Garden Cities in China: Patterns of Development and Construction

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•The School of Landscape Architecture BJFU was founded in 1951. longest landscape educational history in China and in the leading position in LA education field . In 2013, It was evaluated by the ministry of Chinese education as 1st place in LA education in China.

•offers 5 degree: Landscape Architecture, Urban Planning and Design, Architecture, Ornamental Horticulture and Recreation Management.

• 124 full time professors and faculty ,1954 undergraduate students and 571 graduate students and 142 Ph.D students.

•Special thanks to AIPH and Canadian Nursery Landscape Association

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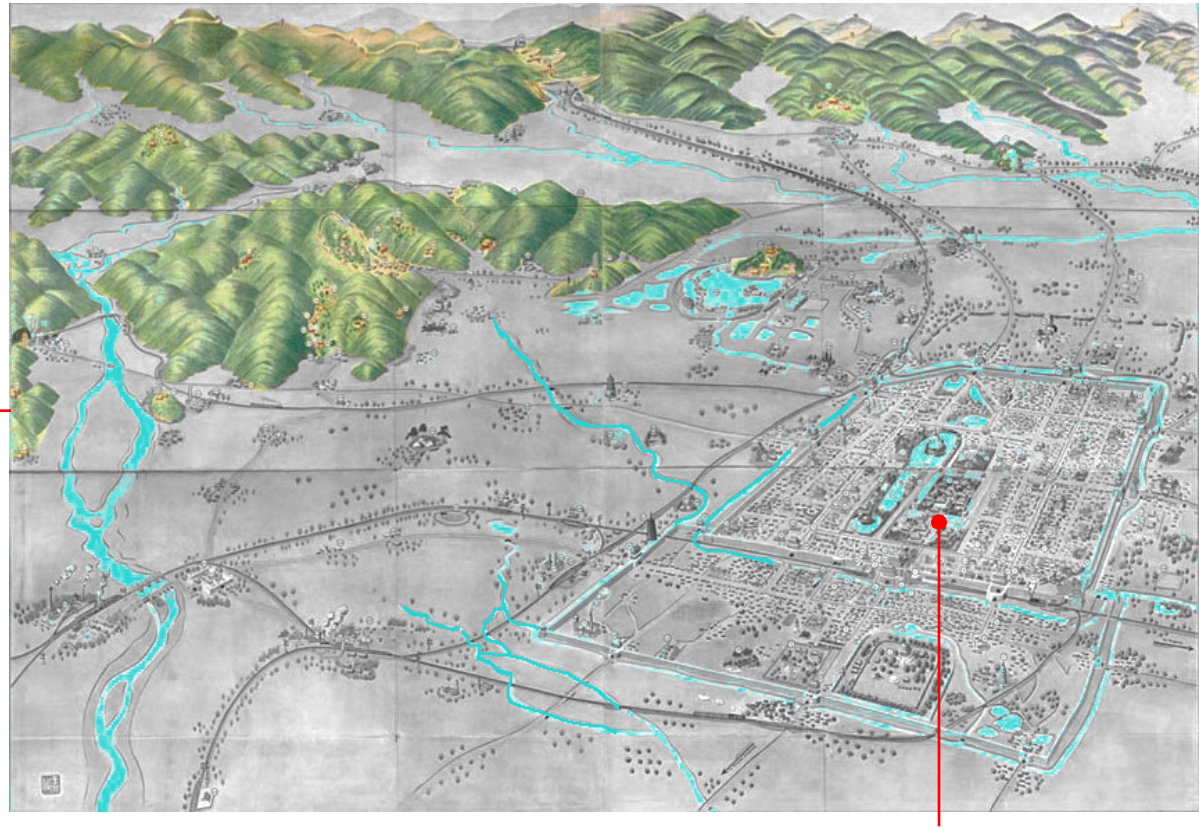
1. Historical precedents

1.1 Imperial Beijing

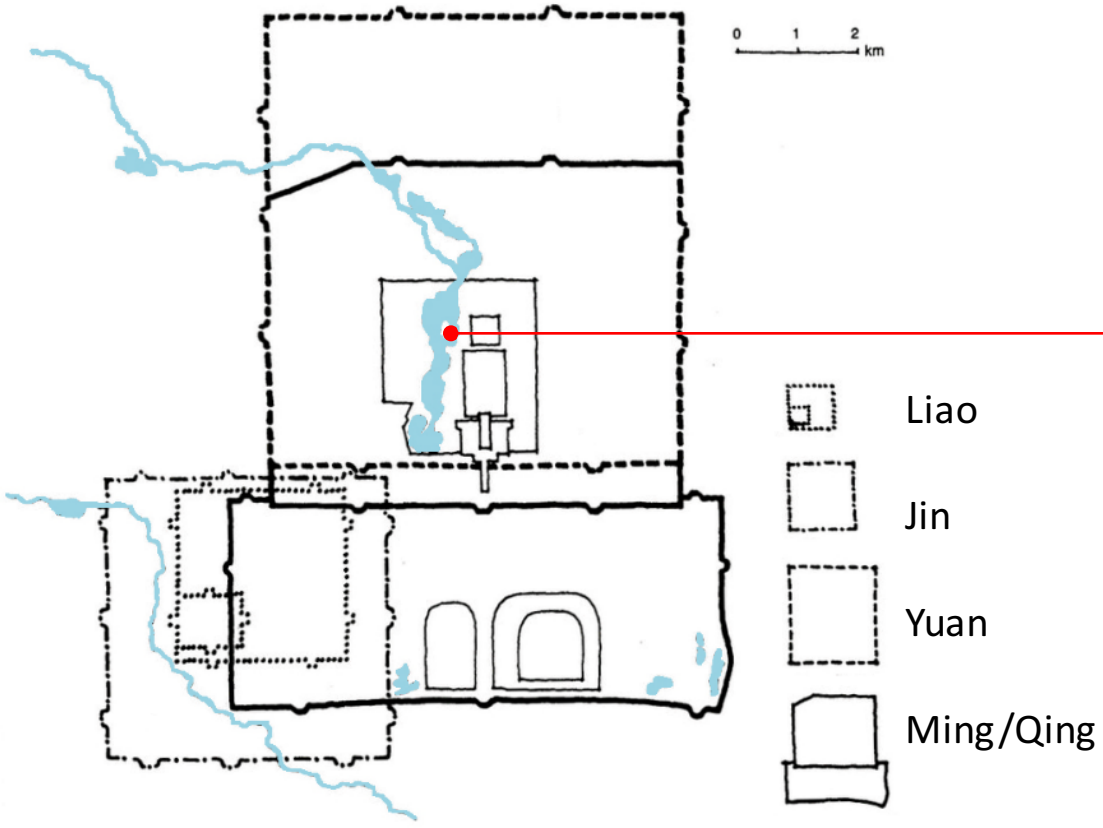
The Mountain-water-city pattern: During the period between the 10th and the 19th century, Beijing emerged as the seat for five successive dynasties, being representative of the Chinese pattern of city building.



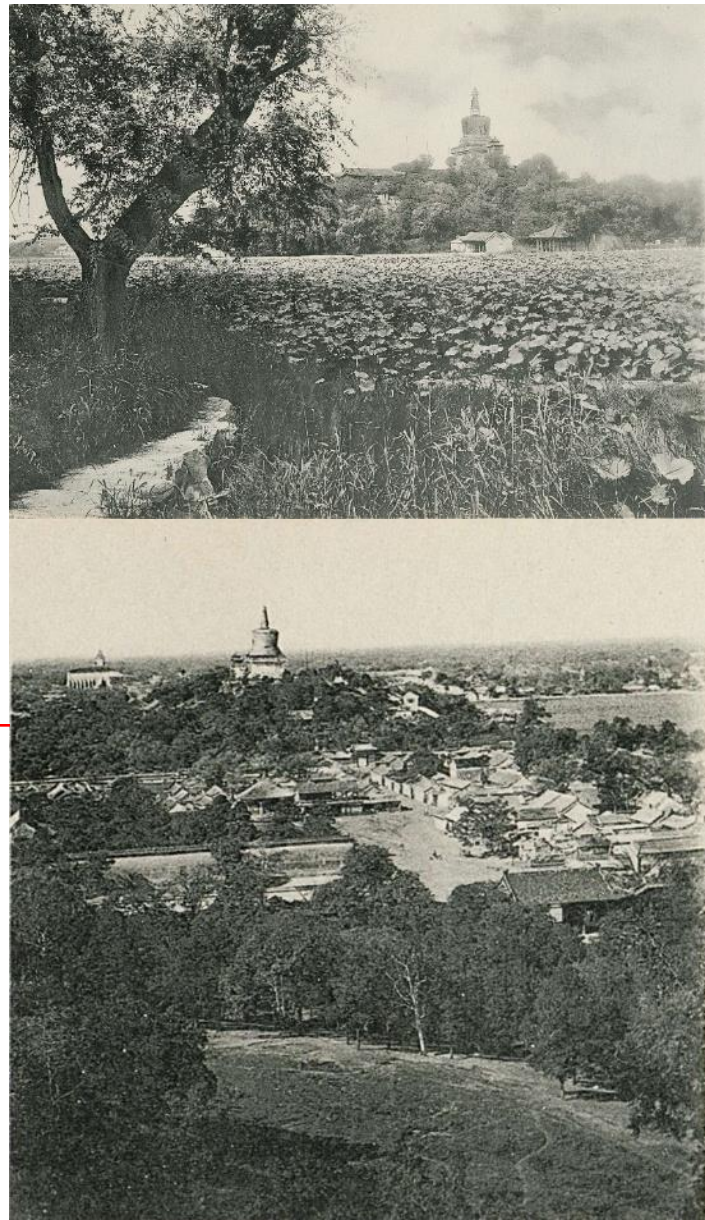
Forbidden City

1.1 Imperial Beijing

Urban development: The city of imperial Beijing had been evolved around water, especially that from the natural springs of the Western Hills. Such water bodies not only supported daily life in terms of water supply and drainage, but were also landscaped as picturesque gardens for royal families.

