Case Study: Urban Green Belt Planning in Foshan City, China

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Abstract
We examine how Chinese planners proposed a green belt to make Foshan resilient to climate change while enhancing recreational opportunities and conserving open space. This effort is noteworthy as the accelerated urbanization in China has created a series of environmental problems.

Introduction

Foshan is a prefecture-level city (herein after also referred to as a municipality) located in central Guangdong Province in southeastern China. The entire prefecture covers 3,848.49 km2 and has an urban population of about 7.2 million. The local government has made substantial investments into technological innovation and its strong support to face environmental challenges has been widely recognized in China.

Green space also plays an important role in urban ecosystems and provides significant ecosystem services with environmental, aesthetic, recreation and economic benefits. Their natural resources and river valleys provide flood protection, fresh water, clean air, local food, and the enjoyment of nature to rural and urban residents. As the population and urbanization of the region expands, the economic, environmental and quality of life solutions delivered by the greenbelt become more important. Through a climate mitigation and adaption lens, the health of the greenbelt and its river valleys is essential to improving resilience in the region.

In recent years, green belts have incorporated the principles of landscape planning into city design, giving predominance to green structures where the relationship between the environment, nature and the landscape are not merely spectators but are key players in the design of cities. These principles were set out in 1988 at the UNESCO Environment and Biosphere Conference which established the need to work jointly on a systematic and collective description for the green areas in a city and suggested that green belt plans must respond to the union between function and design as an integral and active concept. In China, it is possible to find plans based on criteria, but it is difficult to find references to projects which cover all these aspects at once.

In the late 2000's, planners in Foshan developed a greenbelt strategy focused on building a resilient living system which addressed multiple objectives such as recreation, protection, conservation and landscape preservation[i]. As land in China is owned by the government, there is a great deal of potential to conserve the landscape and enhance a resilient ecological strategy.

The overview of Foshan and its existing greenway system

GIS maps of natural and man-made features were created and analyzed. Below are the major findings revealed because of this process.

The administrative region of Foshan had an unbalanced urban construction (Figure 1), by which we mean that there was a greater concentration of high density development in the

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eastern urban area than found in the Western and Northern urban areas. The sprawling urban pattern occupied and split the original “green” natural system with blurred cluster boundaries.

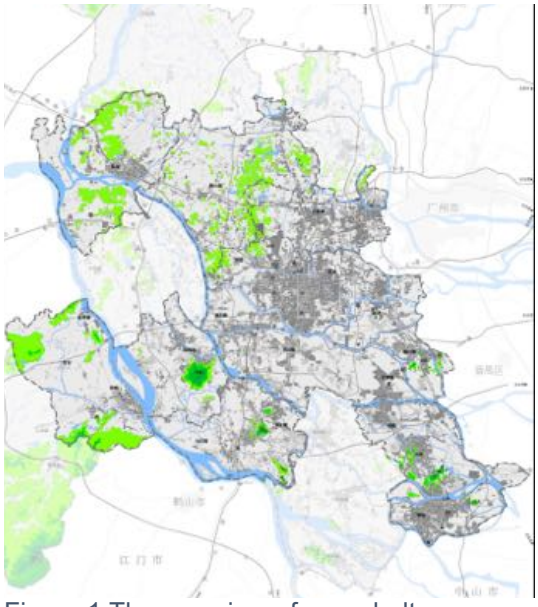


Figure 1 The overview of greenbelt resources in Foshan

Foshan also had unequally distributed forest resources that were mainly located in the Gaoming District in the West (69% of all forests) and the Sanshui District (17% of all forests) in the North (Figure 2). The more developed Nanhai District and Shunde District had fewer forest resources with 9% and 5% of the total Prefecture’s resource respectively. South Asia tropical vegetation accounted for 17.6% of the forest coverage.

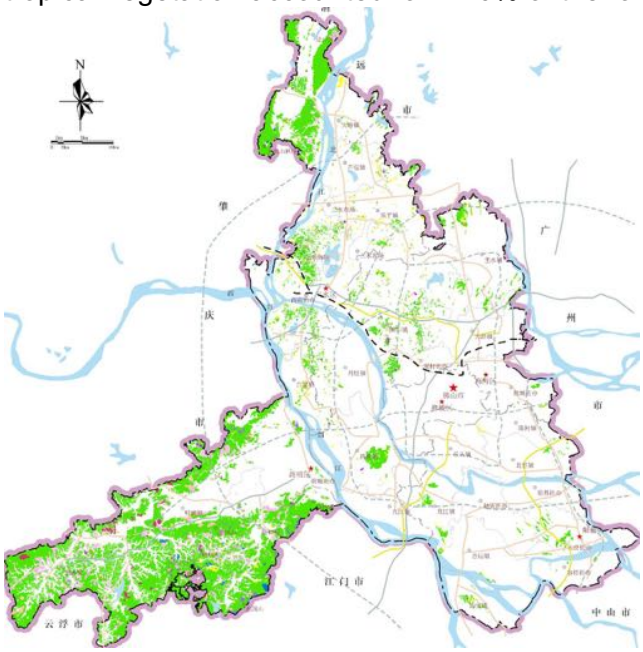


Figure 2 The forest resources of Foshan

Located in the hinterland of Pearl River Delta, Foshan is traversed by the Xijiang and the Beijiang rivers. Both have large flows and boast networked river branches, including the tributary Lubaoyong, Xinanyong and Jiliyong rivers. The land along these rivers is characterized by a typical crisscross water network and a flat terrain. The rivers and their associated wetlands occupy 347.04 square kilometers, or 9.1% of the municipal area (Figure 3). Dike-ponds and farmland cover an area of 731 square kilometers, accounting for 19% of the municipal area. Foshan had three more-than-medium sized water reservoirs.

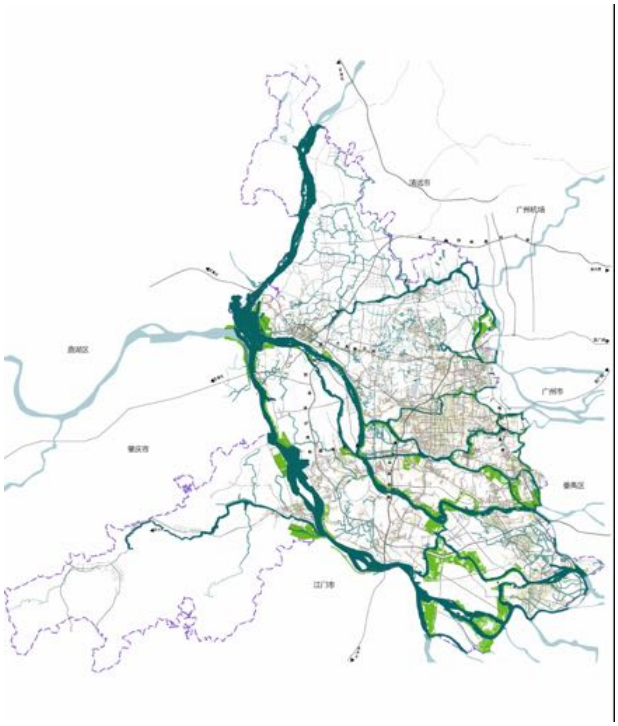


Figure 3 The riverfront green space of Foshan

We also found that although existing regional greenways connected some places of interest, such as forest parks, scenic attractions, and suburban parks, they mostly only connected recreational green spaces. In addition to linking recreational lands, greenways should also serve other purposes, such as eco-conservation and natural feature protection, if they are to become a resilient system.

