c) work outside the village d) private industries  | Work outside the village: 43%<br>Farming & cultivation: 18%<br>Increased income: 25%<br>Provides daily exercise space: 25%  |
| 7 What do you think is the primary benefit of greenways? a) increased income b) improved environment c) created employment d) improved local image e) provide daily exercise space f) provide public services | Improved environment: 15%<br>Improved local image: 15%<br>Outdoor exercise: 42%   |
| 8 What is the primary purpose of your greenway use? a) business b) daily commuting c) outdoor activity d) family activity   | Business: 23%<br>Family activity: 21%   |
| 9 How often did you engage in outdoor leisure activities five years ago? a) almost never b) occasionally c) less than once a week d) multiple times a week  | Almost never: 31%<br>Occasionally: 39%<br>Less than once a week: 26%<br>Multiple times a week: 4%   |
| 10 How often do you engage in outdoor leisure activities now? a) almost never b) occasionally c) less than once a week d) multiple times a week   | Almost never: 7%<br>Occasionally: 50%<br>Less than once a week: 27%<br>Multiple times a week: 16%   |

suggests that greenways provide new employment opportunities for villagers, i.e. they can now work in their hometowns rather than migrating to the city. As managers of restaurants, they often have a higher income than that of their previous jobs. For example, Zhikang Qiu, who worked in the city for two years, returned to Liantang village and now

runs a new restaurant. The financial recourses include his saving and a special fund from the government that supports the employment of villagers along the greenway. The restaurant of Mr. Qiu has become one of the most successful restaurants in the village and earns over CNY 1 million (USD 149,000) per year. Inspired by Qiu, many villagers, who



**Fig. 7.** Jinzhong greenway (left) and bicycle rental stores at the entrance (right) (Source: photo by the first author).



Fig. 8. Greenway tourists riding public quadricycles past restaurants in Liantang Village (Source: photo by the first author).

were migrant workers in the city, have returned to work in Liantang village.

In Liantang Village, Qiaotou Village, and Hezhou Village (Zengcheng district, Guangzhou), 478 tourists and 127 villagers completed questionnaires at our three survey booths (see Table 4). Their responses show that the natural environment and views of the countryside attracted a large number of tourists from nearby cities and districts (questions 1 & 2). During 2010 to 2014, the percentage of villagers who had an annual household per capita income (PCI) of less than CNY 10,000 (USD 1490) had dropped from 52% to 38%. Over the same period, the percentage who had an annual household PCI of over CNY 50,000 (USD 7400) had increased from 11% to 26% (questions 3 & 4). The interview (on August 27, 2014) with the head of Liantang Village showed that the annual household PCI had increased from CNY 5000 (USD 740) in 2009 to CNY 15,000 (USD 2200) in 2014 due to the development of greenways. The economic growth mainly came from 30 self-owned tourism restaurants, which provided new sources of income and employment. The outcomes of these questionnaires further proved the influence of greenways on local employment. For instance, 26% of the villagers worked in the emerging restaurants, while the percentage of outworkers and farmers in the total population had decreased from 53% to 43% and from 33% to 18%, respectively (see questions 5 & 6). This suggests that the greenways had facilitated the transformation of the local rural economy from agriculture to service sector. All in all, villagers considered increased income and the availability of daily exercise spaces the primary benefits of greenways (see question 7).

Although greenways' economic benefits on property value have been heavily investigated (see Noh, 2019), it has not been proved in the PRD greenways. In this research the economic benefits are only found in rural areas that did not establish an industrialized economy, so that the villagers have limited incomes, and the agriculture landscape remains intact and unpolluted. So far, the primary benefits come from the increasing incomes of tourism business and more opportunities in local employment. From this perspective, greenways are performing as a crucial strategy in rural economic transformation, with more potentials to be discovered.