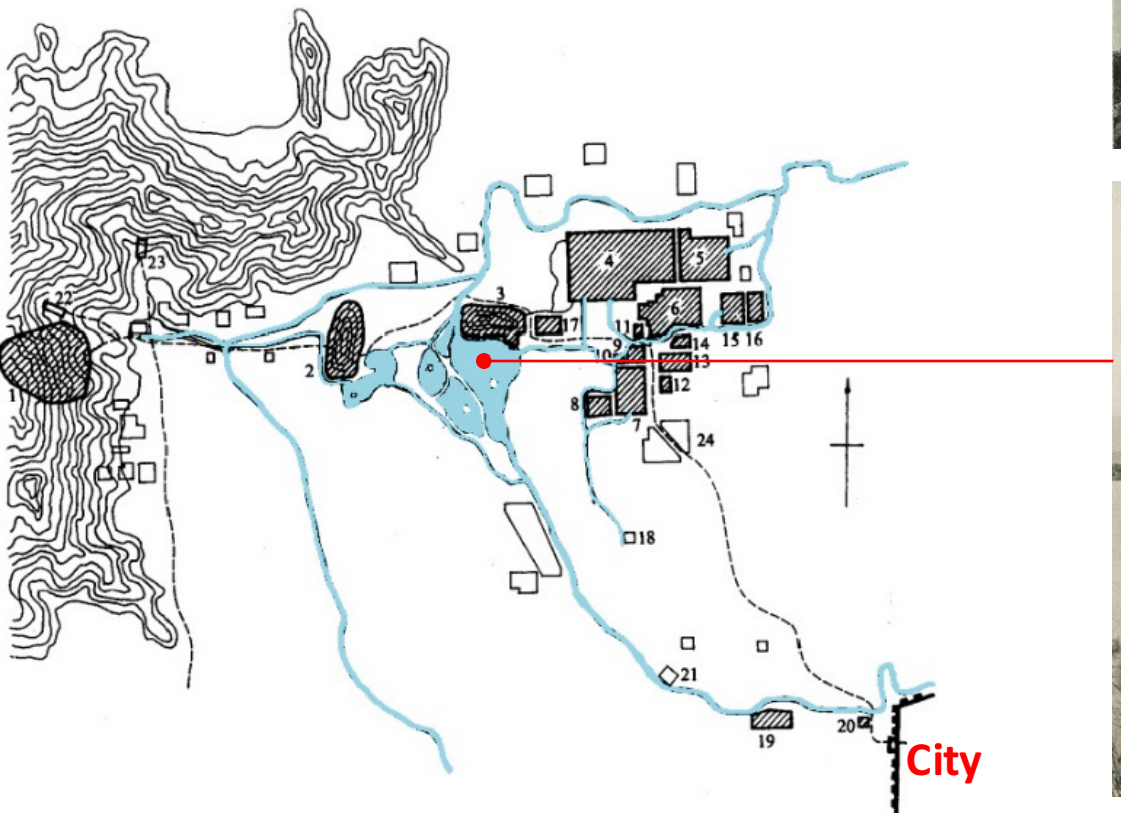


North Sea Palace, photo by Mumm, 1900

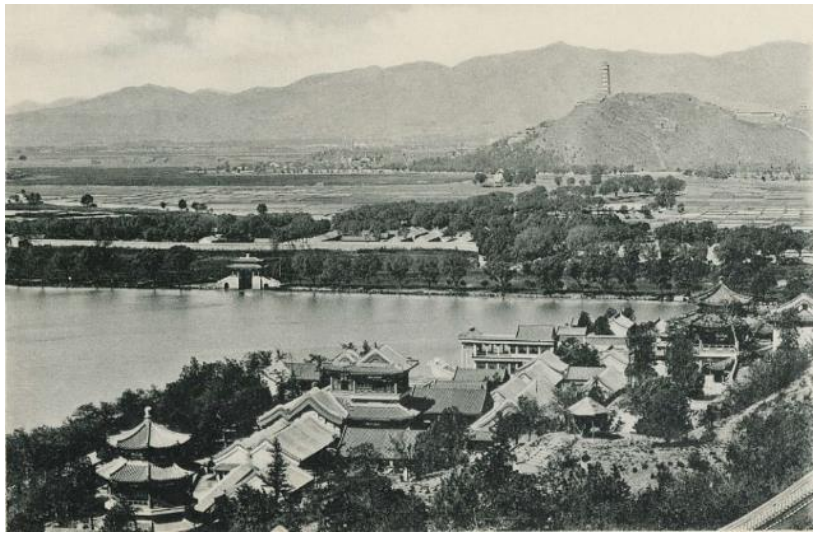


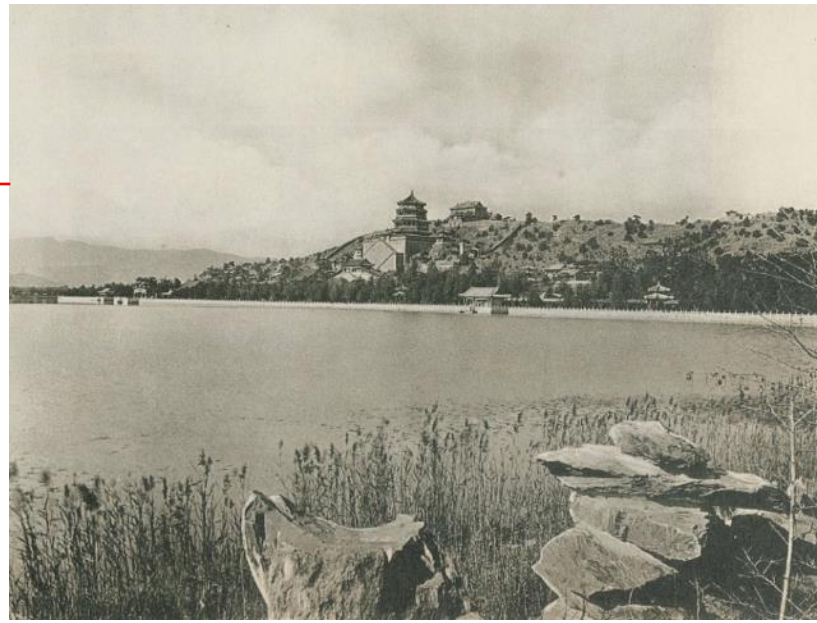
1.1 Imperial Beijing

Suburban development: Outside the city walls, Beijing's elitist residents also built a number of palace gardens and religious temples, especially on the eastern foot of the Western Hills. Mountain water was collected in reservoirs to support gardens and rice farming.



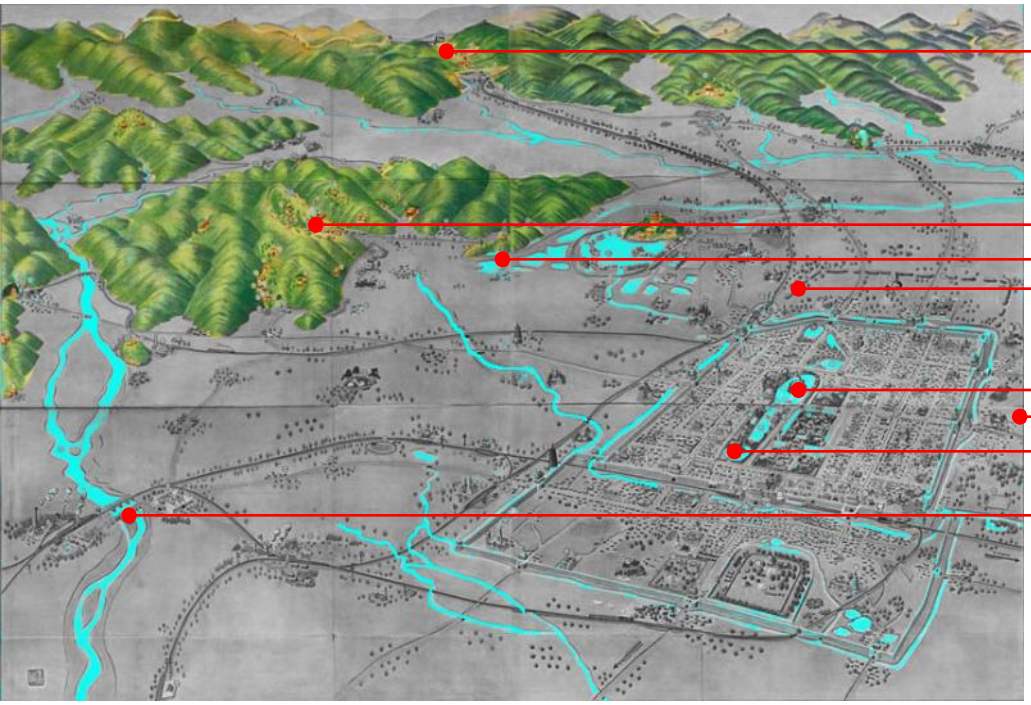
Summer Palaces, photo by Mumm, 1900

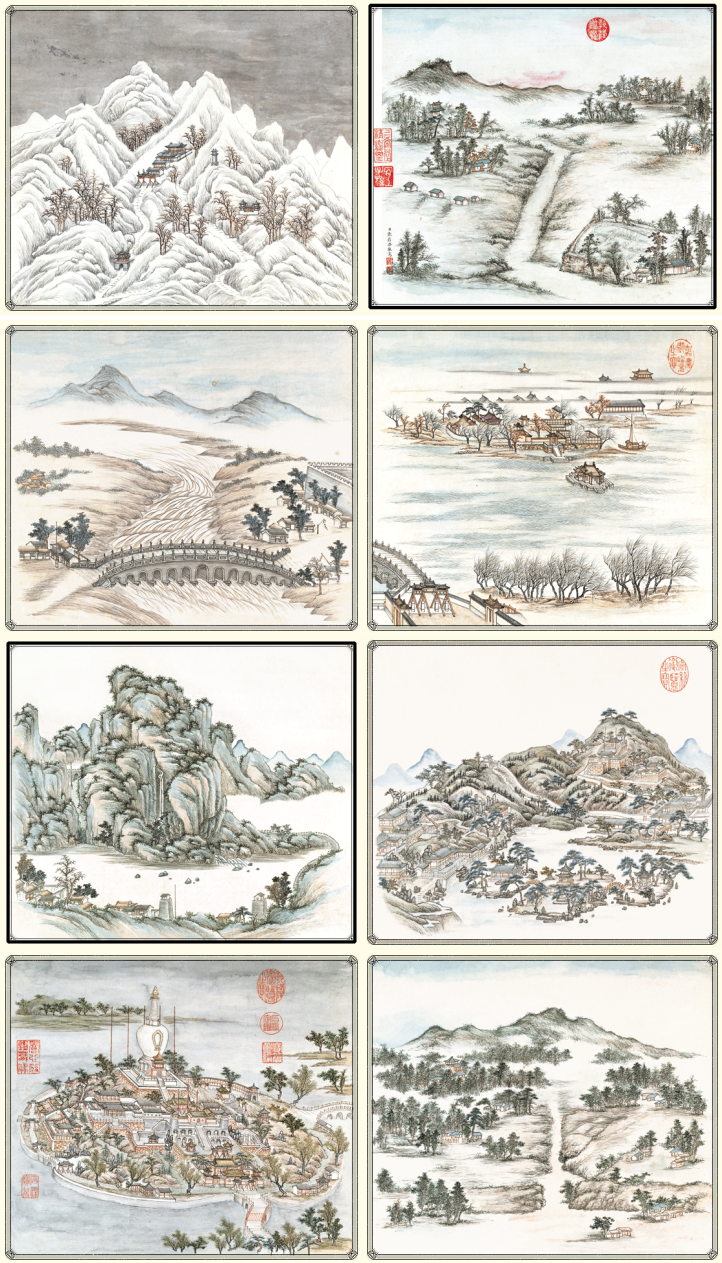




1.1 Imperial Beijing

View naming: is a special form of interaction between human and landscape. Over a long period of time, eight views were identified and named as most characteristic of imperial Beijing and its environments.

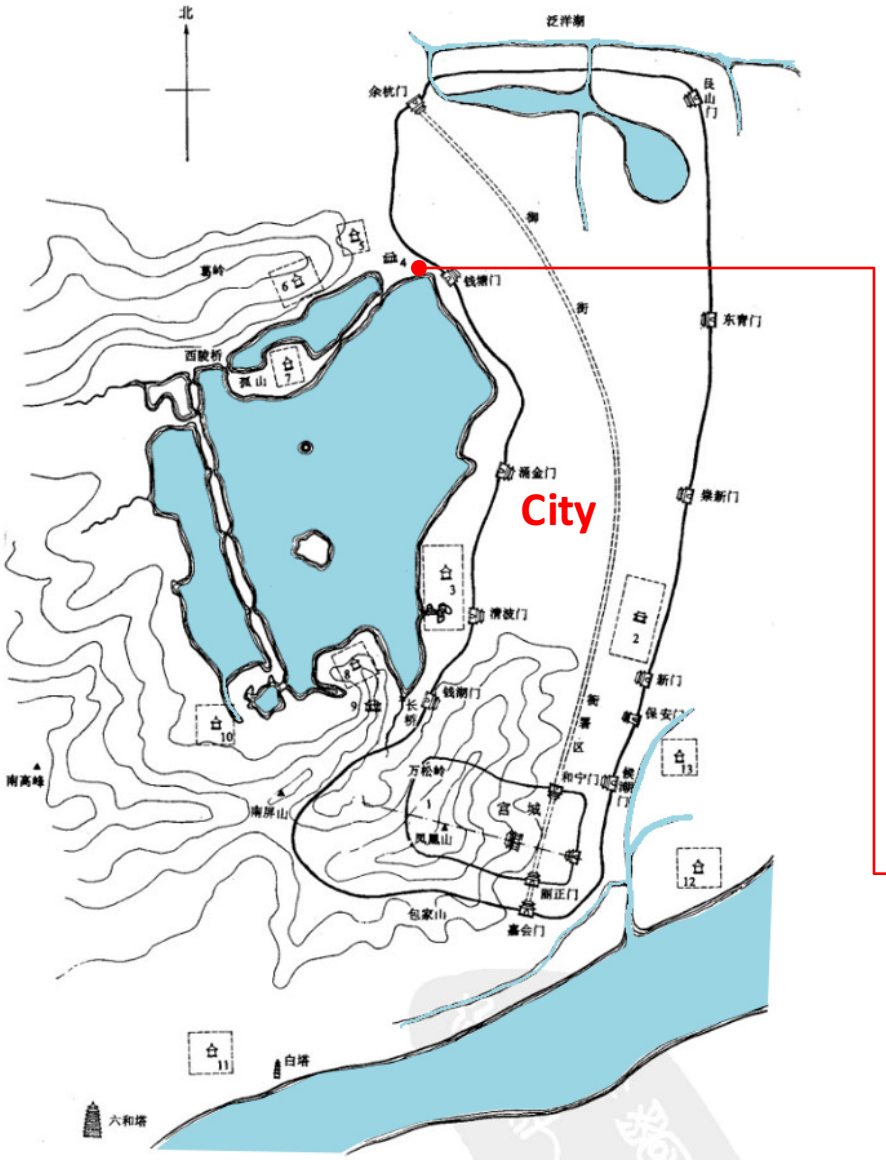




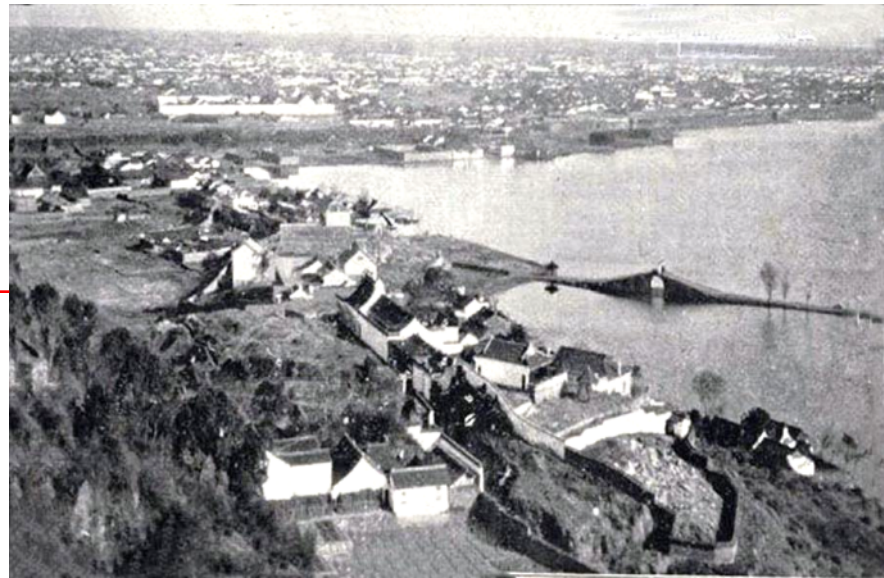
1.2 Imperial Hangzhou

Urban development: Like imperial Beijing, the city of Hangzhou had also followed the mountain-water-city pattern over its long history of evolvement, but in an even more integrated way.