Our strategy

A regional greenbelt system concept was adopted. Our strategy was to develop a regional greenbelt system which would: 1. include essential ecological elements; 2. reinforces the functions and processes in our current land use plans; and, 3. guarantee the conservation and restoration of key ecological systems. We adopted the concept that the regional green belt is a living system. To keep a healthy green belt, connections with the main supplying areas and natural corridors must be insured.

In landscaping, and specially in large green areas, it is fundamental to maintain a tension which features contradictory characteristics. Therefore, Greenbelts must be flexible, adaptable, socially dynamic, and revive environments that are absent from the city. They must be 'resilient' spaces. In other words, our green belts must be capable of responding to changes or disruptions without modifying their fundamental state (Ahern, 2011). To build up a resilient system, we adopted the recommendations of Jack Ahern (2011) who suggested the following greenbelt characteristics. First, greenbelts must have a multifunctional perspective which brings an integrative ecological-social view. Secondly, the design must prevent functional redundancy and fragmentation, while promoting the diversification of mechanisms, solutions and interlocutors which offer more options for assimilating ecological and social changes. Finally, the project should incorporate adaptive planning and design and be used as a laboratory of ideas which can offer dynamic solutions.

We worked with local government officials to increase public benefits from Foshan's greenbelt and regional resiliency. Our work plan started with an analysis of ecological, social and spatial

information at regional and urban scales to offer responses based on resilience. Based on our analysis the following objectives were established:

1. Enhance social wellbeing and identity. The planned greenway should reflect the existing communities and their life styles, related to the prior use of the land and at the same time contribute to the wellbeing and improve of the quality of life, by means of increased accessible and by creating recreation subsystems within the larger project area.

2. Create regenerative and resilient systems and boost the landscape's capacity for recovery, promotion of biodiversity and mitigation of risks. This would be achieved by designing green wedges to penetrate urban boundaries with regional eco-green spaces and by establishing a continuous conservation corridors system to leverage the natural green space resources, ensure the provision of future natural resources, and fight against climate change in urban area.

Background: Management and execution by level

As an of this subordinate green space system planning, *The Master Plan of Foshan* (2008-2020) provided important guidance for developing regional and urban parks and established criteria for establishing the overall area for green space development. That plan called for 9,349 hectares of urban green space, 11.6 m2 of per capita urban green space, and 6,803.5 hectares of urban public green space (8.44 m2 per capita). In total green spaces were to account for 8.3% of urban construction land and an urban greening rate of 48%. Urban green space planning indicators were determined based on the demands and possibility of urban construction and holistic considerations covering short term & long-term development, the development rate, and the special need for urban greening.

Development control of municipal green space were planned to adhere to the regulations of level-based management control and be subject to more specific planning related to the subordinate downtown or the requirements of single green spaces as appropriate.

The programs for new urban green spaces were mainly considered on a case by case basis considering their relationship to existing facilities and in compliance with recreational green space subsystems or landscape green space subsystems criteria. Residential areas and quarters were to be provided with access to municipal park, regional park, residential district park, residential quarter park based on service radius and quantity criteria. For landscape-based subsystem, the instructions on the planning and layout of overall landscape, building and green space areas; greening style and tree species selection were defined in standards and should be executed in the urban design to the scale of detailed single block green spaces and architectural design of subordinate level.

The regional green space system and subsystems

Common to many open space and park systems, the plan envisioned a hierarchy of facilities ranging from regional to neighborhood in scale. This concept was referred to as one consisting of a use classification system and a sub-system based on the function of the facilities.

The regional green spaces were divided into 5 classes and 15 sub-classes (Table 1). Except for the water surfaces of the main rivers, the green space delineated totaled 114,318.35 hectares, accounting for 29.70% of Foshan area. The delineated areas of main rivers and reclamation land reached 30,685.46 hectares (excluded from the statistics).

Table 1 The 5 classes and 15 sub-classes of the regional green spaces

Based on an in-depth survey regarding the diversified functions and inherent connections among regional green space systems, the organization and planning of regional green subsystems (Table 2) was divided into three categories: regional conservation green space subsystem; regional recreational green space subsystem; and, regional protective green space subsystems. This system is displayed in Table 2.

Table 2 Regional green space subsystems

Regional green space types		Type code	Types of regional green space		Type code
Eco-conservation zone	Nature conservation zone	G-E1	**Sightseeing green space**	Forest park	G-L1
	Water-source conservation zone	G-E2		Sightseeing attraction	G-L2
	Basic farmland conservation zone	G-E3		Resort (only green space part)	G-L3
	Soil erosion prevention zone	G-E4		Suburban park	G-L4
Coast green space	Coastline protection forest	G-C1	**Buffer green space**	Green beltway	G-B1
	Coastal wetland and mangrove forest	G-C2		Infrastructure separating belt	G-B2
	Aquaculture farm and reclamation district	G-C3		Disaster preventive green space	G-B3
	Marine life breeding zone	G-C4		Public hazard preventive green space	G-B4
Riverfront green space	Branch river and reclamation area	G-R1	**Special green space**	Geological and geomorphologic landscape area	G-S1
	Large pond and swamp	G-R2		Natural disaster sensitive zone	G-S2
	Large-medium reservoir and water source forests	G-R3		Historical heritage protection entity	G-S3
	Dike-pond system	G-R4		Traditional landscape zone	G-S4

Subsystems	Types of regional green space
Regional recreational green space subsystem	Scenic attraction
	Resort
	Forest park

	Suburban park
	Wetland park
Regional conservation green space subsystem	Natural conservation zone
	Water source conservation zone
	Basic farmland conservation zone
	Large and medium reservoirs
	Dike-pond system
	Geological and geomorphologic landscape area
	Natural disaster sensitive zone
Regional protective green space subsystem	Green beltway
	Infrastructure protection

