

**Ecological Evaluation, Planning Approach
of Urban Green Space and Urban Forest
in China**

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1. Connation, problems and research focus of urban green space



Background

- **Urbanization promotes rapid social and economic development, but at the same time, leads to many problems, such as concentration of the population, traffic jams, housing shortages, resource shortages, biodiversity reductions, "heat island" effects, noise, and air and water pollution ;**
- **Urban greenspaces are an important component of the complex urban ecosystem. Parks, forests and farmlands are three main types of urban greenspace, which have significant ecological, social and economic functions;**
- **The planning and management of urban greening is of significance to urban sustainable development sustainability could be developed for Beijing**



Connotation of urban green space

Urban forest

Urban park

Urban agriculture

Greenbelt along the river

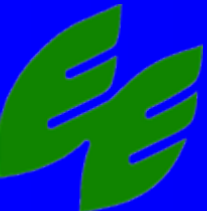
Vertical greening

Green corridor



Problems

- **Research aspects**
- **Research scales**
- **Functions and services**
- **Evaluation indicator**



Research focus

- **Theory system**
- **Ecosystem service**
- **Ecological planning and design**
- **Ecosystem management**
- **Evaluation approach**
- **Influence of urban environment on green space**



2. Ecological evaluation and planning method of urban green space



Urban green space : Ecological evaluation

Three level of indicator system:

- **First level: comprehensive index**
- **Second level: including urban green quantity, landscape pattern, community structure, economic benefit and ecosystem services**
- **Third level : all kinds of quantitative, qualitative indicator**



Evaluation indicator : **Green quantity**

Ratio of Green space in urban area

Green space per capital

Public green space per capital

Green plot ratio

Ratio of green space in visual field

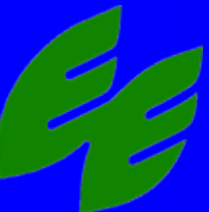
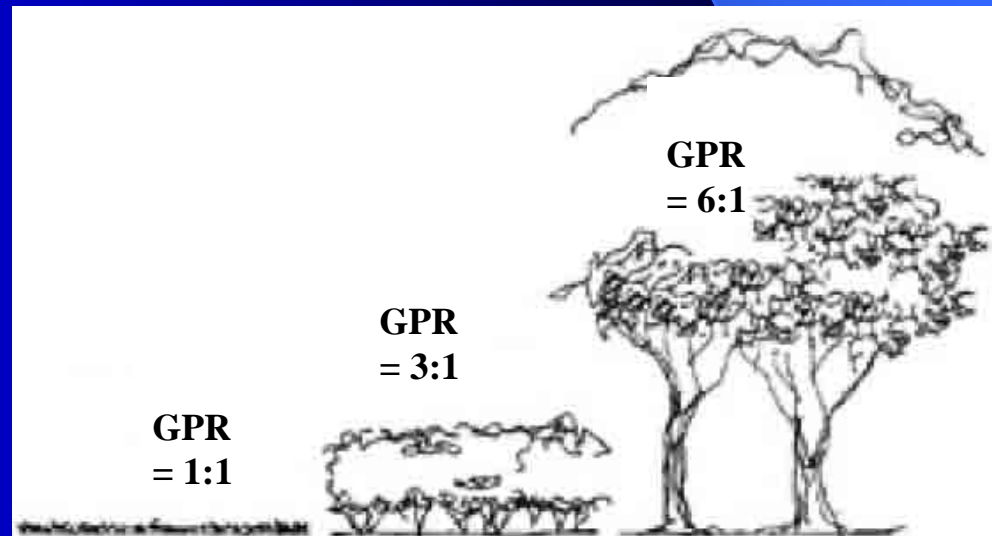
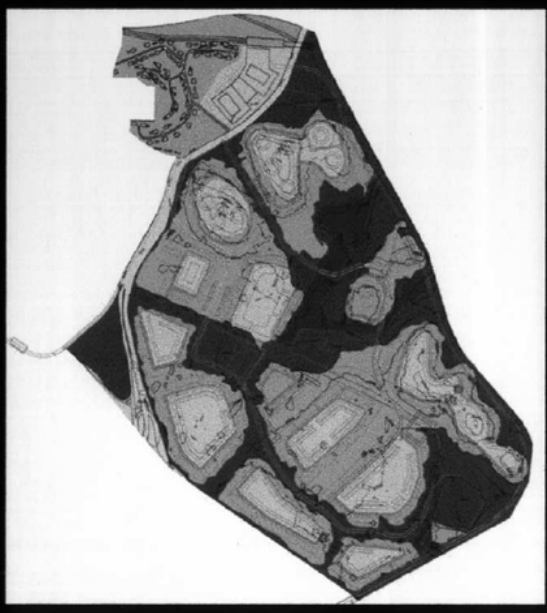