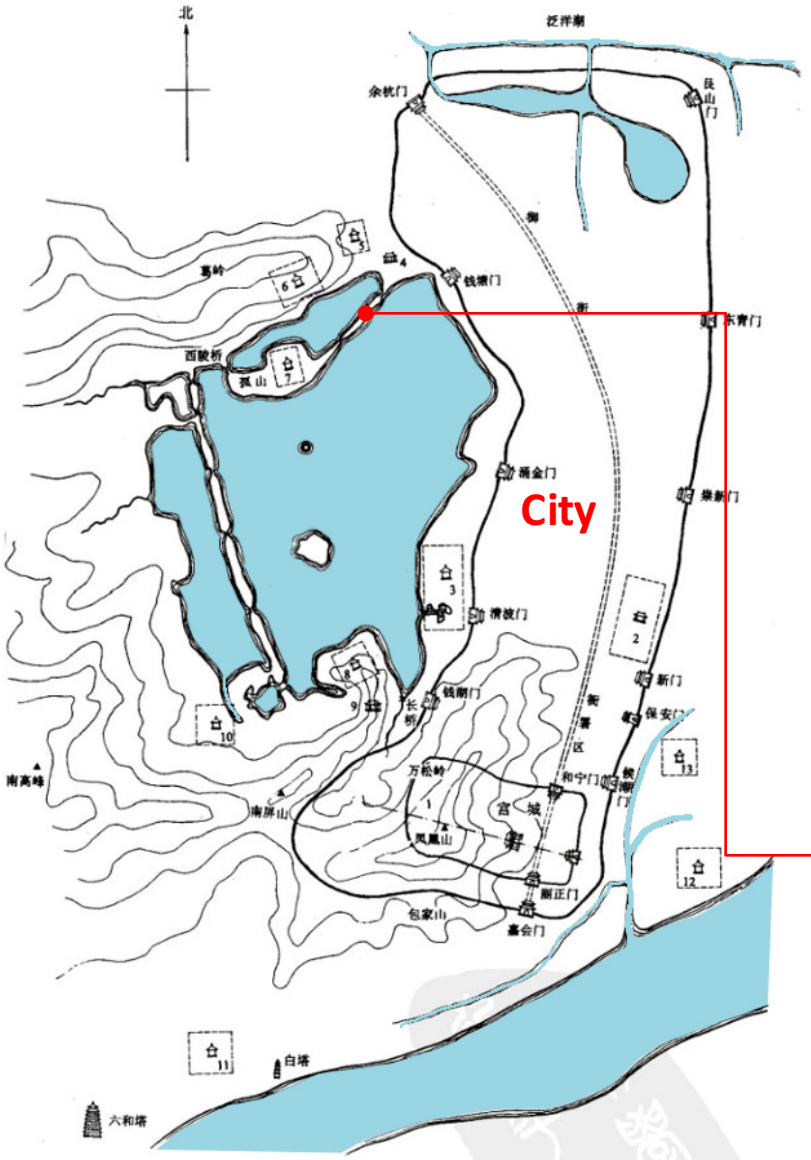
1.2 Imperial Hangzhou



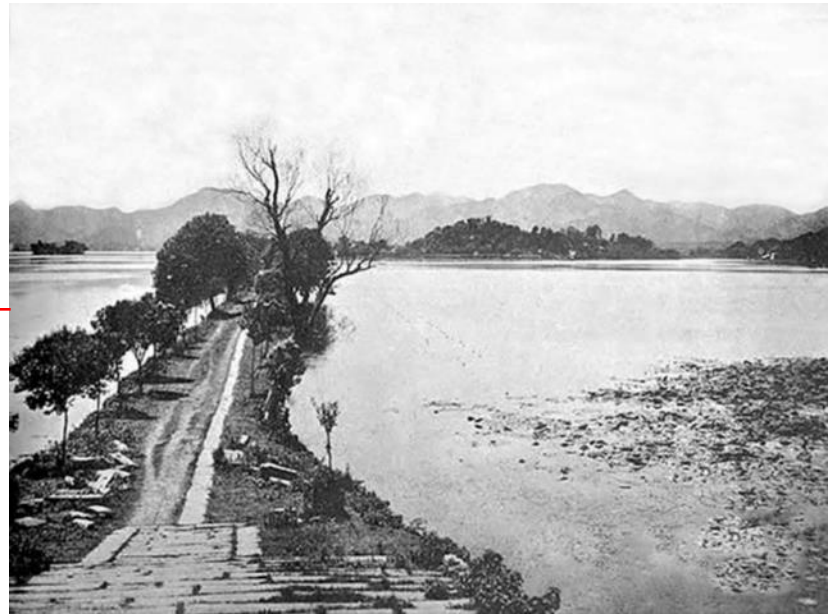
Waterfront development: The city lied on the east bank of the West Lake, for the purposes of not only acquiring fresh water for drinking and irrigation, but also enjoying the picturesque waterfront scenery.



1.2 Imperial Hangzhou



Dyke & island: To prevent the West Lake from silting, local people dredged the water body for several times in history. The resulting silt was used to build a series of dykes and islands that later became the defining features of the landscape. These earthworks served as both transportation infrastructure (walking trails or boat stops) and scenic tourist spots.



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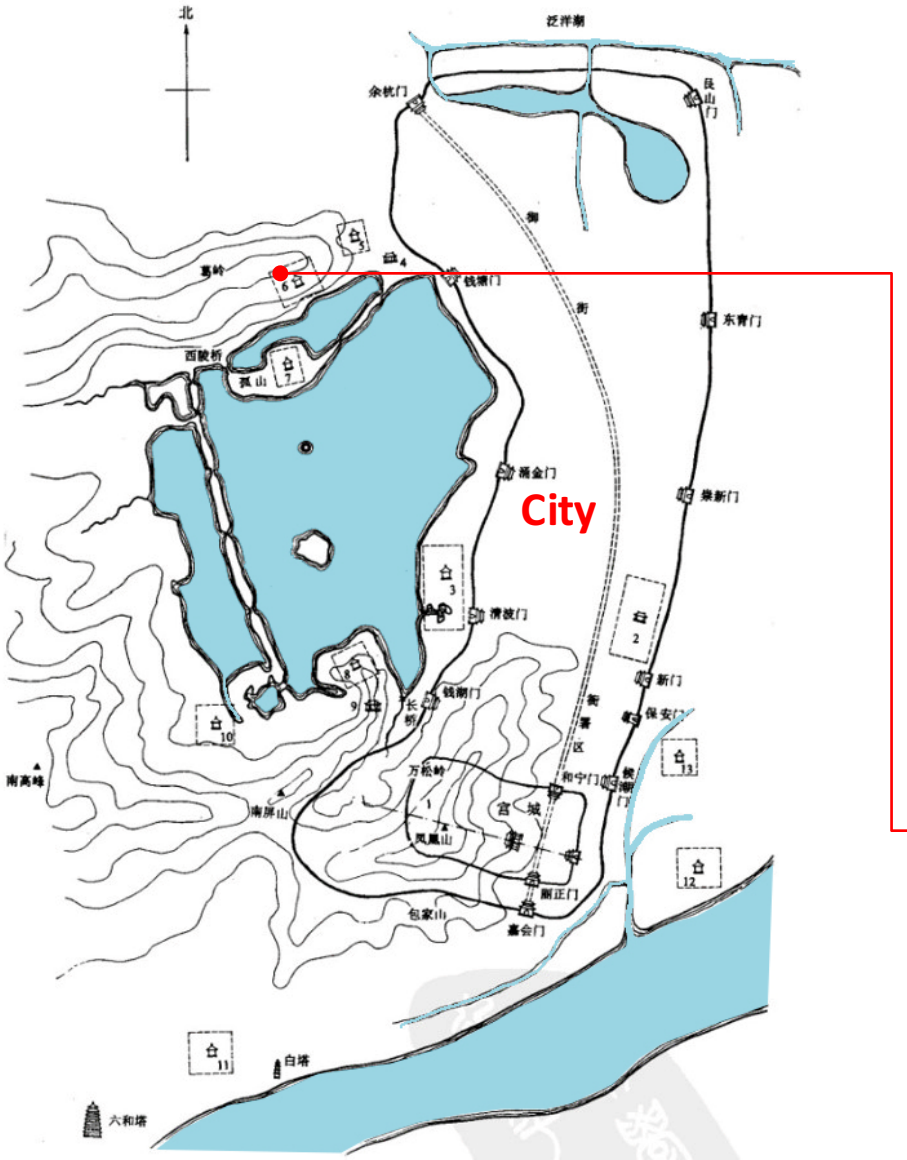
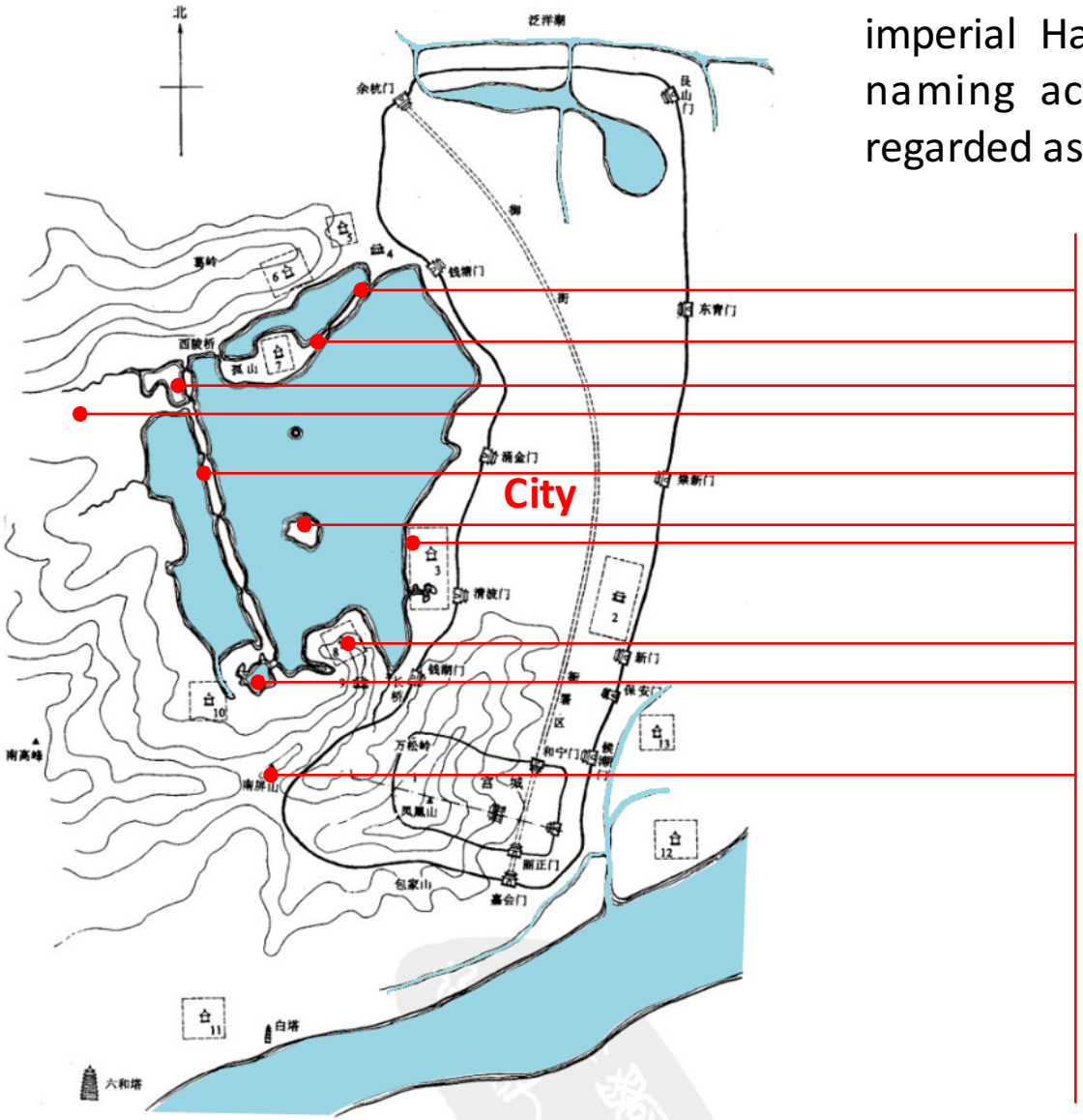


Hillside development: The West Lake is surrounded by low hills and mountains on its three sides, which are highly visible when being seen from the eastern plain areas. During the imperial era, those rugged terrains were gradually dotted with numerous temples, pagodas, and villas that are now regarded as cultural heritage and landmarks.