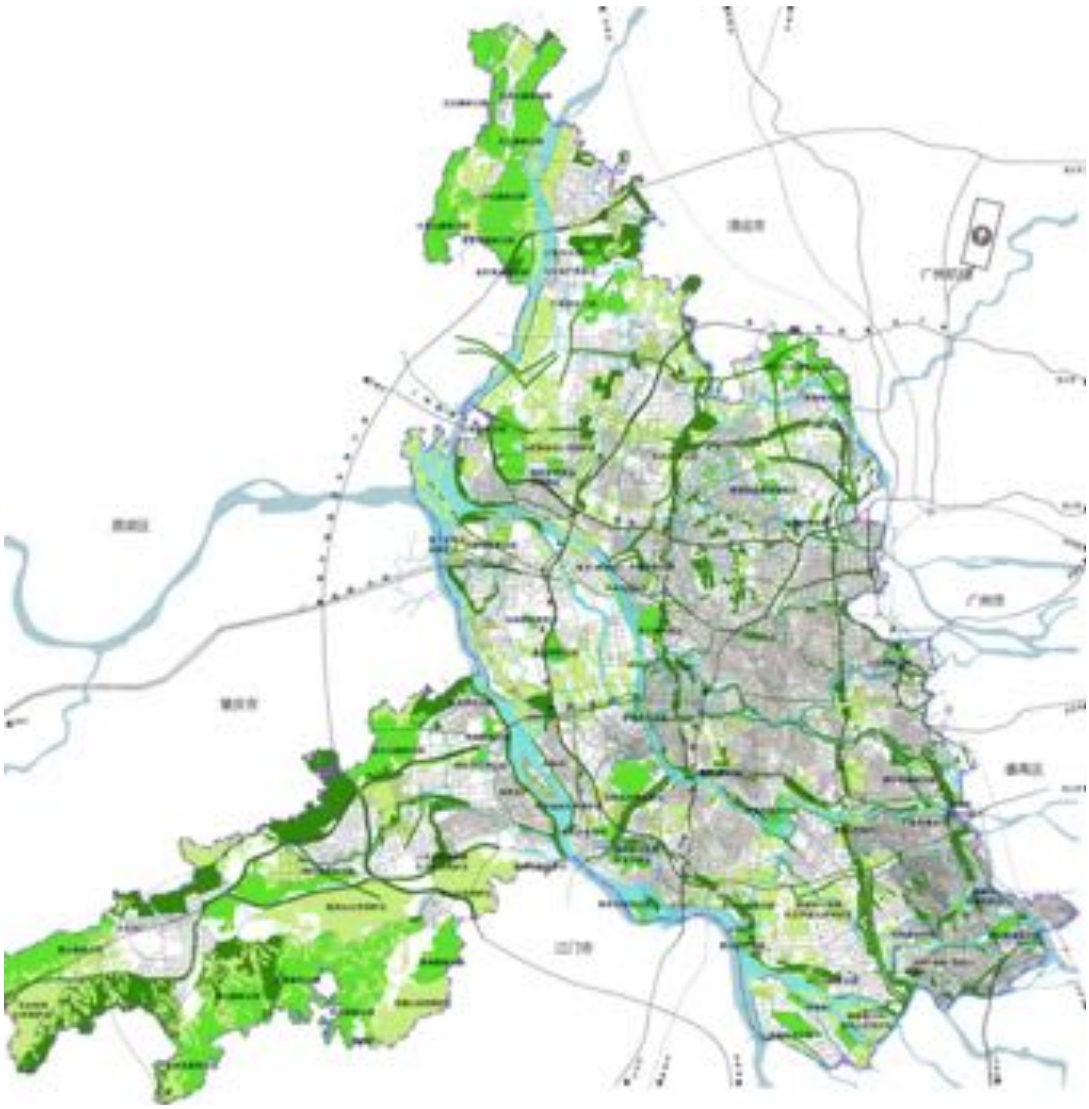


Figure 4 The regional green space system

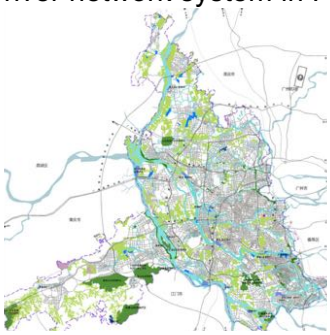
Regional recreational green space subsystem

The planning of municipal recreational subsystem (Figure 5) was arranged based on scenic attractions, forests parks and resorts along greenways, and was integrated with the green space resources, cultural relics and road traffic throughout the municipality.

Figure 5 Regional recreational green space subsystem

Regional conservation green space subsystem

The municipal conservation green space subsystem (Figure 6) covers water source conservation zones, natural conservation zones, seedling nurseries, flower nurseries, grass nurseries and basic farmland conservation zones. It is planned and organized based on the river network system in Foshan.



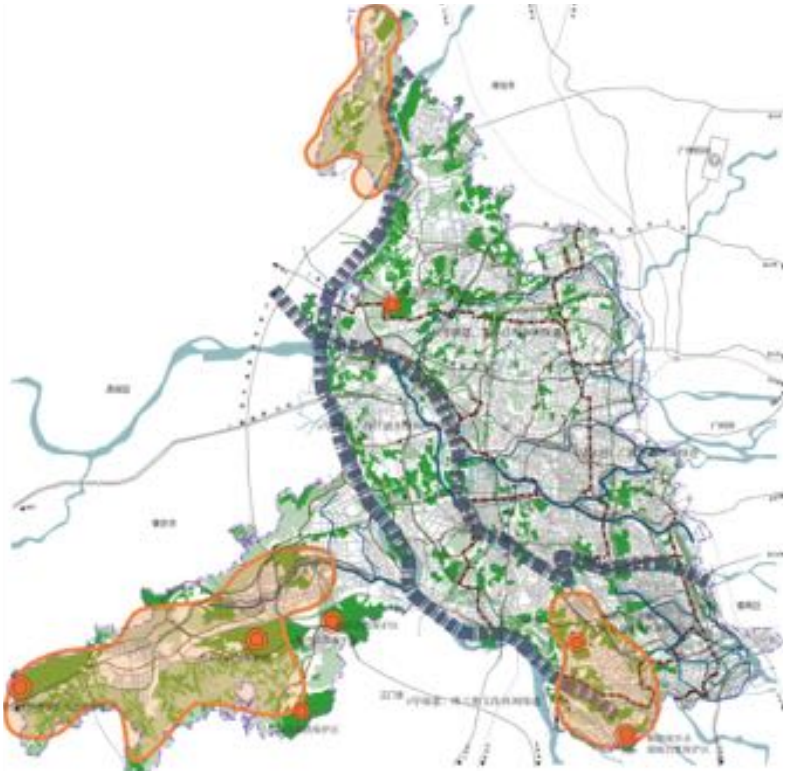


Figure 6 Regional conservation green space subsystem

Our strategy: The urban green space system planning

The principles used to define green land system planning in the urban area (Figure 7) were: first, reflection about the basic structure and layout of regional green space system, and maintenance of the constancy and completeness of natural eco-system; second, defining and coordinating the functions of green spaces and organize the green spaces with similar functions into a subsystem; and third, to ensure a fair and convenient public access. We tried to distribute green spaces evenly.