### 5.3. Lack of ecological and landscape strategies

The PRD greenways were initiated in a protective context addressed by Ahern (1995), but there has been generally a lack of ecological and landscape strategies. Regarding the corridor areas along greenway routes, the greenway planners propose the official concept of Greenway Protected Area (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, pp. 448–451). The concept aims at establishing a network of green corridors through prohibiting building

construction in 20-to-200-m wide corridors along greenway routes. But in greenway planning it rarely focuses on developing new corridors or extending existing green spaces, which only fits to the protective context. However, even though, most cities follow the provincial guidance, which requires provincial and municipal greenways to connect with the mentioned greenway protected areas. Community greenways, which make up the majority of the PRD greenway network, are mainly walking or cycling routes with few or no control areas. There is a lack of concerns on construction control, landscape and greenery in the corridor area, which is the basis of the landscape and ecological strategy. In the end, the primary landscapes along greenways come from existing street trees and vegetation, but whether these narrow landscapes can provide anticipated ecological benefits (i.e. increasing biodiversity) and perform as recreational resources remains unanswered.

Guangzhou and Shenzhen are two good examples to reflect this issue. Through field investigation and mapping, we identified 1935.9 km of greenways in Shenzhen and 367 km of greenways in Zengcheng district of Guangzhou. We categorized the greenways as off-road greenways which are outside of transportation corridors but often inside of green corridors, in-roadway greenways, and on-sidewalk greenways (Fig. 10).

In Shenzhen, 70% of the greenways were in built-up areas (Fig. 9). According to our investigation, off-road greenways comprise 16% of the total, in-roadway greenways 17%, and on-sidewalk greenways 67%. An important result is that 43% of the greenway corridors are less than 3 m wide and 18% are 3–12 m wide. This suggests that the greenways have little ecological value, because green corridors that are less than 12 m wide can hardly improve biological diversity, according to the official greenway guidance (Department of Housing and Urban-Rural Development of Guangdong Province, 2014, p. 425). In addition, these narrow corridors of street greenery are useful in providing shading to non-motorized travelers, but have little effects on decreasing noises and smells caused by vehicles, based on our observation in the fieldwork. Through comparison of images before and after greenway development, we found that 56.5% of the greenways were actually public infrastructure (e.g., sidewalks, trails, and motorized roads) with greenway symbols, and that 43.5% of the greenways are repaved or newly developed. The pavement of the existing sidewalks nevertheless has led to a new problem. Many greenways are not only indistinguishable from ordinary sidewalks, but also are difficult to be used for outdoor exercise and cycling. The problem of greenways in Shenzhen is properly caused by limited land resources in the city and difficulties in requisitioning collective land for the development of greenways.

In Zengcheng district of Guangzhou, we identified 367 km of greenways and mapped land use types in the 1000-m-wide corridors along greenways (left in Fig. 11). Comparing with Shenzhen,