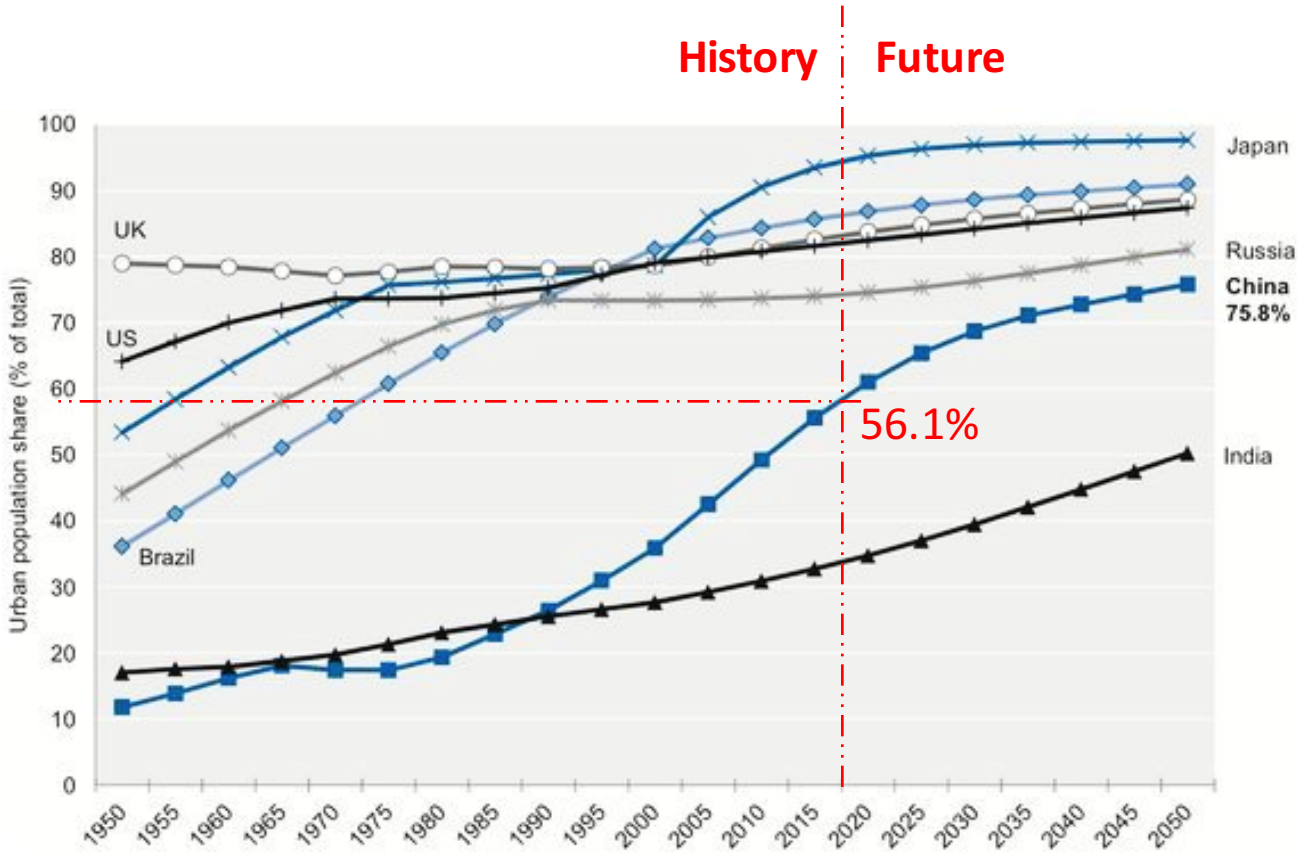
1.2 Imperial Hangzhou



View naming: Like imperial Beijing, imperial Hangzhou is also subject to view naming activities, and ten scenes were regarded as most characteristic of the region.

2. Urbanization in contemporary China

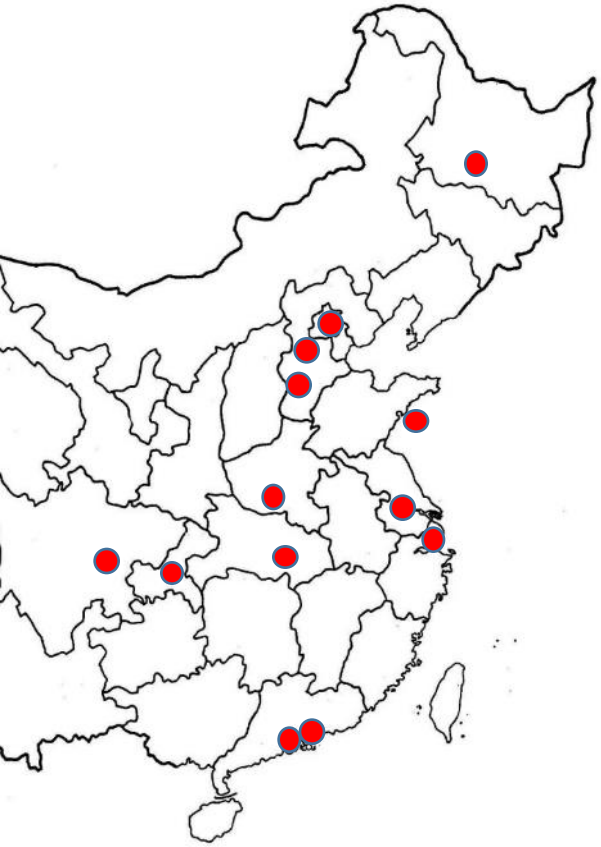
2.1 Urban population share

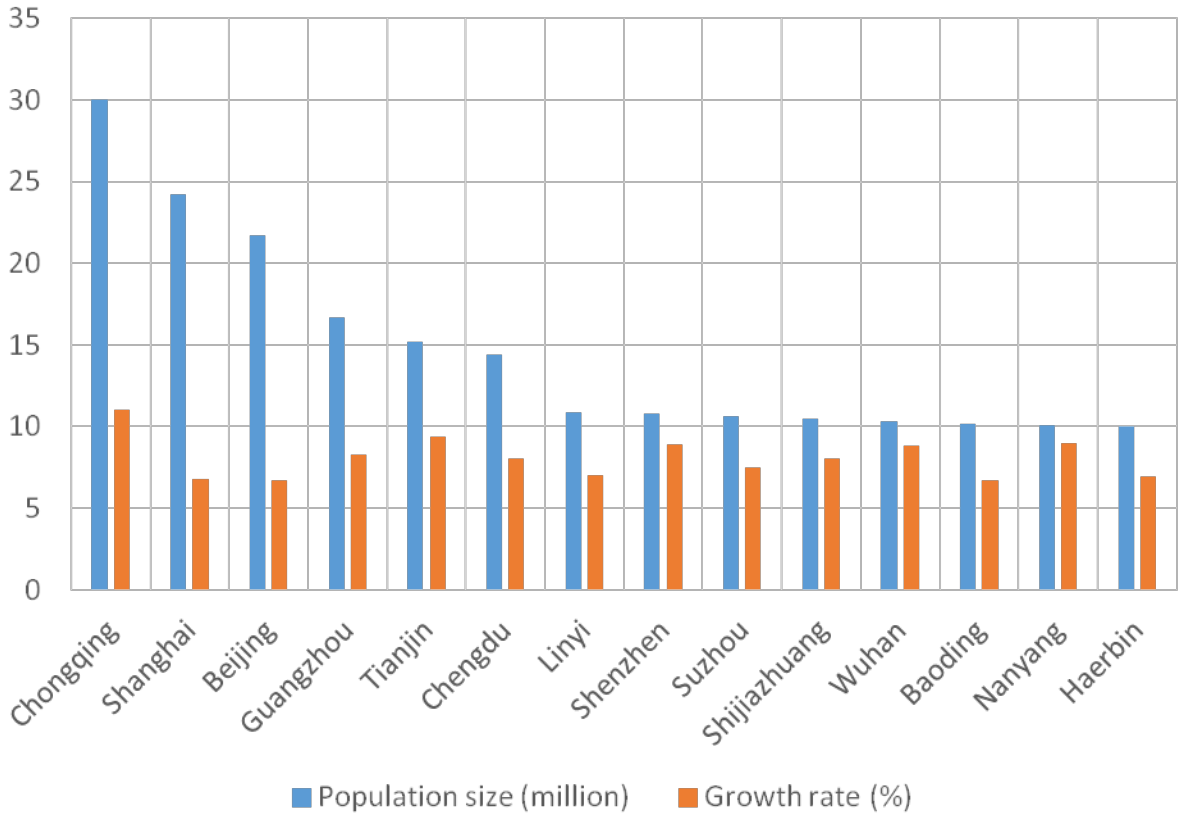


国家统计局

According to the data released by the National Bureau of Statistics of China on January 19, 2016, China's urban population reached 7711.6 million by the end of the year 2015, accounting for **56.1%** of the national total population, and increasing 1.33% compared to that of 2014.

2.1 City with a population exceeding ten million





国家统计局

According to the data released by the National Bureau of Statistics of China on January 19, 2016, there are **14 cities** in China with a population exceeding ten million by the end of the year 2015.

2.2 Urbanization-induced problems

I. Population aggregation

Rapid population aggregation has caused severe congestion in road, subway, and residential space.

Urban residents lack sufficient green open spaces for relax, recreation, and social interaction.

2.2 Urbanization-induced problems

II. Multiple forms of pollution

Rapid urbanization has caused a variety of pollution ranging from **smog** to **water** and **soil contamination**.

These forms of pollution pose great threat to human health and biological diversity.

2.2 Urbanization-induced problems

III. Landscape damaged

Urban economic activities has caused damage to defining landscape features, such as mountain and river.

Massive mining has left numerous scars in mountain areas. Natural riversides has been turned into concrete banks to prevent floods and thus provide more land for real estate development.

2.2 Urbanization-induced problems

IV. Resource shortage

The concentration of population and economy in a few particular regions has caused severe resource shortage, because the natural resources within the confine of a single region are inevitably limited.

For example, Beijing has to rely upon water coming from remote mountains or even the southern part of the country, and it costed billions of dollars to build trans-regional aqueducts.

3. National Garden City since 1992

3.1 Goal

Green	• Increasing the number and area of urban green spaces • Promoting a more balanced distribution of green spaces • Strengthening landscaping and greening of downtown area
people	• Accelerating the construction of park, residential green space, roadside green space, and greenway according to urban residents' daily needs for recreation and transportation
Economy	• Promoting energy-saving landscaping and greening
Nature	• Integrating urban and rural greening based on the protection of water system, mountain, wetland, forest, and other natural ecological resources

3.2 Four fundamental principles

giving priority to ecology and developing scientifically

- Preserving natural features and resources that a city relies upon, including mountains, water bodies, forests, and animals

combining quantity and quality so as to improve function

- Not only increasing the number and area of green spaces, but also improving the overall quality of such spaces in terms of green system layout and structure

respecting local conditions and saving resources

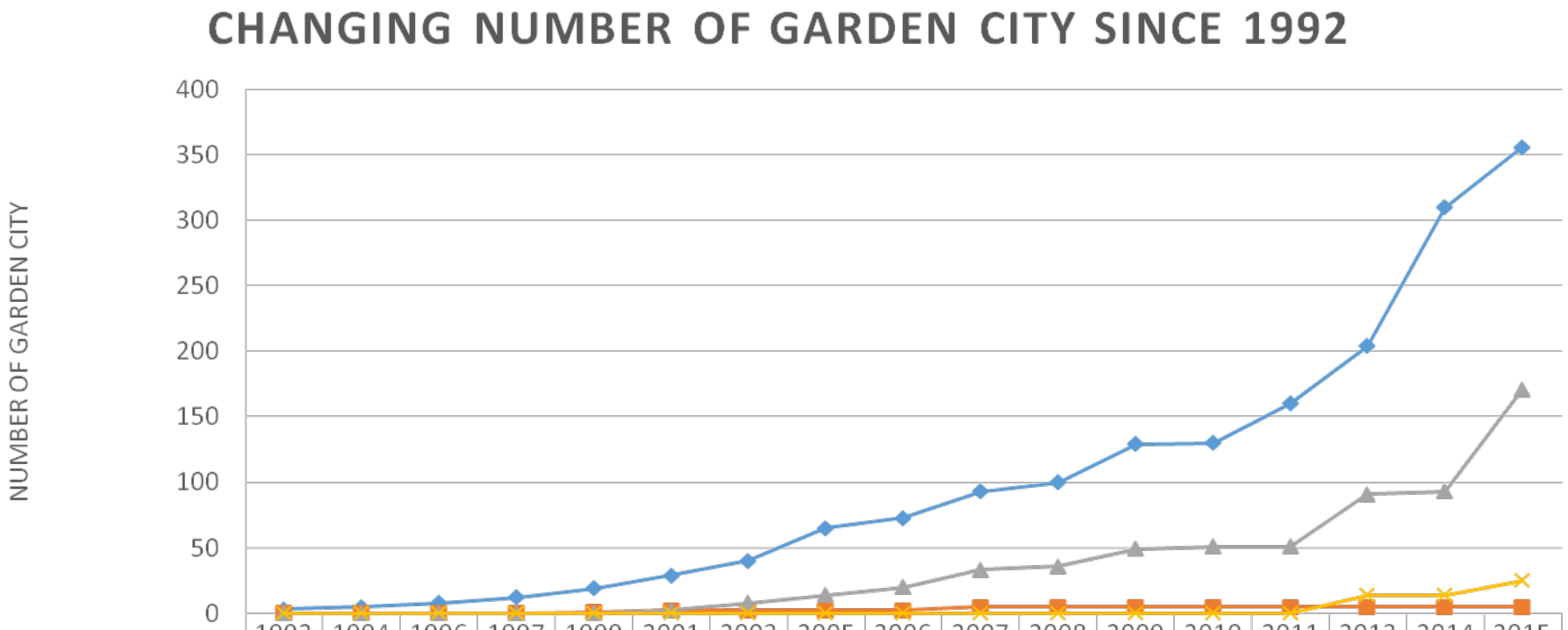
- Making economic use of land, water, and material; reducing urban air and water pollution as well as the energy consumption of urban buildings and infrastructure

government plays a leading role, with community involved

- Strengthening the role of government in resource allocation, idea introduction, planning, financial investment; encouraging private sector to be involved in the operation and maintenance of landscaping and greening; increasing public participation in planning, construction, and management