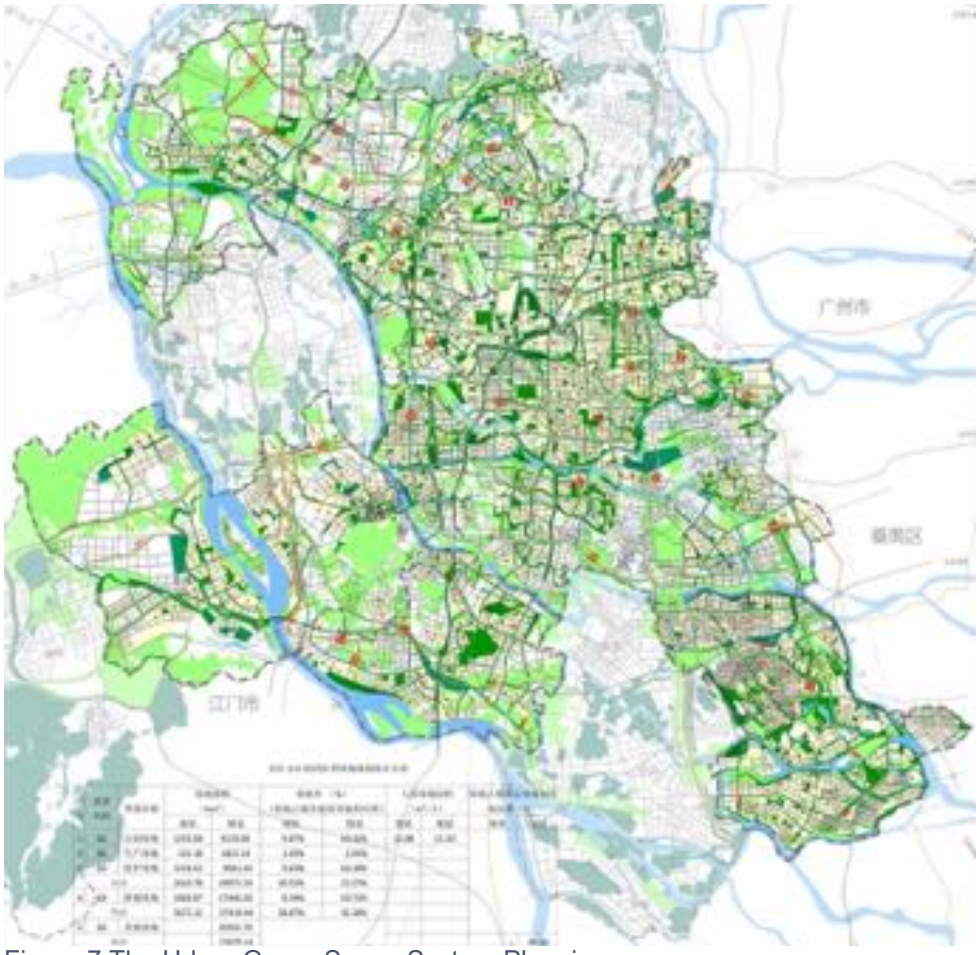


Figure 7 The Urban Green Space System Planning

The layout of green spaces in Central cluster

The layout of green spaces in the central cluster (Figure 8) could be described as **"Four-ring, five-wedge, and multi-axis". "Four-ring"** refers to the relatively independent, but related, four small clusters formed by Jiliyong Water Branch, Tanzhou Waterway and Dongping waterway. The urban green space forms a ring boundary around all the clusters to protect the landscape system in the cluster. **"Five-wedge"** refers to the municipal green-space-composed broad green belts that connected the periphery and centre of clusters and further divide the cluster interior. The green wedges of clusters were arranged in the same positions of the green wedges in the municipal green space system structure. **"Multi-axis"** refers to the North-South landscape axis of the central zone and its roads. Due to the dense development in these central clusters, the axis planning along with the prevailing wind direction helped a lot to improve urban climate and landscape development.

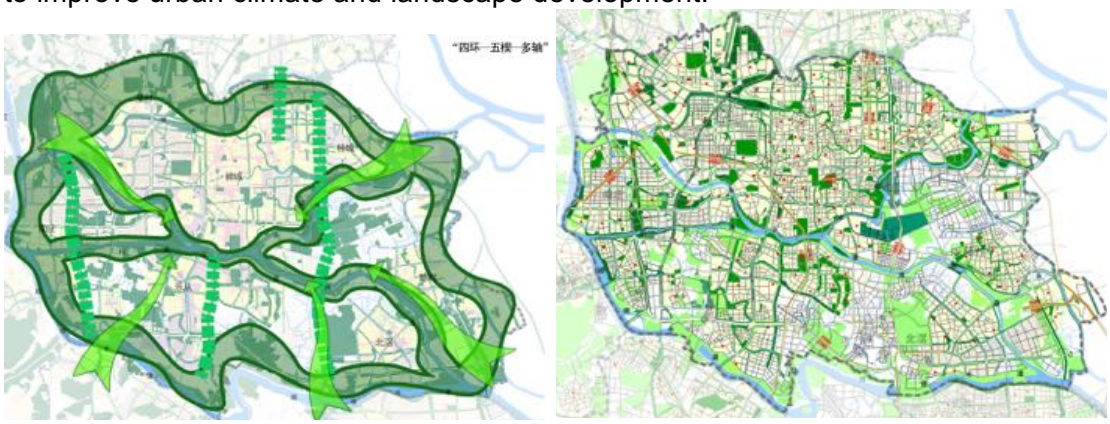


Figure 8 The layout of green spaces in Central cluster

The layout of green spaces in Daliang-Ronggui

The green space layout of Daliang-Ronggui could be described as **"one-ring, one-core, and two-corridor"**. **"One-ring"** refers to the 200-500 m wide green beltway of Shunde composed of the Shunde, Ronggui, Hongqili, Guizhou, and Jiya Waterways and their waterfront green spaces. Shunde Waterway runs along the North, the Lijiasha Waterway headed to the East and then the West front; relocated No. 105 National Highway and the waterway along Lungui Road extend to the West;and, Guizhou Waterway approached the South. "**One-centre**" referred to the urban green centre surrounding Shunfeng Mountain and the extensive lake. The centre consists of a large-scale area connected with the small waterways and green belts that run through clusters to define a closely interconnected green space system. It is the most prominent recreational and landscape system in the cluster. **"Two-corridor"** referred to the areas consisting of waterways and 400-800 m green belts which separate each cluster. The corridor between Lunjiao and Daliang was formed by municipal buffer green spaces (more than 200 m) along Guangzhou Ring Expressway and that between Daliang and Ronggui is established with Ronggui Waterway and riverfront green space (including the Shunfeng Island and Dashan Island in Desheng River). These two broad corridors separated Daliang-Ronggui Cluster further to form a relatively independent yet interconnected urban land structure.