Evaluation indicator : **GPR**

GPR—Green plot ratio

green plot ratio

GPR = 1:1
3:1
6:1
water bodies



Evaluation indicator : Green landscape

Diversity indicator of green space

Evenness indicator of green space

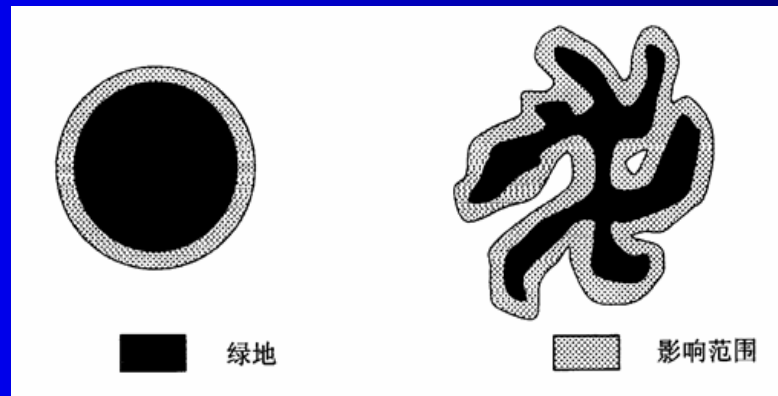
Patch density indicator of green space

Corridor density indicator of green space

Width and connectivity of green space

Service radius of green patch of green space

Area and shape of green space



Evaluation indicator **Plant community structure**

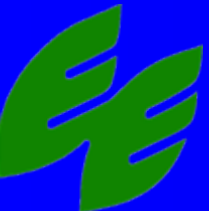
Proportion of arbor to shrub

Proportion of timber to herbage

**Proportion of ever green trees to
hardwoods**

**Proportion of rapid, middle, slow
tree species**

Biodiversity Index



Evaluation indicator: **Economic benefit**

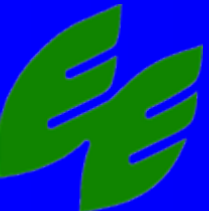
Young plant supply

Young plant fares

**Green space maintenance and
management fares**

**Tour earning of parks and
beauty spot**

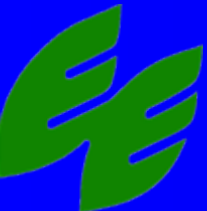
**Cost for protection of old and
famous trees**



Evaluation indicator : **Service function**

Absorbing CO₂ producing O₂, absorbing venomousness gas, preventing dust, reduce noise, killing bacterium, regulating micro-clime, maintaining biodiversity, entertainment, culture, health care, providing employment

Different functions and services in different areas, such as inhabitation areas, factories, roads, parks, wetlands, and so on