3.3 Timeline of inscription

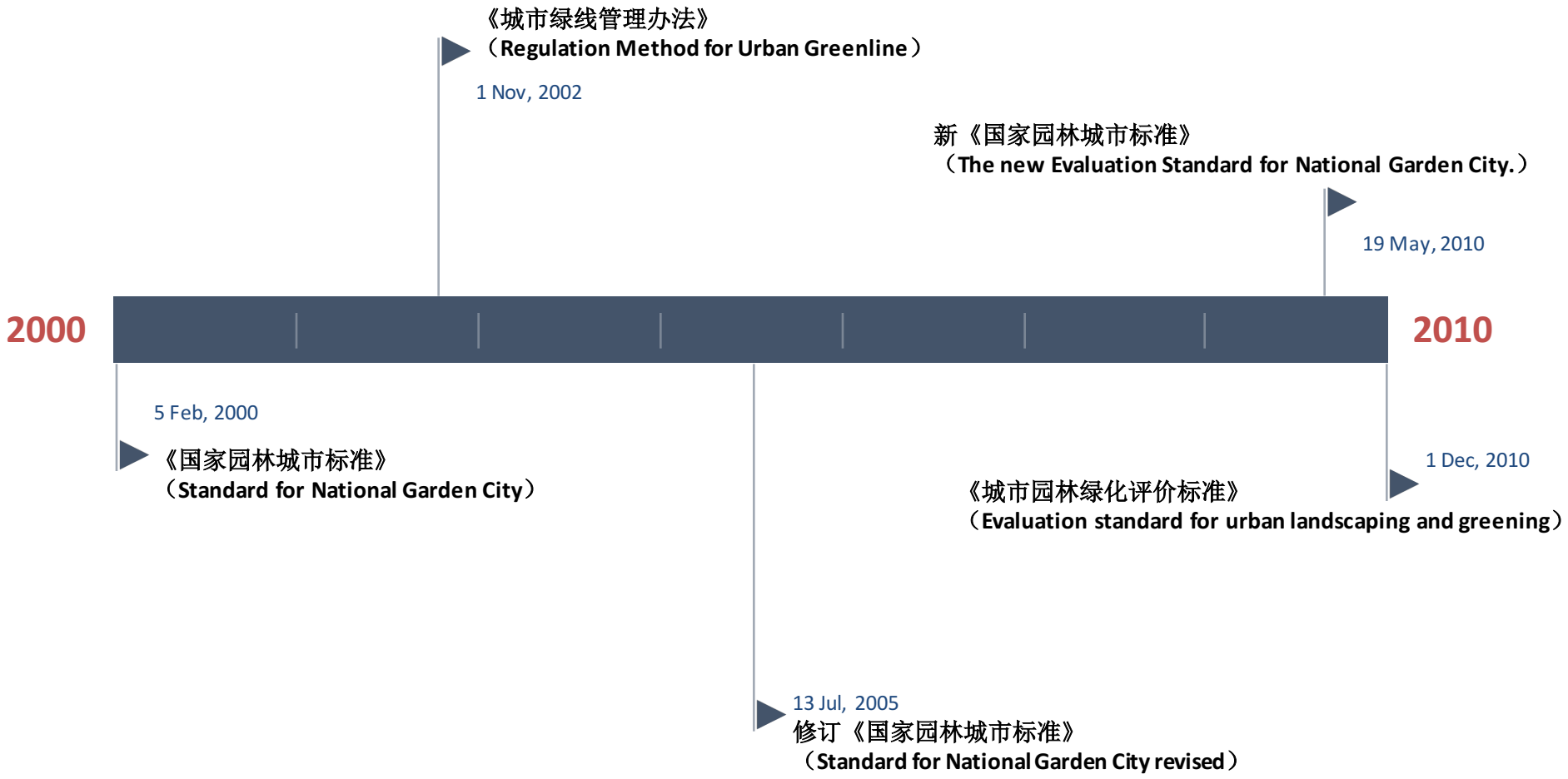
Ever since the year of 1992, the inscription has been carried out at four levels, including municipality, district, county, and town. By far, 356 municipalities, 5 districts, 171 counties, and 25 towns have been included on the National Garden City List.



	1992	1994	1996	1997	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011	2013	2014	2015
municipal level	3	5	8	12	19	29	40	65	73	93	100	129	130	160	204	310	356
district level	0	0	0	0	1	2	2	2	2	5	5	5	5	5	5	5	5
county level	0	0	0	0	0	2	8	14	20	33	36	49	51	51	91	93	171
town level	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14	25

3.4 Timeline of standardization

Ever since the year of 2000, the Ministry of housing and urban-rural development has issued several standard documents for National Garden City to guide the application and evaluation processes.



3.5 Our achievements

I. Initiating large-scale ecological protection in an organized way

A large number of natural features of exceptional scenic and scientific value have been protected and managed as nature preserves, scenic areas, or forest parks. Development is sensitively controlled within these areas so as to avoid damage to nature.

geology
石林

meadow
百花山

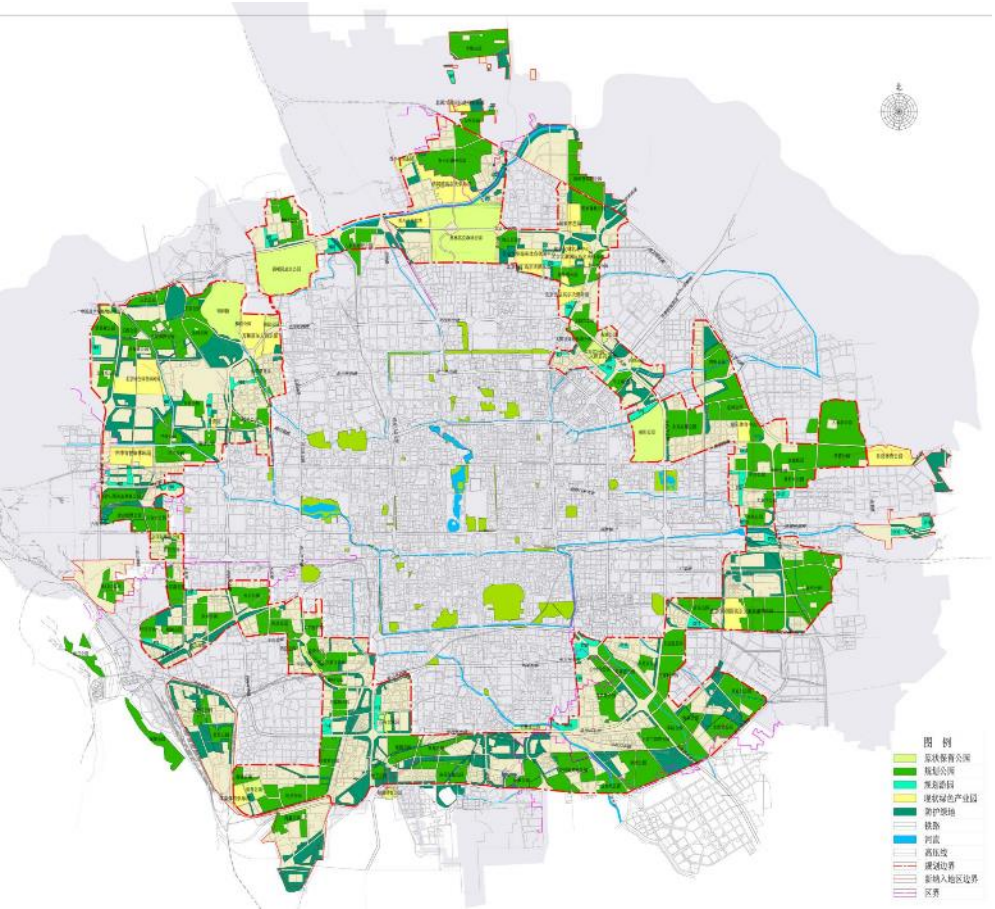
watercourse
三江源

forest
张家界

3.5 Our achievements

I. Initiating large-scale ecological protection in an organized way

On the periphery of major urban centers, vast tracts of land have been designated as green spaces so as to prevent urban sprawl.



Green Buffer Belt, Beijing

Since 2000, Beijing Municipal Government initiated the construction of a 240-square-kilometer greenbelt around the downtown area. This greenbelt separates the downtown area from ten peripheral urban cores, resulting in a more evenly distributed urban land use.

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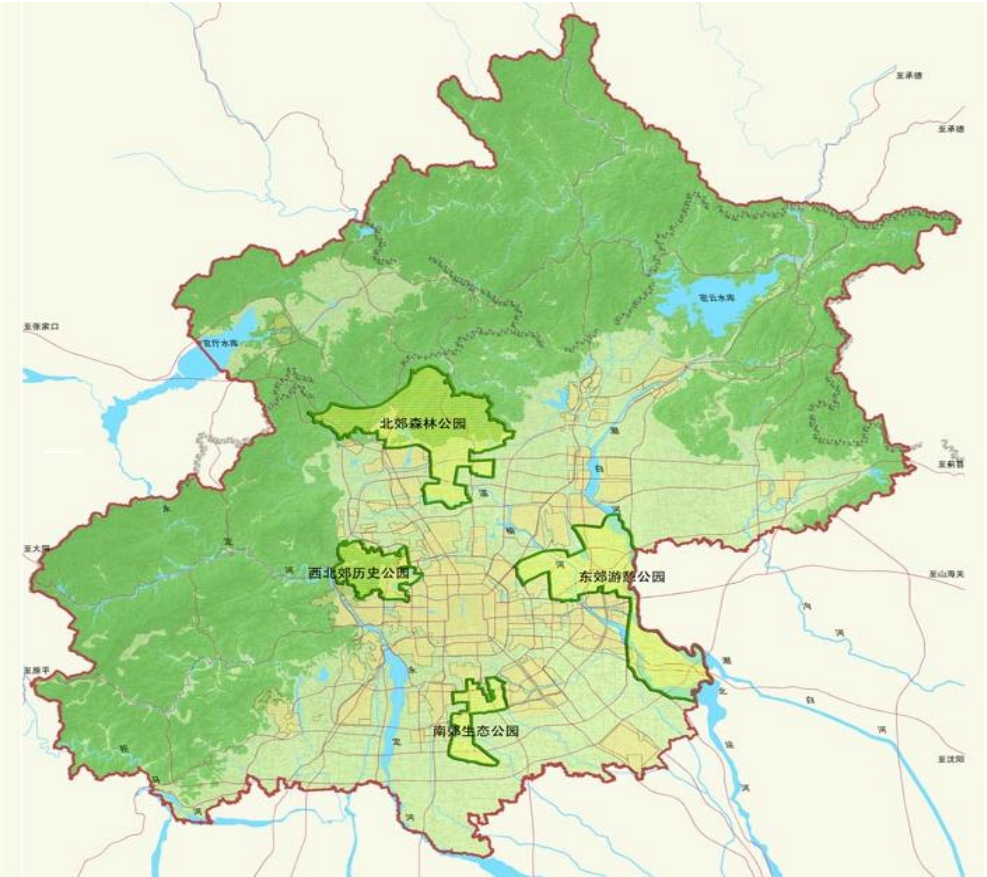

Suburban Park System, Beijing

The Beijing City Masterplan (2004-2020) proposed the construction of four suburban parks in Beijing's environs. The purpose was to curb the concentric sprawl of the city, and further improve the urban green space system. Each park has been designed under a theme based on natural and cultural resources within its confine.

3.5 Our achievements

II. Improving the living quality of Chinese cities

With the increasing number and area of urban green spaces, Chinese urban dwellers' need for health, leisure, recreation, beauty, culture, scientific education, and disaster prevention are greatly satisfied.

large park
奥森

botanic garden
辰山植物园

community park
山水间

road greening
北京

3.5 Our achievements

II. Improving the living quality of Chinese cities

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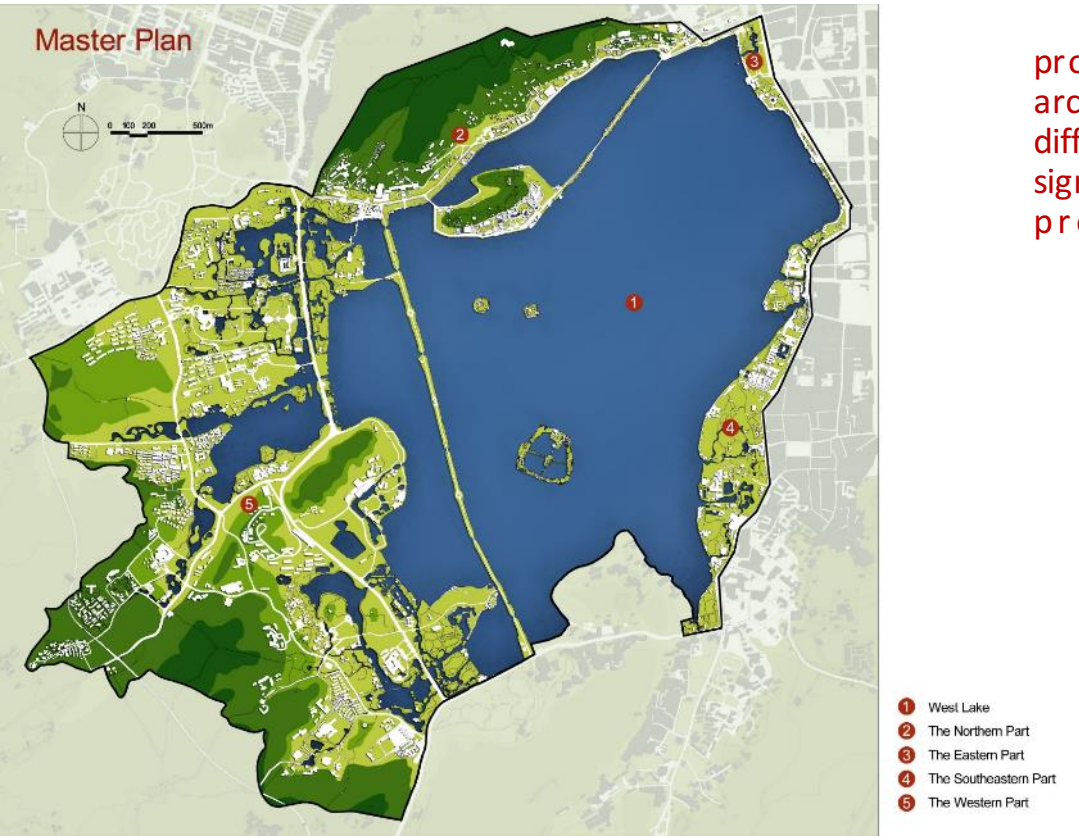


Landscape renovation around the West Lake, Hangzhou

This complex large-scale landscape renovation project has been planned since 2001. Landscape architects proposed different solutions according to different issues, the implementation of which have significantly improved the regional environment and provided high-quality urban open spaces.