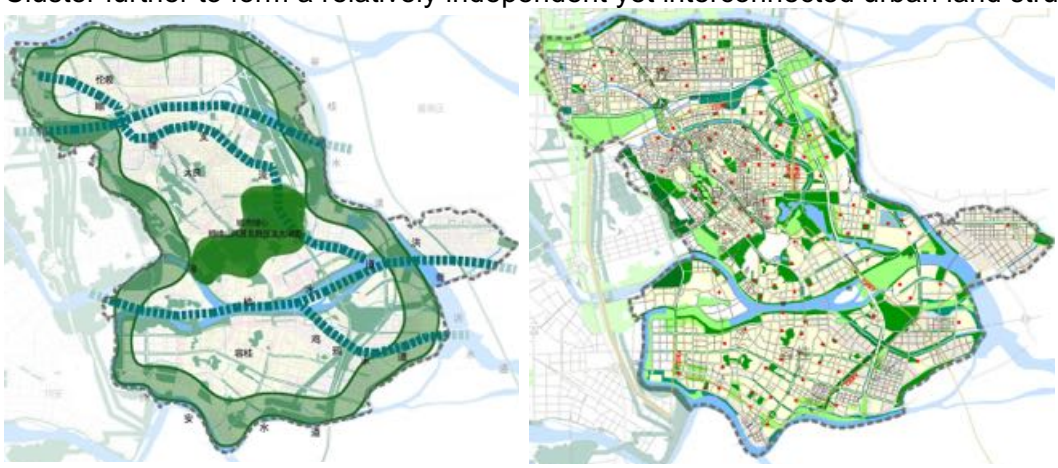


Figure 9 The layout of green spaces in Daliang-Ronggui

The layout of green spaces in Shishan Cluster

The layout of green spaces in Shishan Cluster (Figure 10) could be described as **"a big green spot+ a large green corridor**" following the green space systematic structure positioning of Shishan Cluster in the Master Plan. The "**big green space**" referred to the concentration of shallow hills, reservoirs and fish ponds, including the extensive hills, lakes, plantation and waters (as part of the Green Centre in municipal green space system) between Nanguo Peach Garden Tourist Holiday Resort, Emperor's Tomb (Tianzimu) Scenic Spot, East of Shishan, Songgang, Dali and Luocun. If we interpreted the whole cluster as a figure-ground diagram, the municipal serves as the ground, and the construction land, the figure. Shishan Cluster worked as an essential urban green core in the overall structure of municipal green space in Foshan.

"**Large green corridor**" referred to the channels consisting of the the scattered water branches and fishponds. This corridor brings waterfront green spaces in the cluster. It could separate the construction land blocks and buffer each eco-blocks and serve a crucial eco-corridor to connect with the Big Green Spot, contributing to a conservation system featuring eco-diversity.

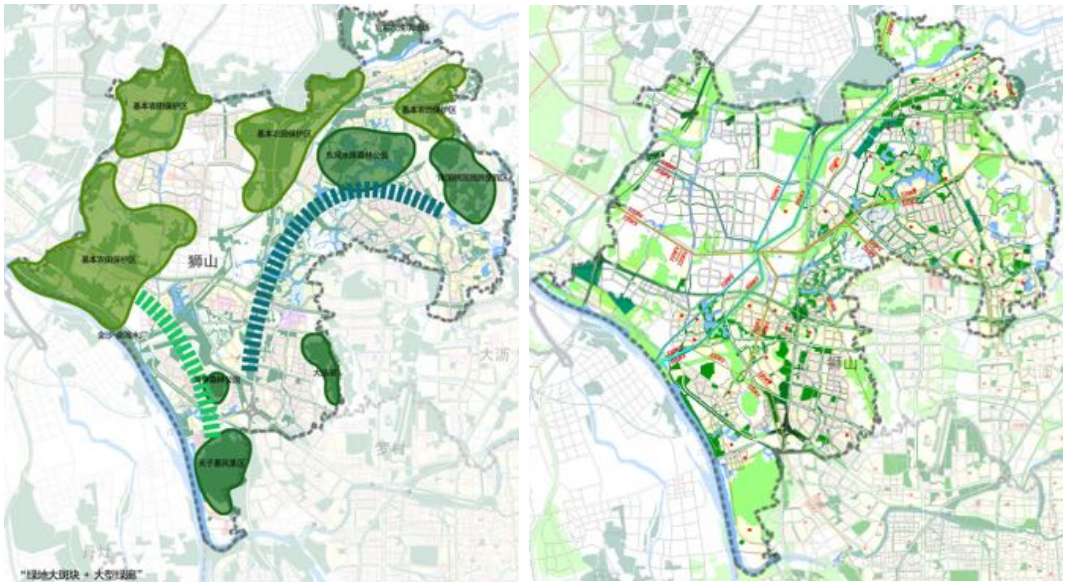


Figure 10 The layout of green spaces in Shishan Cluster

The layout of green spaces in Xi'nan Cluster

The layout of green spaces in Xi'nan Cluster (Figure 11) could be summarized as "**one-axis, two-belt and three plots**". "**One-axis**" referred to the city axis, composed of various urban green spaces, that connects Yundonghai and Ma'angang,. This cluster connected two important large green spaces in the Xi'nan Cluster, the Yundonghai Wetland Conservation and the Ma'angang Suburban Park. It serves to make the urban green space landscape more consistent, holistic and enhances city ventilation with its North-South orientation. **"Two-belt"** referred to the trunk streams of the Xijiang and Beijiang Rivers as well as the buffer green spaces along the rivers and riverfront green space. It protected city water resources and shapes the urban waterfront landscape. "Three-plots" referred to the three large green spaces which serve as the cardinal conservation system in the cluster. One green space is an essential area for wetland conservation that featured a special geographic landscape located at an estuary. It is the intersection of two rivers, where a group of concentrated islands could be found. The other two green spaces are Yundonghai Wetland Conservation and the South-extending hills of Ma'angang; both important municipal green spaces. Located in the North and South of the city along the dominant wind direction, these Green Spaces helped to improve the climate and environment of the city.