Evaluation indicator: **Different scales consideration**

Inhabitation areas

Built-up areas

Urban areas

Regional areas

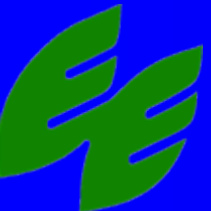
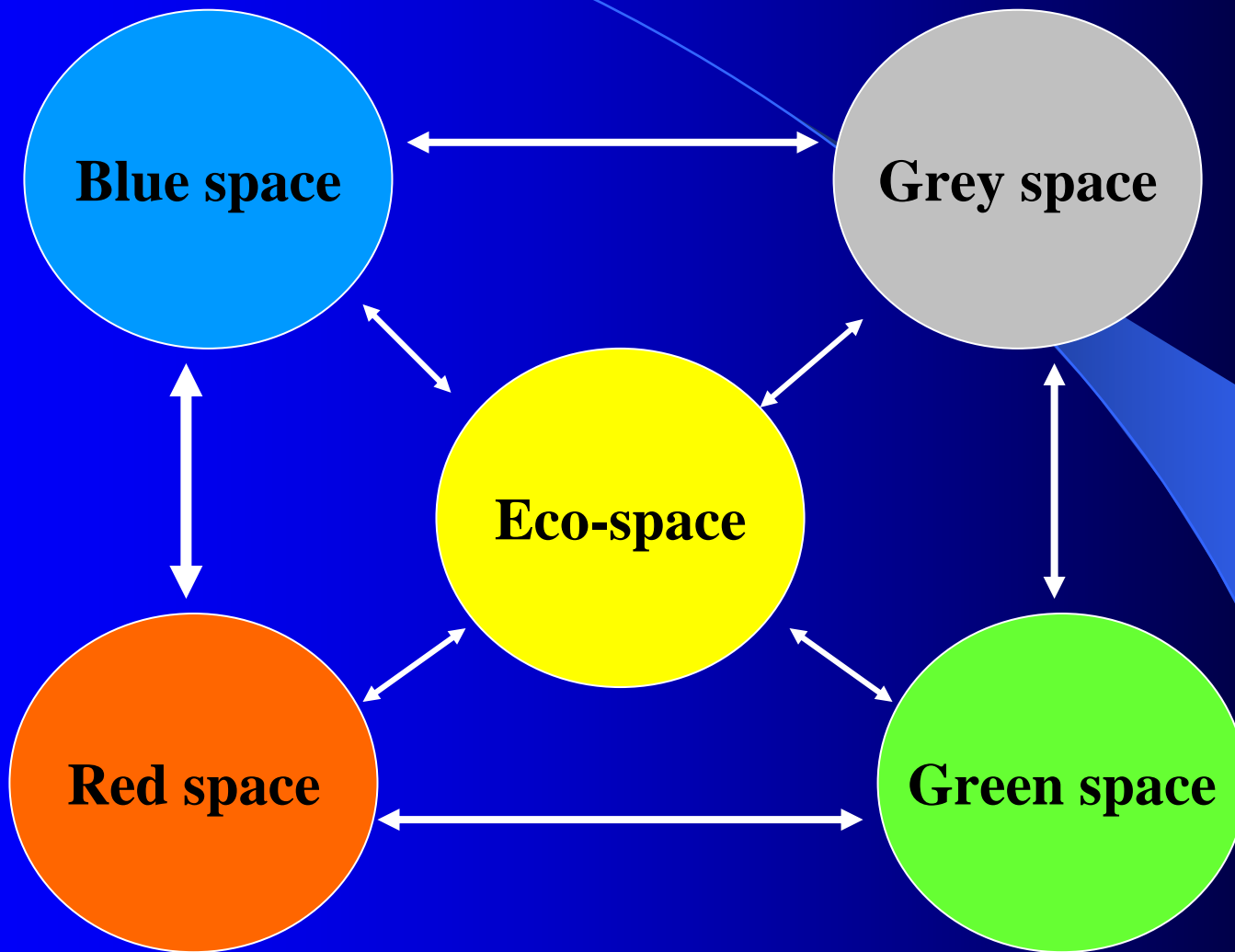