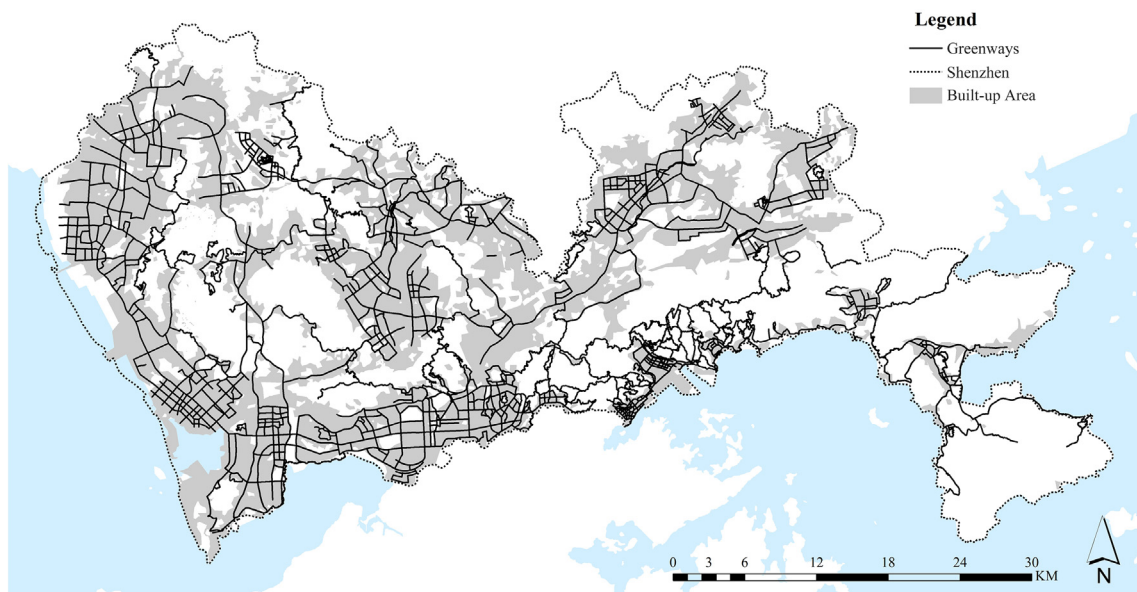


Fig. 9. Shenzhen greenways overlaid with built-up area. Source: Shenzhen Greenway Map 2014.

Zengcheng district has more natural resources and wider greenway corridors. Our mapping reflects that 66% of the corridors is natural green spaces and 66.5% of greenways have green corridors with a width of more than 100 m. However, the landscape contexts of greenways are quite different. Some greenways are developed in densely built-up areas (area 6 in Fig. 11), while some are located in farmlands (area 1 and 2 in Fig. 11). Although the greenway corridors have natural supporting landscape, the proportion of off-road greenways is still comprised of 15%, close to that of Shenzhen. Like greenways in many cities in the PRD, most of the greenways (85% in Zengcheng and 84% in Shenzhen) are overlapped with transport corridors, which can reduce

the ecological function of greenways.

Therefore, based on the case studies of Shenzhen and Zengcheng, as well as our observations of other greenways in the region, we conclude that the majority of the PRD greenways are developed among transport corridors. The primary action is the construction of cycling routes, while there is a lack of concern on landscape and ecological aspects. However, this research primarily focuses on the consistency between official guidance and practical outcomes. Future evaluation on the ecological biodiversity, environmental improvement or stormwater management could be useful evidence to validate our arguments.



Off-road greenway

In-roadway bicycle tracks

On-sidewalk bicycle track

On-sidewalk buffered bicycle track

Fig. 10. Typical greenway spaces in Shenzhen (Source: photos by the first author).