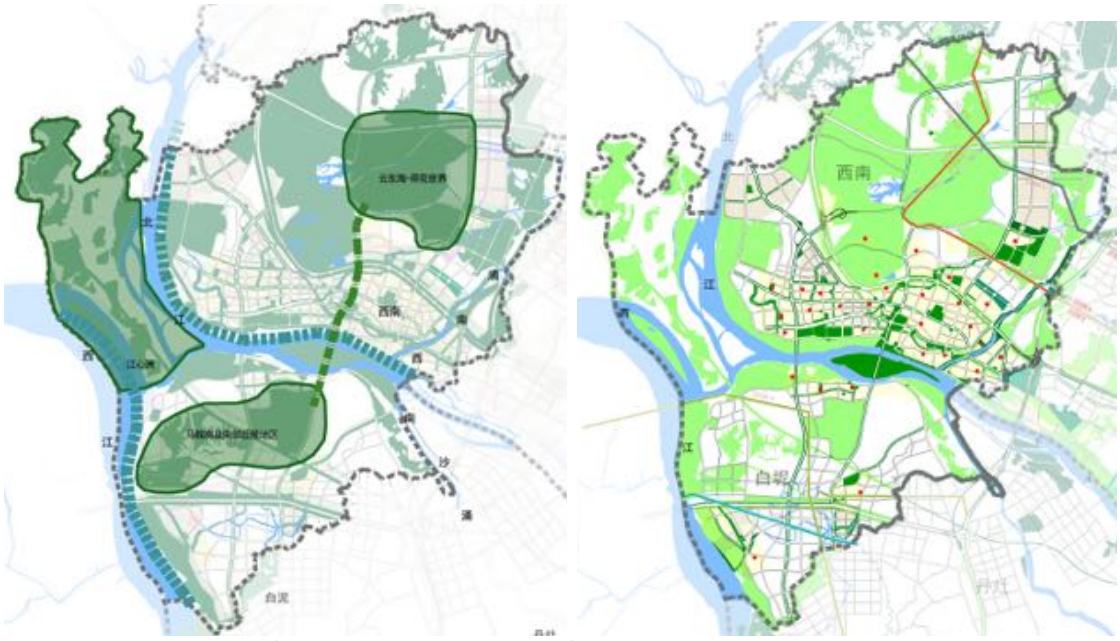


Figure 11 The layout of green spaces in Xi'nan Cluster

The layout of green spaces in Xijiang Cluster

The layout of green spaces in Xijiang Cluster could be described as **"One-river, multi-corridor and three-spot"**. "**One-river**" refers to the Fuwan trunk of Xijiang Riiver. The flat shoal in this section was planned as a suburban park themed for wetland conservation. "**Multi-corridor**" referred to the green beltways along the Guangzhou Ring Expressway and the green belts on, or along, the water system across the cluster. The green belts along traffic paths and water branches, constituted eco-corridors that run through the cluster and connect green spots and Gaoming Forest in the West. The criss-cross pattern of the corridor and green spot helped to organize urban recreational and landscape system.**"Three-spot"** referred to the Xiqiao Mountain Scenic Spots and its dike-pond system agricultural conservation zone, the West Bank Conservation Zone, and, the Lingyunshan Forest Park recognized by UNESCO.

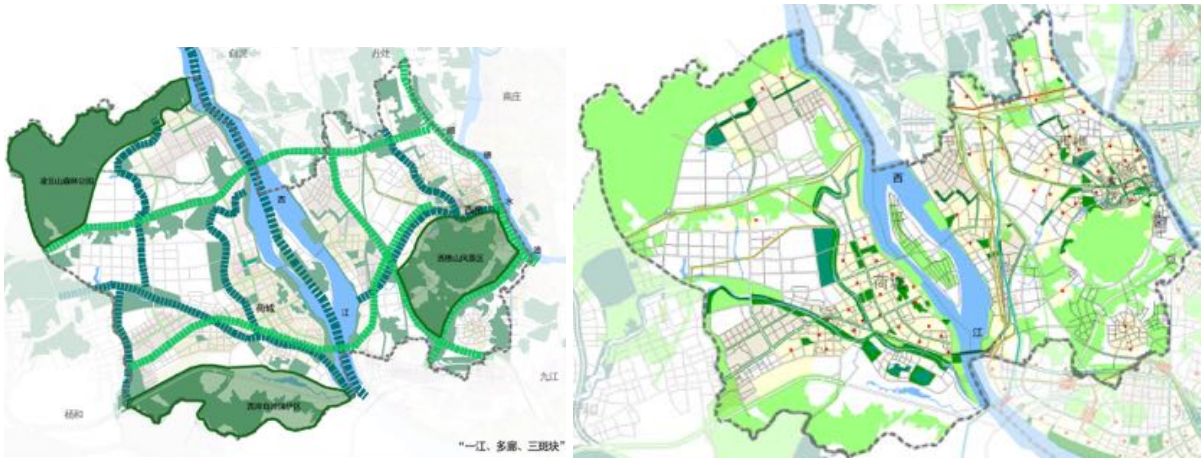


Figure 12 The layout of green spaces in Xijiang Cluster

The layout of green spaces in Dali Cluster

The layout of green spaces in Dali Cluster (Figure 13) could be understood to be **"One-ring, two-corridor and two-axis"**. The term "One-ring" referred to the intersection between Huangqi, Yanbu and Guangzhou set aside for water resource conservation forests; the intersection between Northern & Western Songgang, Luocun and Shishan (dense hills and reservoirs are distributed in the junction of Western Dali, Luocun and Shishan); and the

waterfront green space which is an important buffer green space separating the cluster and central cluster. These water resources areas consisting of conservation forests, hills, reservoirs, waterways, and waterfront green spaces constituted a green beltway for Dali Cluster. **"Two-corridor"** referred to two eco-corridors. Dali Cluster was planned with a North-South green corridor to link the forest oxygen source, where the Nangou Peach Garden Tourist Holiday Resort is located (in the north of the cluster) and the Dali Cluster, intended to improve the domestic environment in the Cluster. Another eco-corridor, combined with the Southern green space resources form a wider green belt which serves as the wind inducing forests and a buffer between industry and residence. For the **"two-axis"**, one axis referred to the urban landscape axis, an extension of the green axis in Nanhai centre landscape which is an essential urban public green space for sightseeing and recreation. The other axis, a road green axis formed with the green belts of Foshan ring by ring, which provided a green open space between the urban areas and North of Foshan.