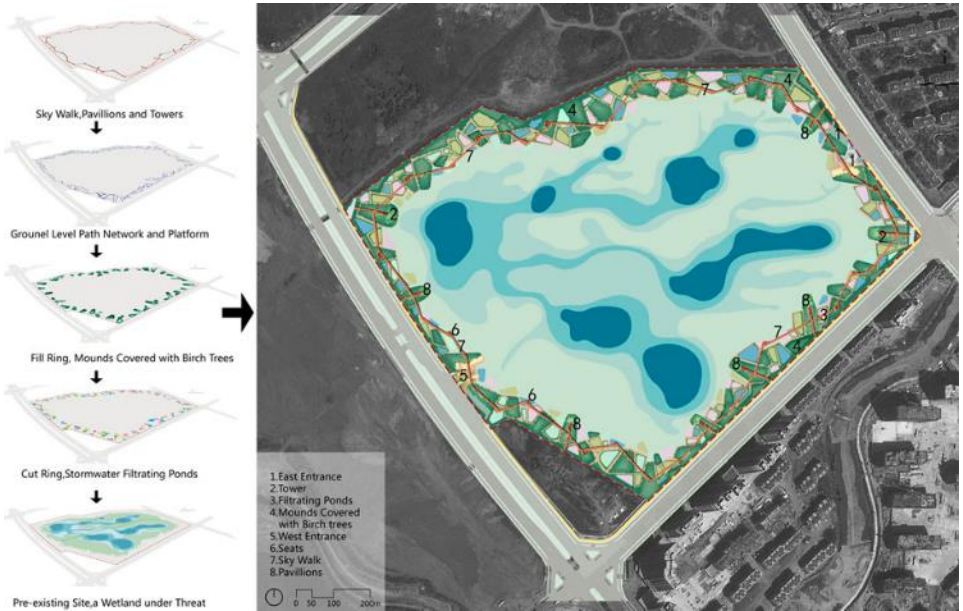
3.5 Our achievements

III. Promoting comprehensive and sustainable development of Chinese cities

By improving urban appearance and securing urban ecological soundness, the National Garden City initiative increases the attractiveness and reputation of Chinese cities and thus booting urban economy. The movement has also promoted an integration of landscaping and greening into municipal infrastructural construction, as well as the overall improvement of urban comprehensive management.

Qunli National Urban Wetland, Harbin

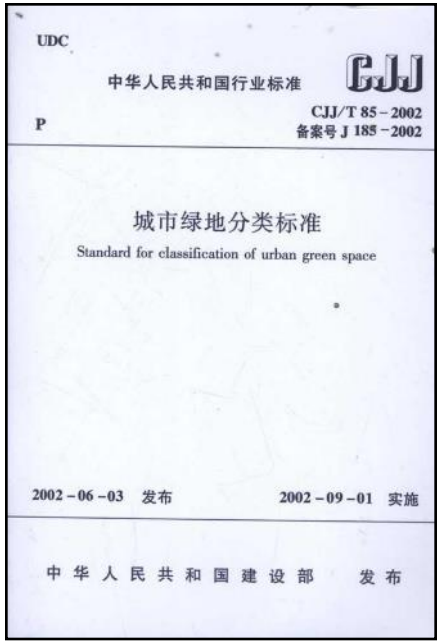
This park acts as a green sponge, cleansing and storing urban stormwater and can be integrated with other ecosystem services including the protection of native habitats, aquifer recharge, recreational use, and aesthetic experience, in all these ways fostering urban development.

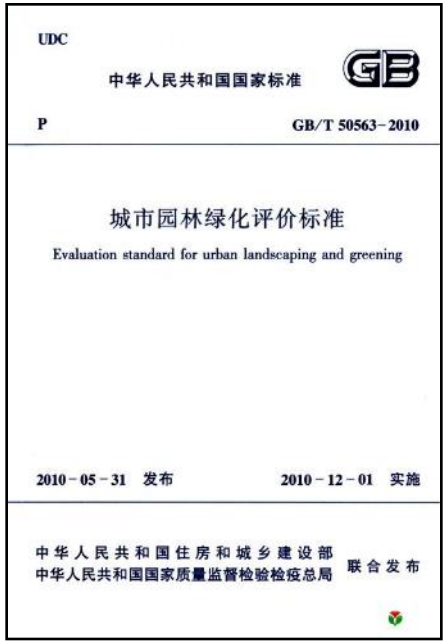


3.5 Our achievements

IV. Standardizing urban landscaping and greening activities across the country

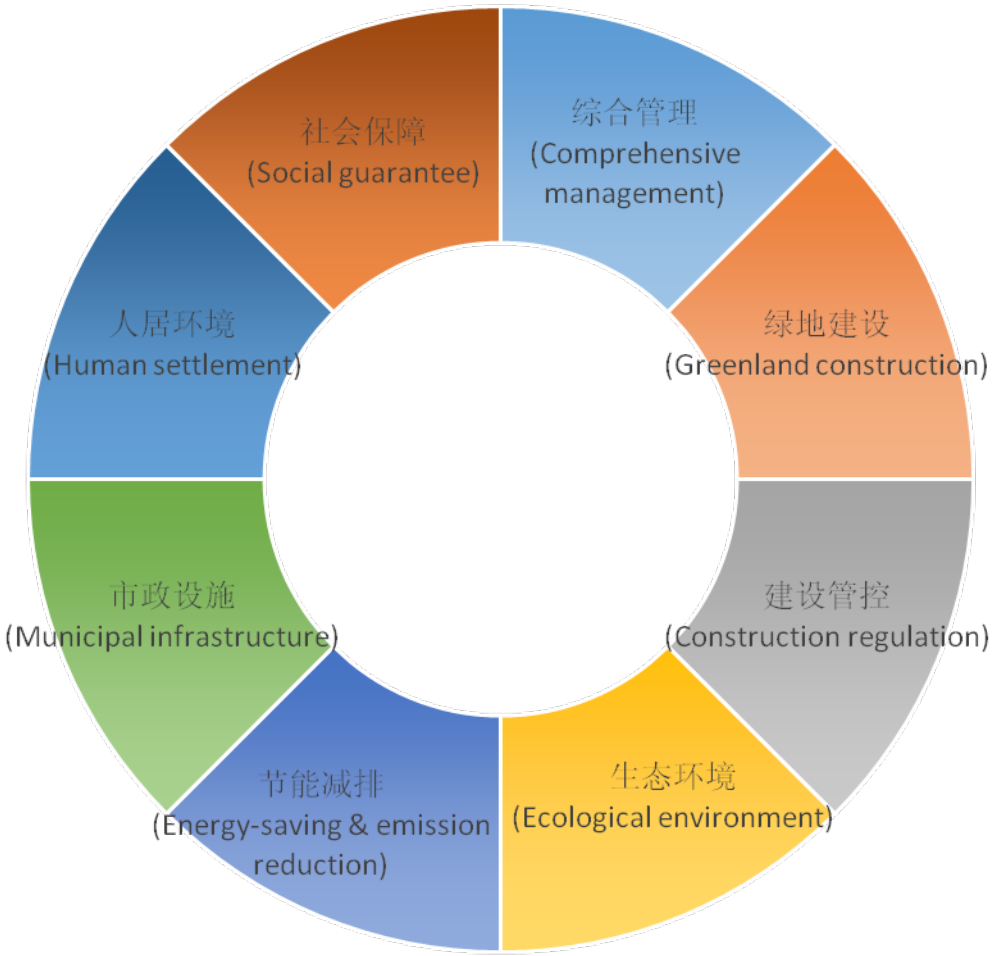
As a set of legal documents concerning National Garden City were issued, the urban landscaping and greening activities have become increasingly standardized, and relevant professionals are equipped with more scientific methods to deal with the complex and changing national conditions.





4. Evaluation standard for National Garden City

4.1 Eight categories of standard



Category I: comprehensive management (综合管理)

	Standard	Basic	Advanced
1	Regulatory agency	Setting up an independent professional regulatory agency	N/A
2	Construction & maintenance fund	Allocating a special fund and increasing it annually.	N/A
3	Scientific research ability	Setting up a special research institution whose outcomes should be applicable in practice	N/A
4	Urban green space system planning	Being conducted by qualified agencies, approved by government, and included into Comprehensive urban planning	N/A
5	Green-line regulation	Drawing green-lines which should be announced through at least two public medias	N/A
6	Blue-line regulation	Drawing blue-lines in accordance with the Regulation Method for Urban Blue-line	N/A
7	Administrative system	Involving green-line, construction, maintenance, public notice, etc.	N/A
8	Information technology application	• Creating a digital database as well as a platform for information announcement and social service sharing; • Dynamically monitoring construction and regulation; • Ensuring public participation and supervision	N/A
9	Public satisfaction	≥ 80%	≥ 90%

Category II: green space construction (绿地建设)

	Standard		Basic	Advanced
1	Green coverage ratio of built area		≥ 36%	≥ 40%
2	Percent of green space in built area		≥ 31%	≥ 35%
3	Urban park per capita	city with less than 80㎡ development land per capita	≥7.50㎡ per capita	≥9.50㎡ per capita
		city with 80-100 ㎡ development land per capita	≥8.00㎡ per capita	≥10.00㎡ per capita
		city with more than 100 ㎡ development land per capita	≥9.00㎡ per capita	≥11.00㎡ per capita
4	Percent of arbor and shrub in green coverage of built area		≥ 60%	≥ 70%
5	Minimal green space ratio among all districts		≥ 25%	N/A
6	Minimal urban park per capita among all districts		≥5.00㎡ per capita	N/A
7	Coverage ratio of park green space service radius		≥ 70%	≥ 90%
8	Index of comprehensive park shared by ten thousand people		≥ 0.06	≥ 0.07
9	Percent of urban road being greened		≥ 95%	≥ 100%
10	Pass percent of green space in new/renovated urban residential area		≥ 95%	≥ 100%
11	Pass percent of urban public infrastructure green space		≥ 95%	N/A
12	Percent of green buffer being implemented		≥ 95%	≥ 90%

Category II: green space construction (绿地建设)

	Standard	Basic	Advanced
13	Percent of productive green space in built area	≥ 2%	N/A
14	Pass percent of urban road green space	≥ 80%	N/A
15	Number of botanical garden larger than 40 hectare	≥ 1.00	N/A
16	Popularization ratio of shady parking lot	≥ 60%	N/A
17	Percent of river corridor being greened	≥ 80%	N/A
18	Ecological and landscape recovery ratio of damaged and abandoned land	≥ 80%	N/A

Category III: construction regulation (建设管控)

	Standard	Basic	Advanced
1	Comprehensive evaluation value of urban landscaping/greening	≥ 8.00	≥ 9.00
2	Functional evaluation value of urban park	≥ 8.00	≥ 9.00
3	Landscape evaluation value of urban park	≥ 8.00	≥ 9.00
4	Cultural evaluation value of urban park	≥ 8.00	≥ 9.00
5	Greening evaluation value of urban road	≥ 8.00	≥ 9.00
6	Standardization ratio of park management	≥ 90%	≥ 95%
7	Percent of old trees being protected	≥ 95%	100%
8	Percent of energy-saving green space being constructed	≥ 60%	≥ 80%
9	Popularization of vertical greening	Making encouragement policies and plans	N/A
10	Regulation of other urban green space	Establishing an integral urban-rural green system	N/A
11	Popularization of biological control	≥ 50%	N/A
12	Implementation ratio of park emergency site	≥ 70%	N/A
13	Ratio of waterfront naturalness	≥ 80%	N/A
14	Preservation of urban historic characteristics	Drawing purple-lines and making historic preservation planning	N/A
15	Protection and management of scenic and historic area as well as cultural/natural heritage	Protecting National Scenic and Historic Area or World Heritage Site	N/A

Category IV: ecological environment (生态环境)

	Standard	Basic	Advanced
1	Number of days with annual air pollution index lower than or equal to 100	≥ 240 days	≥ 300 days
2	Percent of water body with Type-IV or better surface water	≥ 50%	• 100% pass rate of surface water; • No water body with Type IV or worse surface water
3	Average value of regional environment noise	≤ 56.00dB (A)	≤ 54.00dB (A)
4	Intensity of urban heat-island effect	≤ 3.0℃	≤ 2.5℃
5	Index of local wood plant	≥ 0.80	≥ 0.90
6	Protection of biological diversity	Conducting municipal or larger-scale survey of biological species resources	N/A
7	Protection of urban wetland resources	• Conducting wetland resource survey within the confine of urban planning; • Making urban wetland resources protection plan and implementation measures	N/A

Category V: energy-saving & emission-reduction (节能减排)

	Standard		Basic	Advanced
1	Charge ratio of residential heat supply in northern region with heating facilities		≥ 25%	≥ 35%
2	Percent of energy-saving building	Cold region	≥ 40%	≥ 40%;
		Region with hot summer and cold winter	≥ 35%	≥ 35%
		Region with hot summer and warm winter	≥ 30%	≥ 30%
3	Percent of renewable energy use		N/A	≥ 10%
4	Discharge rate of industrial solid waste per unit GDP		N/A	≤ 25%
5	Pass percent of urban industrial waste water discharge		N/A	≥ 80%
6	Percent of urban renewable water being used		N/A	≥ 30%

Category VI: municipal infrastructure (市政设施)

	Standard	Basic	Advanced
1	Evaluation value of urban appearance	≥ 8.00	≥ 9.00
2	Pass percent of urban water pipe network checking project	≥ 99%	100%
3	Percent of urban waste water being processed	• ≥80% • Not lower than annual average value of cities nationwide	• ≥ 90% • Not lower than annual average value of cities nationwide
4	Percent of urban household waste being processed to be harmless	• ≥80% • Not lower than annual average value of cities nationwide	• ≥ 90% • Not lower than annual average value of cities nationwide
5	Integrity of urban road	≥ 95%	≥ 40.00km/h
6	Average speed of urban main road	≥ 35.00km/h	≥ 40.00km/h
7	Safe operation of municipal infrastructure	• Complete documentation of municipal infrastructures; • Complete operation management system	N/A
8	Urban drainage	N/A	• Separating rain and waste water • Setting up special regulatory agency and fund
9	Control of urban landscape lighting	N/A	Lightening outdoor space according to the Code for Lighting Design of Urban Nightscape