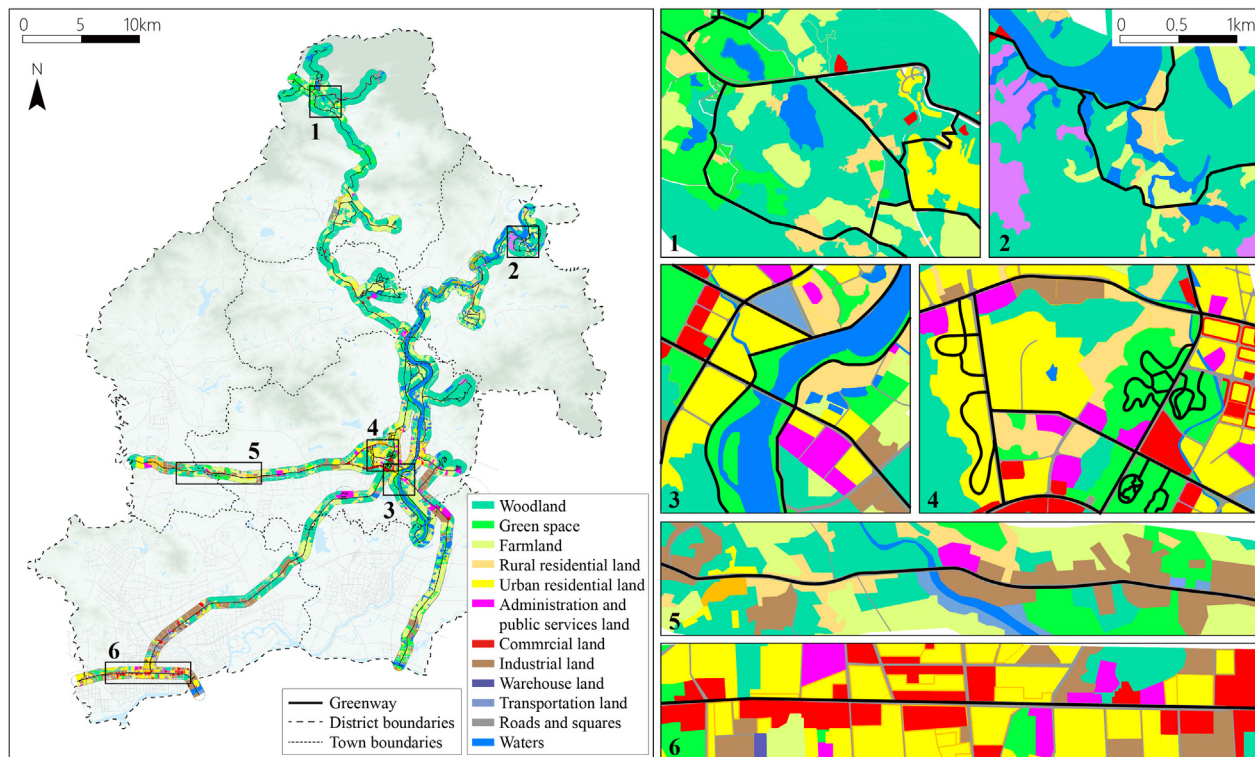


Fig. 11. Zengcheng greenways and land use types in the 1000-meter-wide corridors along greenways.

## 6. Discussion

In the PRD greenway planning, the official stated goals aim at improving the ecological environment, enhancing the quality of life, and promoting economic development. Our research shows that, to some extent, the PRD greenways bring social and economic benefits to the region through providing public facilities (i.e. public bikes, bikeways and exercise facilities) and promoting tourism economy in some less developed villages. However, there is inconsistency between goals and outcomes of the overall greenways. The empirical works in Guangzhou and Shenzhen show that, although the greenways were planned as a special instrument to bridge the urban-rural divide, in practice only some cases show that greenways function as linkages between urban and rural settlements. Most greenways (i.e. community greenways) are implemented in urban areas and are comprised of walking and cycling routes. This suggests that greenways become a transportation strategy. Moreover, the ecological objective of greenways is hardly achieved, since most greenways do not have an adequate corridor. There are several reasons for the inconsistency between goals and outcomes, including inadequate supporting resources, a short time frame, and the excessive dependency of institutional arrangements.

### 6.1. Inadequate landscape, budget and time

The primary reason is that the supporting resources and budget are inadequate to accomplish the ambitious goals in such a tight schedule. The context of the PRD Greenway Network is characterized by a densely built-up landscape and a high population density. To use Ahern's planning strategies (1995), the PRD greenways are operating in a very defensive strategy, and with high competition for greenway space. This suggests that it is a big challenge to mitigate conflicts over natural resources and develop ecological greenways. This context is different from that in many Western countries. For instance, greenways in the United States are usually developed on residual leftovers and abandoned linear corridors (Walmsley, 1995), in which corridors are key elements of multipurpose greenway planning (Conine, Xiang, Young, &

Whitley, 2004). In the PRD, the landscape contexts, especially land resources, act as a major constraint for achieving the ecological goal of greenways. Although regional governments develop various greenway models in order to achieve the ecological goals, local governments that are operating under governmental pressure from the centralized administrative system have to construct the greenways in a short period with limited land resources and budgets. Especially in big cities, the lack of cheap and available lands, and the unwillingness of governments to re-appropriate already developed lands for greenways, has impeded the implementation of ecological and landscape strategies. In fact, during the planning process, there should have been more efforts of evidence-based findings to support the decision-making, so that the unrealistic ecological objectives could be avoided, considering such a short time frame and insufficient landscape resources.