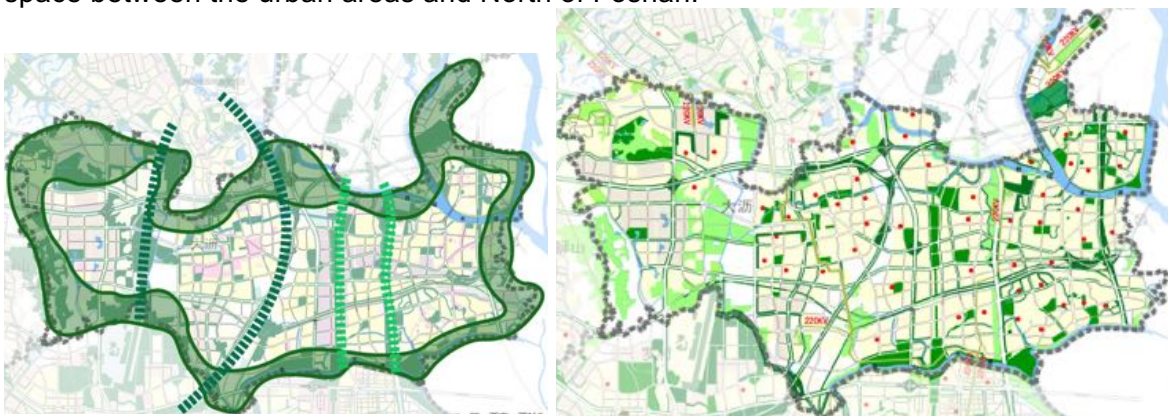


Figure 13 The layout of green spaces in Dali Cluster

The layout of green spaces in Jiujiang-Longjiang Cluster

The overall layout of green spaces in Jiujiang-Longjiang Cluster could be defined as "**a green beltway, a cross-shaped green corridor and multi-spots**". The "**green beltway"** referred to the ring green belt enclosed by the Jiujiang-Longjiang Section Xijiang (in the North-South boundary of the Cluster); the Shatou-Longjiang Section of Dongping Waterway, and the extensive farmlands in the eastern and western boundaries. The "**cross-shaped green corridor**" referred to the protective green spaces that transverse the middle of cluster, W-E extending along Guangzhou Ring Expressway and those running along Foshan-Kaiping Expressway in North to South direction. Since the area is an important traffic hub, we planned to delineate a nearly 200 meter wide buffer green spaces along the key traffic path at both sides (including Guangzhou Ring Expressway and Foshan-Kaiping Expressway) and establish a reserved right of way for regional traffic. "**Multi-spots**" referred to the massive green spaces, Huangji Heron Conservation Zone, Longfengshan Forest Park, Dajinshan Forest Park and the concentrated farmland in the west, and southeast of Longjiang area.

Figure 14 The layout of green spaces in Jiujiang-Longjiang Cluster

Our strategy: Urban Green Subsystem Planning

The planning of urban green space subsystems

Besides the **quantitative** demands to be fulfilled, the urban green space system should be provided with defined urban **functions** and a **rational layout**. An urban green space system, can be divided into four subsystems: the green space for recreation, the green space for protection, the green space for conservation; and, a landscape preservation green space.

The urban green space should be arranged based on the land use pattern of the urban master plan. It should highlight the functions of urban green space system to the whole city, maximize the connections to other functional green space, balance the distribution of greenway activities and rationalize the spatial arrangement for each green space type.

Recreational green space is provided for the daily activities of citizens and should be fully integrate into the urban areas, such as residential land, commercial land, and road and river system. To integrate urban recreational green space resources, it was necessary to establish green network for people's daily and holiday access. Therefore, the green space with recreational as major function will become an independent system for such outdoor leisure activities as sightseeing, exercise and social intercourse to enhance urban life quality (Figure 15).

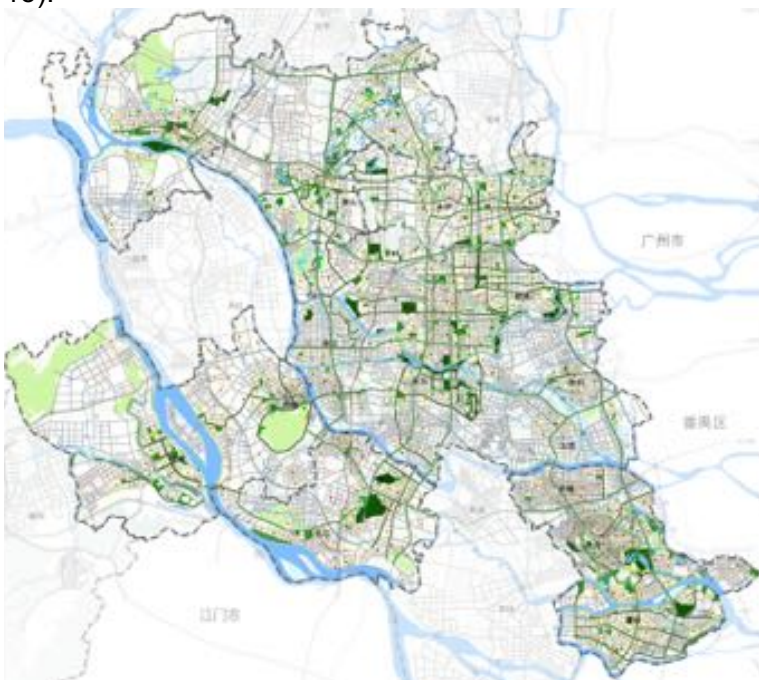


Figure 15 The urban recreational green space subsystem of Foshan

Recreational green space subsystem was divided into two factors (Table 3): planning for recreational spots and recreational corridors. The former mainly consisted of the planning of green space for holiday, daily recreation, and theme recreation. The planning of recreational corridors integrated the planning of **greenway and greennet with the layout of recreational spots**, and provide corresponding classification.

Table 3 The components of urban recreational green space subsystem

	Subsystem components	Planning contents	Types of green space	Notes
			Municipal park	Area ≥45 hm^2

Recreational green space subsystem	Recreational spot	Planning of holiday recreational green space	Suburban park	Excluded from indicator statistics
		Planning of daily recreational green space	Regional park	Service radius: 1,600 m, area: 5-20 hm^2
			Residential district park	Service radius: 600 m, area: 1.5-3 hm^2
			Residential quarter park	Service radius: 350 m, area: 0.5-1 hm^2
			Roadside green space	Determined base on road traffic organization and community park distribution
		Planning of theme recreational green space	Children's park, botanical garden, historical legacy park, scenic attraction park, playground, other theme park	Determined base on green space resources and historic legacy of Foshan
	Recreational corridor	Planning of municipal recreational corridor	Planned based on roadside Greennet and Greenway	Connecting municipal park
		Planning of district recreational corridor	Ditto	Connecting regional park
		Planning of community recreational corridor	Ditto	Determined on regulatory planning
		Planning of theme recreational corridor	Planned based on belt park, river net, etc.	Connecting theme recreational green spaces or comprehensive recreational green spaces

The planning of protective green space subsystem

The planning of protective green space should be arranged based on the local climate and the priority of urban hazards and other disadvantages. A protective green space should not only protect the city from flood, fire or pollution, but also can improve the natural environment by inducing wind, a crucial factor to improve urban residence given Foshan's climate features.

Moreover, the protective green space system provides post-disaster a sheltering system that can accommodate people after evacuations. The planning of protective green space system mainly includes the planning of wind-inducing forests, separating green space, disaster prevention green space and sheltering green space (Table 4).