Category VII: human settlement (人居环境)

	Standard	Basic	Advanced
1	Construction of community supporting facilities	A wide variety of facilities including education, medical treatment, sport, culture, WC, etc.	N/A
2	Renovation of shanty area and urban village	• Eliminating shanty areas within built area, resettling residents, and adopting property management; • Making and implementing plans for renovating urban villages	N/A
3	Popularization of shady avenue	≥ 70%	≤ 85%
4	Percent of green traffic travel being shared	N/A	≥ 70%
5	Planning and construction of pedestrian and bicycle transportation system	N/A	Making and implementing plans for pedestrian lane, bicycle lane, and public bicycle renting system

Category VIII: social guarantee (社会保障)

	Standard	Basic	Advanced
1	Percent of Housing guarantee	≥ 80%	≥ 85%
2	Percent of affordable housing construction plan being completed	≥ 100%	N/A
3	Barrier-free facility construction	• Installing barrier-free facilities in public spaces like main roads, parks, public buildings • All such facilities are in good condition	N/A
4	Percent of social insurance fund being collected	N/A	≥ 90%
5	Urban lowest life guarantee	N/A	• Lowest life guarantee line being higher than provincial average standard for similar cities • Guaranteeing those who deserve such guarantee

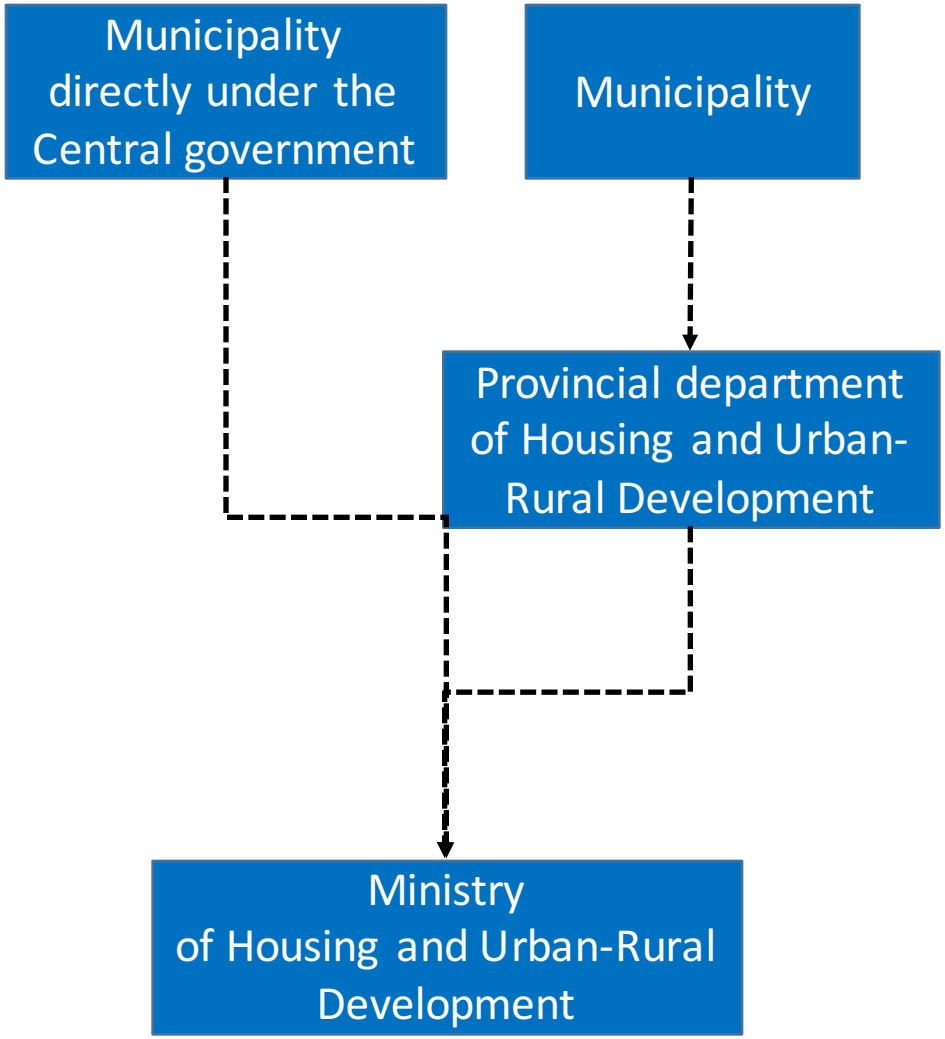
Four veto standards

A city that fails to reach any of the following four standards can not be inscribed as National Garden City.

1. - No urban green system planning has been conducted;
   - No green-line has been drawn according to the Method for Urban Green-line Management and announced through two public media
2. Percent of green space in built area does not reach the standard (≥31%)
3. Percent of urban waste water being processed does not reach the standard (≥80%, and not lower than annual average value of cities nationwide)
4. Percent of urban household waste being processed to harmless does not reach the standard (≥80%, and not lower than annual average value of cities nationwide)

5. Inscription process of National Garden City

5.1 Application



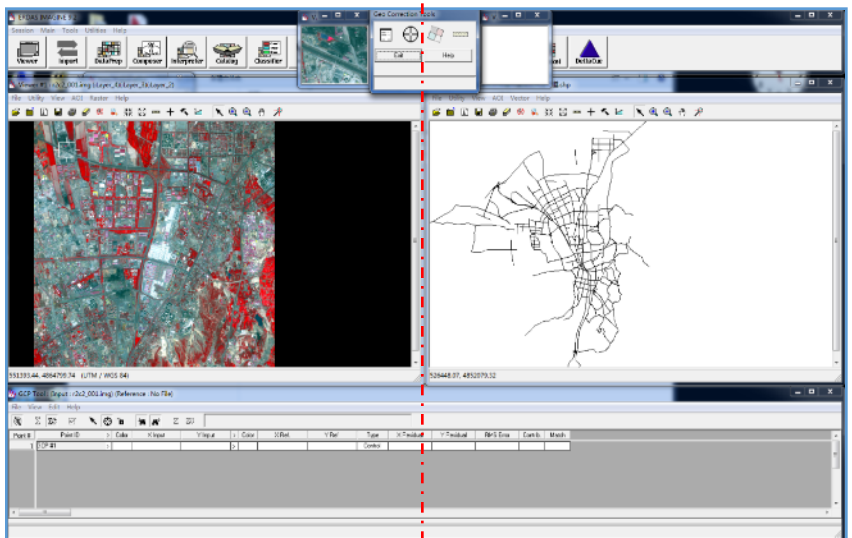
	Application material
1	City overview; Newest urban master plan; Map of built area; Map of current green system; Map of administrative division
2	Description of green-line system and its implementation; Map of green-lines; Public notice
3	Self-evaluation according to the Evaluation Standard for Urban Landscaping and Greening
4	Remote sensing data
5	Explaining all materials according to the Standard for National Garden City
6	Textual and video report of Garden City preparation work and technique

5.2 Remote sensing data processing

Raster data	Vector data
• High-resolution satellite image	• Map of built areas • City masterplan • Green space system plan • Map of park green spaces • Map of National Historical Cultural District • Map of residential areas built or renovated after 2002 • Map of public infrastructure • Map of main roads • Map of protective green spaces • Map of productive green spaces

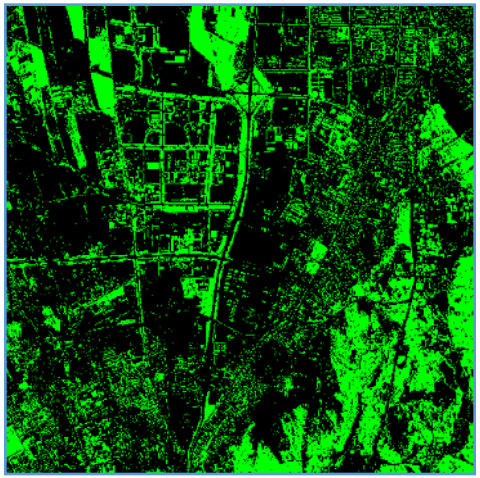
Data calibration

First overlapping raster and vector data, and then calibrating raster data by identifying corresponding features in vector data



5.2 Remote sensing data processing

Data calibrated



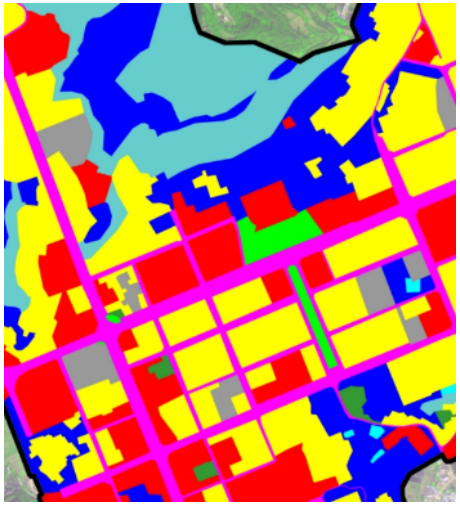
Extracting green data

Overplapping vector, raster, and green space data

Calculating percent of green in all types of land use

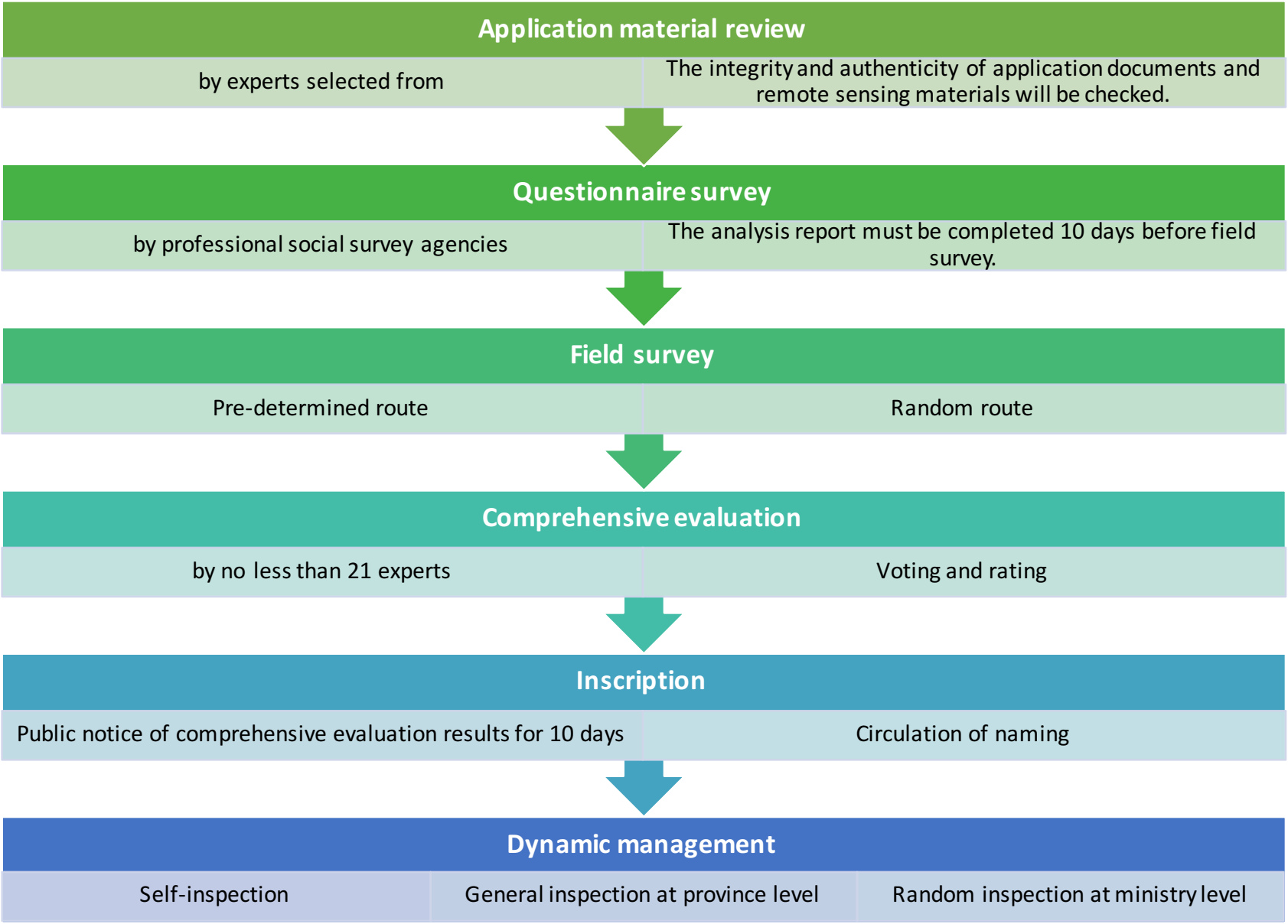
	A	B	C	D	E
1		用地面积		绿色信息	
2	公共	4405527	110.14	3626017	90.650425
3	居住	17286215	432.16	3269769	81.744225
4	单位	14094154	352.35	4070708	101.7677
5	生产	489899	12.25	474301	11.857525
6	防护	1421300	35.53	1362295	34.057375
7	风景	0	0.00	0	0
8	道路	6591591	164.79	2448986	61.22465
9	水体	52106	1.30		0
10	农田	11013852	275.35		0
11	其他feilvdi	1233376	30.83	434682	10.86705
12					
13	建成区面积（影像实测）	56588020	1414.7005		
14	建成区净面积		1138.05155		
15	人口（万）		13.74		
16					
17			计算值		达标指数
18	绿地率		23.84%		31.00%
19	绿化覆盖率		34.46%		36.00%
20	人均公共绿地		8.02	82.82762373	8
21	公园绿地服务半径覆盖率		83.70%		70.00%
22	城市新建、改建居住区绿地达标率		79.33%		95.00%
23	城市防护绿地实施率		70.60%		80.00%
24	生产绿地占建成区面积比率		1.04%		2.00%
25	城市道路绿地达标率		92.95%		80.00%
26	河道绿化普及率		100.00%		80.00%
27					
28					
29					
30	五类绿地			百分百	
31	公园	110.14	411.66	26.75%	
32	附属	255.60	411.66	62.09%	
33	生产	11.86	411.66	2.88%	
34	防护	34.06	411.66	8.27%	
35	其他	0.00	411.66	0.00%	
36	总计	411.66		100.00%	
37					