### 6.2. Excessive dependency of centralized administrative system

The rapid development of greenways in the PRD is largely attributed to the centralized administrative system. There are strong leadership in the development of PRD greenways, which is often missing in the Western context (Erickson, 2004a; Ryan et al., 2006). However, the importance of practical ability is widely overlooked. On the one hand, the planners have little influence on the implementation, because of the absence of detailed action plans. On the other hand, the limited budget of greenway projects cannot afford experienced planners and designers. Therefore, the local-level governmental units become the primary actors of greenway implementation (see Table 5), which have various administrative duties and often lack professional skills and experiences of greenways.

Although the knowledge from interested professionals and social groups is required for greenway planning, the centralized institutional structure does not provide necessary accesses for their participation. In western countries, greenway organizations play a crucial role in initiating greenway programs, applying for funds and managing greenways, such as East Coast Greenway Alliance and Atlanta Development Authority in the United States. In China, although there has been an

**Table 5**  
Detailed data of Shenzhen greenways, in kilometers.

|                                    | Regional greenways | Municipal greenways | Community greenways | Total  |
|------------------------------------|--------------------|---------------------|---------------------|--------|
| <i>1. Locating spaces</i>          |                    |                     |                     |        |
| off-road greenways                 | 120.8              | 122.6               | 41.5                | 284.9  |
| in-roadway greenways               | 86.7               | 93.7                | 192.9               | 373.3  |
| on-sidewalk greenways              | 129.8              | 419.9               | 728.0               | 1277.7 |
| <i>2. Width of green corridors</i> |                    |                     |                     |        |
| 1–12 m                             | 64.1               | 356                 | 756.5               | 1176.6 |
| 12–30 m                            | 1.8                | 18.6                | 43.2                | 63.6   |
| 30–60 m                            | 10.2               | 21.6                | 7.6                 | 39.4   |
| 60–100 m                           | 5.8                | 4.4                 | 5.7                 | 15.9   |
| > 100 m                            | 257.3              | 233.8               | 149.3               | 640.4  |
| <i>3. Improvement initiatives</i>  |                    |                     |                     |        |
| only symbols                       | 213.6              | 354.7               | 347.6               | 915.9  |
| pavement or construction           | 125.6              | 279.8               | 614.6               | 1020.0 |
| <i>4. Pavement</i>                 |                    |                     |                     |        |
| bricks                             | 132.7              | 336                 | 556.1               | 1024.8 |
| asphalt                            | 113.7              | 231.2               | 256.9               | 601.8  |
| cement                             | 74.1               | 49.6                | 145.8               | 269.5  |
| sand-gravel                        | 18.7               | 17.6                | 3.5                 | 39.8   |
| <i>5. Management</i>               |                    |                     |                     |        |
| Scenic parks                       | 12.8               | 39.7                | 0                   | 52.5   |
| Sub-district offices               | 181.0              | 129.5               | 410                 | 720.5  |
| District bureaus                   | 145.4              | 436.9               | 498.3               | 1080.6 |
| Municipal departments              | 0                  | 28.4                | 53.9                | 82.3   |

increase in the number of interested professionals, most of them are unable to acquire financial supports and have not participated in the greenway planning and implementation (interview with the planner of the Institute for Transportation and Development Policy in Guangzhou in September 2016).