Table 4 The components of urban protective green space subsystem

Subsystems	Subsystem component	Types of green space
Protective green space subsystem	Green space with wind-inducing forests	Urban wind-inducing forest in North-South direction
	Separating green space	Traffic separating green space (including protective green space for railway, expressway, urban freeway and urban main road), sanitary separating green space
	Disaster prevention green space	Waterfront protective green space, green space along high-voltage grid corridor and other hazardous protective green space
	Sheltering green spaces	Sanctuary and escape passage

Figure 16 The urban protective green space subsystem of Foshan

The planning of conservation green space subsystem

In this planning, conservation green space contains resources to be protective and nourished and includes natural zones and the eco-rehabilitating lands crucial for the integrity of urban ecosystem. These areas should maintain and enhance the stability and continuity of local natural eco-system. Based on the natural characteristics of Foshan, planning of the subsystem consists of four parts (excluded from indicator statistics): planning for protective green space, for rehabilitating green space, for productive green space and for conservation corridor.

Subsystems	Subsystem components	Types of green space
Conservation green space subsystem	Protective green space	Riverfront green space (medium reservoir, dike-pond system) Eco-conversation zone (natural conservation zone, water resource conversation zone and basic farmland conservation zone)
	Rehabilitation green space	Natural disaster sensitive zones, soil erosion prevention zone, water &soil conservation zone, landfill rehabilitation land, etc.
	Productive green space	Seedling nursery, flower nursery, grass nursery, etc.
	Conservation corridor	Green beltway and infrastructure separating zone

Figure 17 The planning of urban conservation green space subsystem

The planning of landscape green space subsystem

The green space crucial for a city's characteristics and identity is called the urban landscape green space. A landscape green space should focus on the holistic urban arrangement, organize the link between natural and artificial environments, and enhance the key segment to establish a subsystem by planning and integrating. We divided the landscape green space subsystem planning into the following three parts: Planning of landscape guiding control cluster, planning of landscape nodes and planning of landscape corridor.

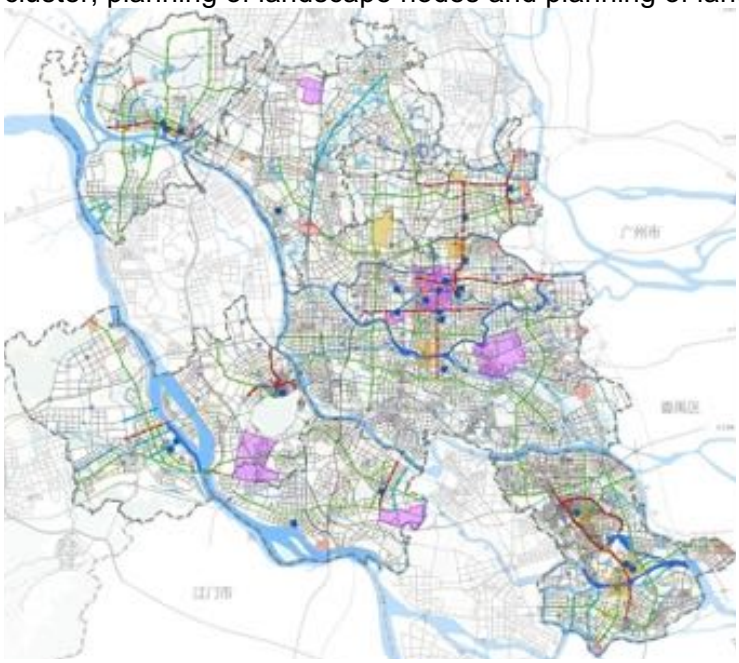


Figure 18 Urban landscape green space subsystem

The planning of urban disaster preventive & sheltering green space

The development of **s**heltering bases, passage and waterfront facilities are the key factors of the urban disaster preventive and sheltering green space system. The location of such green spaces should established where most people live and dwell. The size of a sheltering urban green space should be 1-2 m^2 per capita with an average area of 5-10 hectares.We have identified several types of sheltering green spaces.

1) A **temporary shelter** domestic green space is generally no less than 1 hectare and desgned to accommodate at least 500 people. Its service radius is about 600 meters and travel distance to the shelter should be no more than 10 minutes of walk, including residential district parks.

2) A **fixed shelter** domestic green space should be more than 10 hectares, with a short edge of more than 300 meters. Its service area ranging from 1 to 2 km and it should be accessible with about a 1 hour walk, including regional parks.

3) A **central shelter** domestic green space should cover an area of nearly 50 hectares, with a short edge of more than 300 meters. The service radius extended to 2 to 3 km, and it should be accessible with less than a 2-hour walk. Such facilities would be mainly included in municipal parks and suburban parks.

(II) A **disaster preventive corridor** is a network connecting disaster preventive spots with urban main roads. We plan to divide the disaster preventive corridors into ones for cars and ones for walking access. To ensure smooth and accessible corridors, the buildings along the road should be set-back from their property lines by 5 to 10 meters. High-rise buildings should set-back more. Both sides of the main corridors should be planned with green belts with width ranging from 10 m to 30 m.

Figure 19 The planning of urban disaster preventive & sheltering green space

Tree species planning

Urban tree species planning is the foundation and basis to achieve diversity of garden plants, to upgrade the ecological functions of urban green space system, and develop the eco-network of urban open space.

Foshan has a South Asia tropical and subtropical humid monsoon climate. Foshan's local forests consist of South Asia tropical evergreen broad-leaved species. However, there is only a small block of natural secondary evergreen broad-leaved forests and other plantations are mostly artificial forests. Most lower slopes serve as fruit orchards, while the plain is dominated with cultivated plants. The common garden trees in the municipal area total 116 families, 333 categories and 546 species.

The Basic principles of tree species planning were: 1. develop an urban greening landscape dominated with South Asian tropical plants with local charm; 2. plant mainly evergreen trees in embellished with deciduous trees, combining slow-growing trees with those growing fast and bring together the landscapes of short-term, medium-term and long-term performance; 3. highlighting the diversities in species and genetic inheritance; and, 4. developing the green space mainly with arboreous species, auxiliary areas with bushes & vines, and combine the bio-benefits with landscape performance

Discussion

The condition of green space underpins the functioning of urban ecosystems, which plays a key role in supporting biodiversity and providing important ecosystem services in urban areas. We added the new features of using green development to mitigate heat sinks and moderate summer temperatures, and the use of greenways to provide emergency shelter in the event of disasters. The provision of urban green belt systems and subsystems has given a permanent counterthrust to regular urban planning. The strategy of developing green belts has attained social acceptance and successfully resolves environmental issues while balancing ecological and economic development.

The greenbelt is indeed a physical reality today, but it is also 'a way of doing things'. We believe that this should be a desirable and feasible step towards making real progress

References

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[i] For example, in Foshan, the wind is an important factor to mitigate climate change impacts and therefore our greenbelts include a wind induced forest. These green belts can also serve as evacuation locations and provide shelter after disasters.