Categorization of urban land use



Type-1. public park
Type-2. residential
Type-3. government agency
Type-4. nursery
Type-5. green buffer
Type-6. scenic
Type-7. road
Type-8. water
Type-9. farmland
Type-10. others

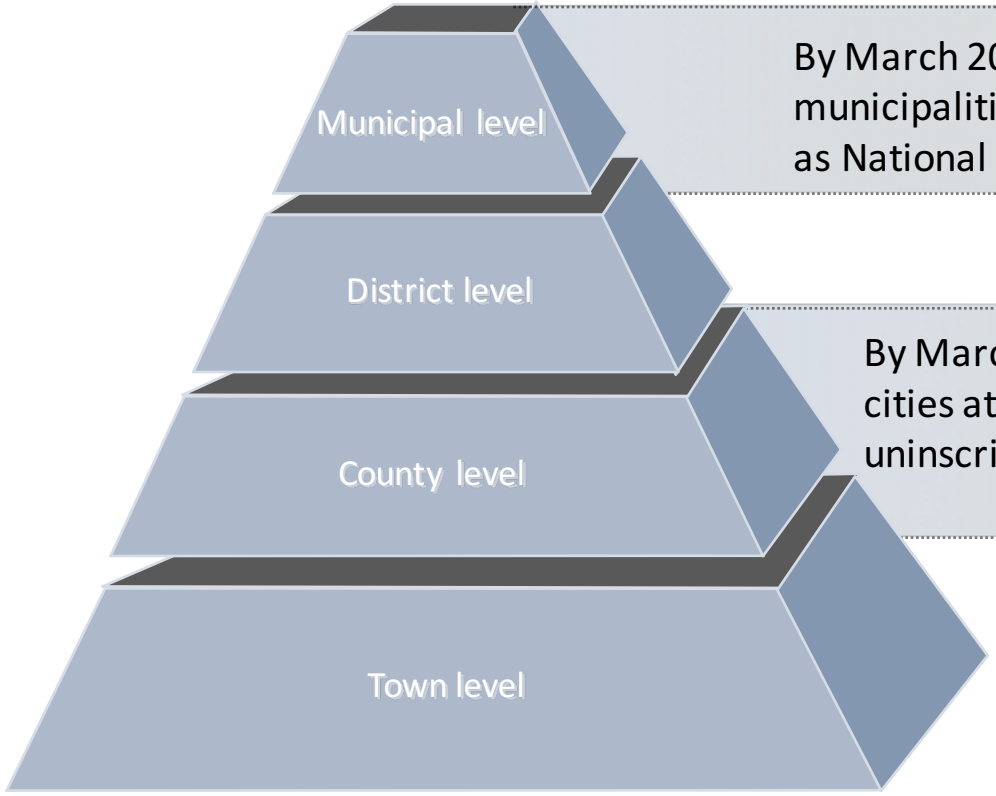
5.3 Evaluation



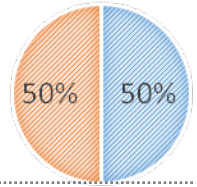
6. About the future

6.1 Inscription to be continued

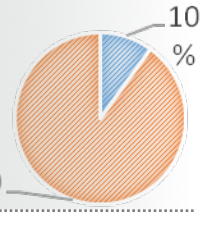
By far, a large number of municipalities, districts, counties, and towns across China remain uninscribed as National Garden City. Given the impressive pace of Chinese urbanization, more national land is expected to be subject to non-agricultural uses in the years that follow, requiring us to continue the inscription so as to improve the living conditions of Chinese urban population.



By March 2016, 50% of Chinese municipalities remain uninscribed as National Garden City.



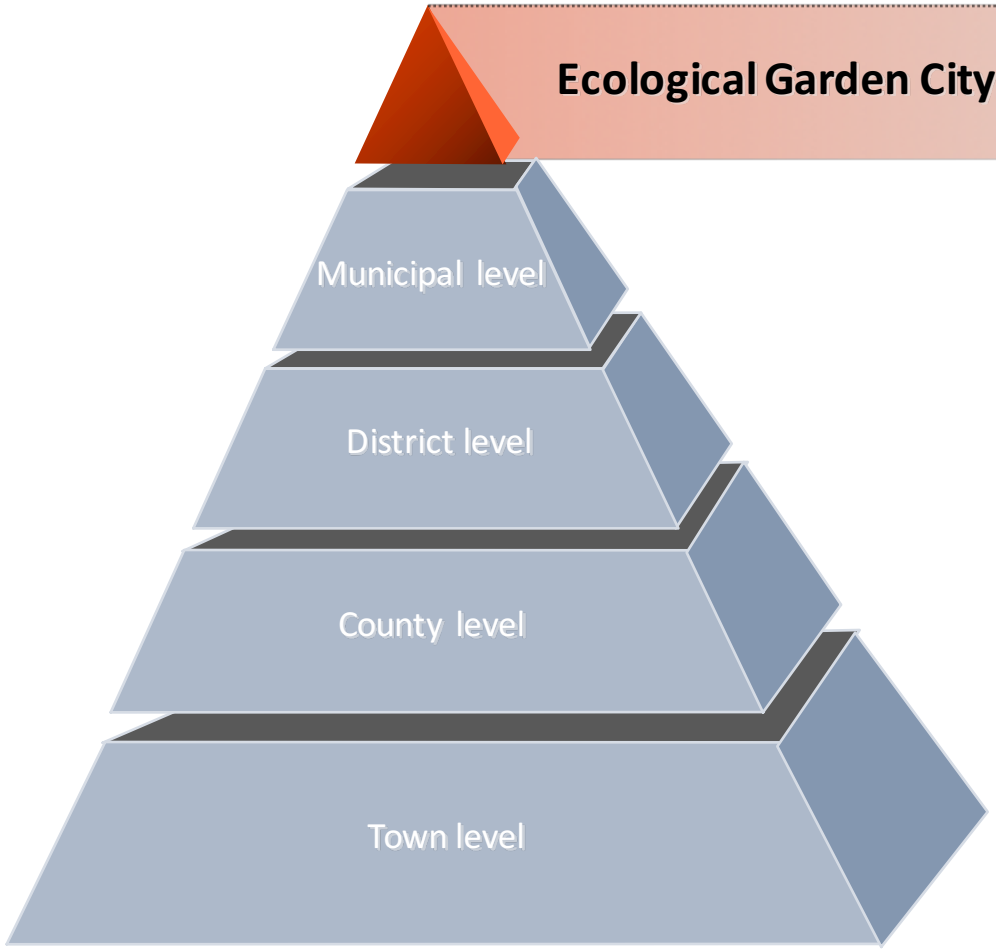
By March 2016, 90% of Chinese cities at county level remain uninscribed as National Garden City.



Hierarchy of National Garden City

6.2 The advent of National Ecological Garden City

Those already inscribed as National Garden City are now encouraged to apply for the National Ecological Garden City inscription.



National Ecological Garden City is an advanced version of National Garden City, focusing on sustainable development featuring environmental protection, low carbon, and energy saving. It aims at a balanced and comprehensive integration of environment, society, and economy.

A National Ecological Garden City has to reach both basic and advanced requirements of all the standards, while a National Garden City only has to reach basic requirements.

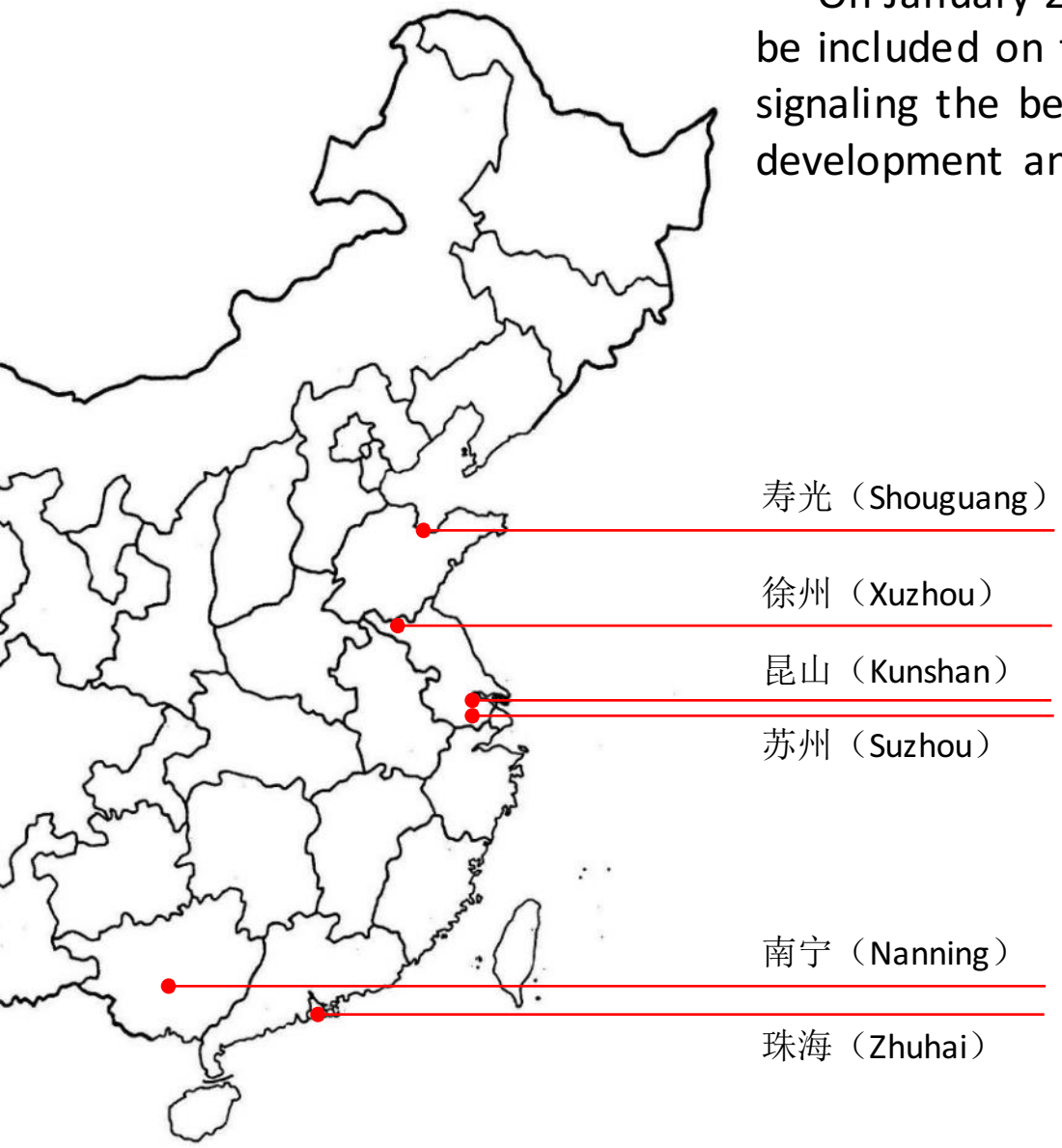
6.3 Seven veto standards

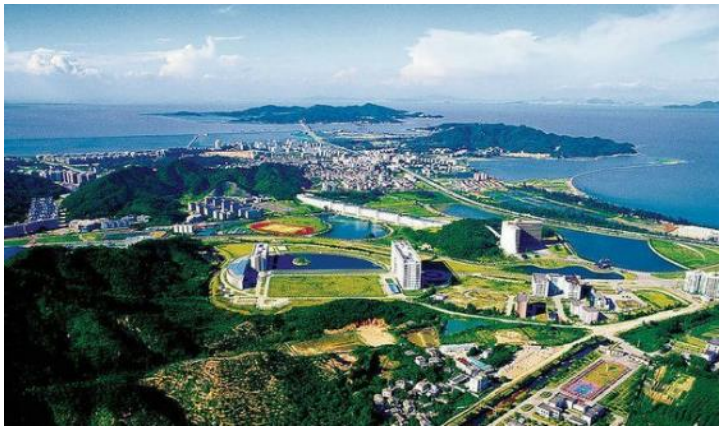
To be inscribed as National Ecological Garden City, a city is required to reach not only the four veto standards for National Garden City, but also another three standards.

1. - No urban green system planning has been conducted;
   - No green-line has been drawn according to the Method for Urban Green-line Management and announced through two public media
2. Percent of green space in built area does not reach the standard (≥31%)
3. Percent of urban waste water being processed does not reach the standard (≥80%, and not lower than annual average value of cities nationwide)
4. Percent of urban household waste being processed to be harmless does not reach the standard (≥80%, and not lower than annual average value of cities nationwide)
5. Minimal green space ratio among all districts does not reach the standard
6. Coverage ratio of park green space service radius does not reach the standard
7. Popularization of shady avenue does not reach the standard

6.4 The first batch of National Ecological Garden City

On January 29, 2016, seven cities became the first to be included on the National Ecological Garden City List, signaling the beginning of a new round of Garden City development and construction in contemporary China.





The end. Welcome to School of LA BJFU