### 6.3. Emerging transportation-led greenways in the world

As shown in the empirical works, the development of the PRD greenways reveals a new type of greenway development, namely of transportation-led greenways. It has been overlooked for years until recently some researchers referred it as “new urban greenways”, which are “landscaped and traffic-calmed pathways with a mix of bicycle facilities and other streetscape improvements” (Ngo, Frank, & Bigazzi, 2018, p. 716). A few studies on greenways in London, Singapore, and Oranienburg show that it is easy to require land resources for greenways along the road traffic networks (Bloß, 2016; East Coast Greenway Alliance, 2016; Tan, 2006; Transport for London, 2014a,b). But these greenways also raise a new question: How to achieve multiple benefits in the built-up traffic corridor? In some cases, for example in London, greenways have adopted new meanings, for example “quietways,” with a focus on the transportation or recreational function in the urban landscape. Other cases start with traffic-based routes but with an emphasis on separating the greenways from motorized traffic step by step. Research reflects that mixed traffic imposes a sense of threat and high emotional stress on bicycle users (Chataway, Kaplan, Nielsen, & Prato, 2014), while off-road bicycle routes can increase bicycle traffic by 332% (Hankey et al., 2012). The East Coast Greenway Alliance is developing a long-distance, off-road travel route. It has already completed 1408 km of off-road greenways, and there are still 3277 km of in-road routes to be improved (East Coast Greenway Alliance, 2016). Regarding these greenways, transport usage requires more concerns on cycling design, such as safety, directness, comfort, coherence, attractiveness and adaptability (see Transport for London, 2014a,b), which are also urgently needed in the PRD greenways.

In the end, because of the inadequate planning resources, the centralized administrative system and the need for non-motorized transportation, the PRD greenways have apparent inconsistency between goals and outcomes. However, the PRD greenways, as a part of the international movement, shows a great adaptive capacity of the greenway concept in which publicity and inclusiveness are key values.

## 7. Conclusion

For many greenways in western countries, effective institutional structures are necessary, not only because of the need to coordinate inter-agency cooperation, but also in order to focus stakeholder interests towards a targeted goal (Erickson, 2004b; Ryan et al., 2006). This research contributes to the international debate on greenways in the following aspects. First, the PRD greenways show new approaches, outcomes and issues of greenway planning, which is largely caused by the specific centralized Chinese planning and administrative system context. The PRD greenways reflect that the centralized institutional structure that is characterized by strong leadership plays a significant role in mobilizing multi-level governments and agencies, integrating government resources, and establishing a long-term institutional structure. Second, although there is generally a lack of landscape and ecological actions in greenway planning, the PRD greenway can be seen as a successfully social strategy by providing public infrastructure, facilities and recreation spaces for both urban and rural areas and mitigating the gaps between these two areas in terms of public goods. Future research is recommended to document the extent that the PRD greenways provide ecological and hydrological function. In some rural areas, greenways also perform as an economic strategy through promoting tourism economy and providing new job opportunities to local villagers. In urban areas, many greenways have become a new transportation strategy that defines space for walking and cycling routes. Third, the research reveals that one of the main issues of the centralized institutional structure is how to engage local agencies, interested groups and greenway stakeholders in the planning process. To solve this issue will improve the consistency of achieving targeted goals and conducting effective planning activities. In the PRD greenway movement, local agencies were widely mobilized because of administrative pressures. In the recent development of South Canton Historical Trails, the regional leaders have begun to recognize the importance of local agencies in a regional greenway scheme. With a similar centralized structure, they have changed the governance mode from a top-down administrative system to a more collaborative approach based on competitive applications for funds. Provincial departments and local agencies sign contracts that have clear agreements on yearly objectives, under the supervision of over 300 volunteering experts of urban planning, architecture and tourism. This collaborative approach has largely increased the willingness of local agencies to participate in the planning process. However, how to engage the interested groups and affected stakeholders in the decision-making and implementation stages has still been a big challenge in greenway planning.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://>

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