Ecological planning

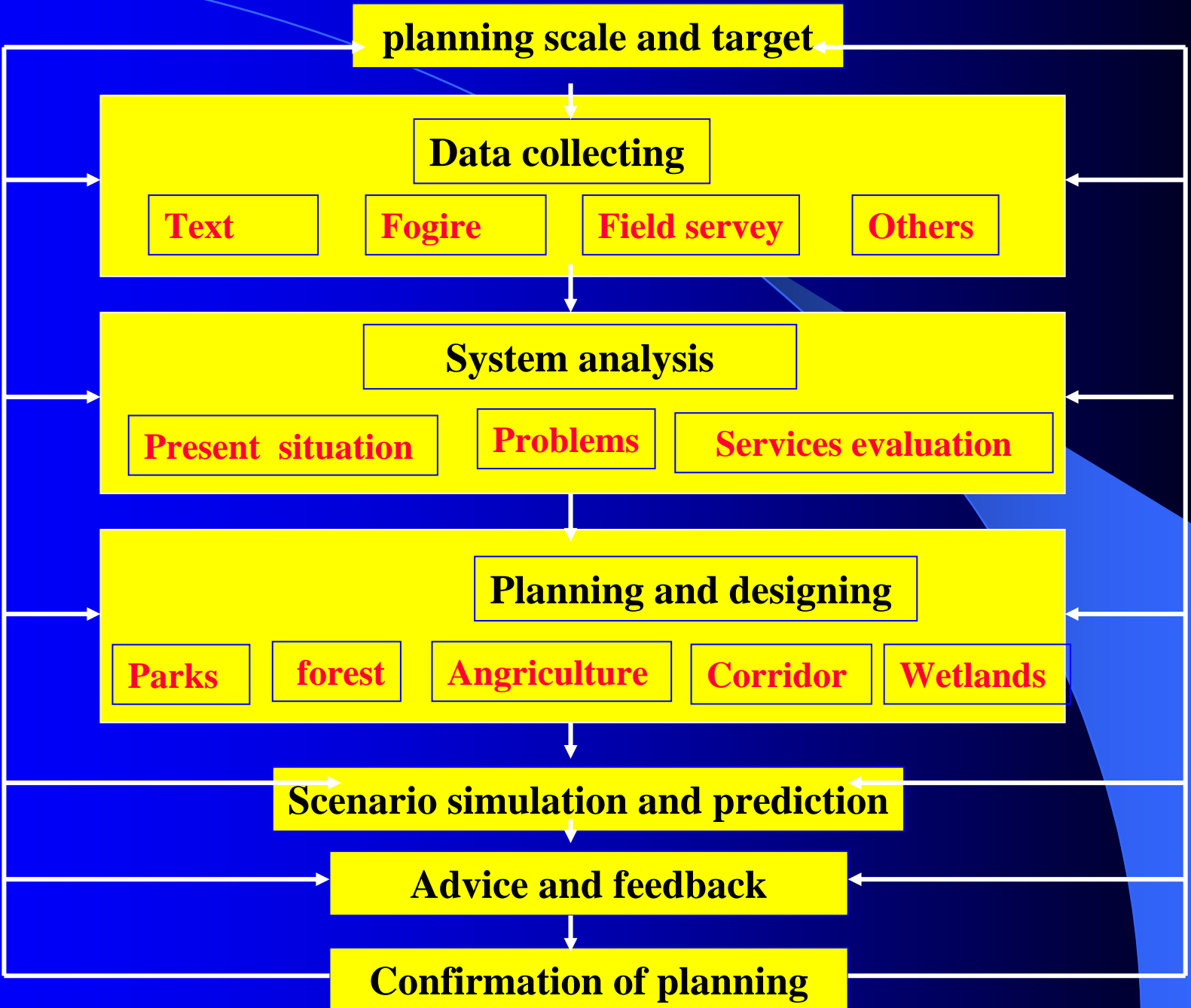
- **Ecological transition**
- **Eco-integration**
- **Landscape ecology**
- **Ecological principles**
- **Scenario analysis**
- **Procedure**



Eco-integration



Procedure of ecological planning of urban green space



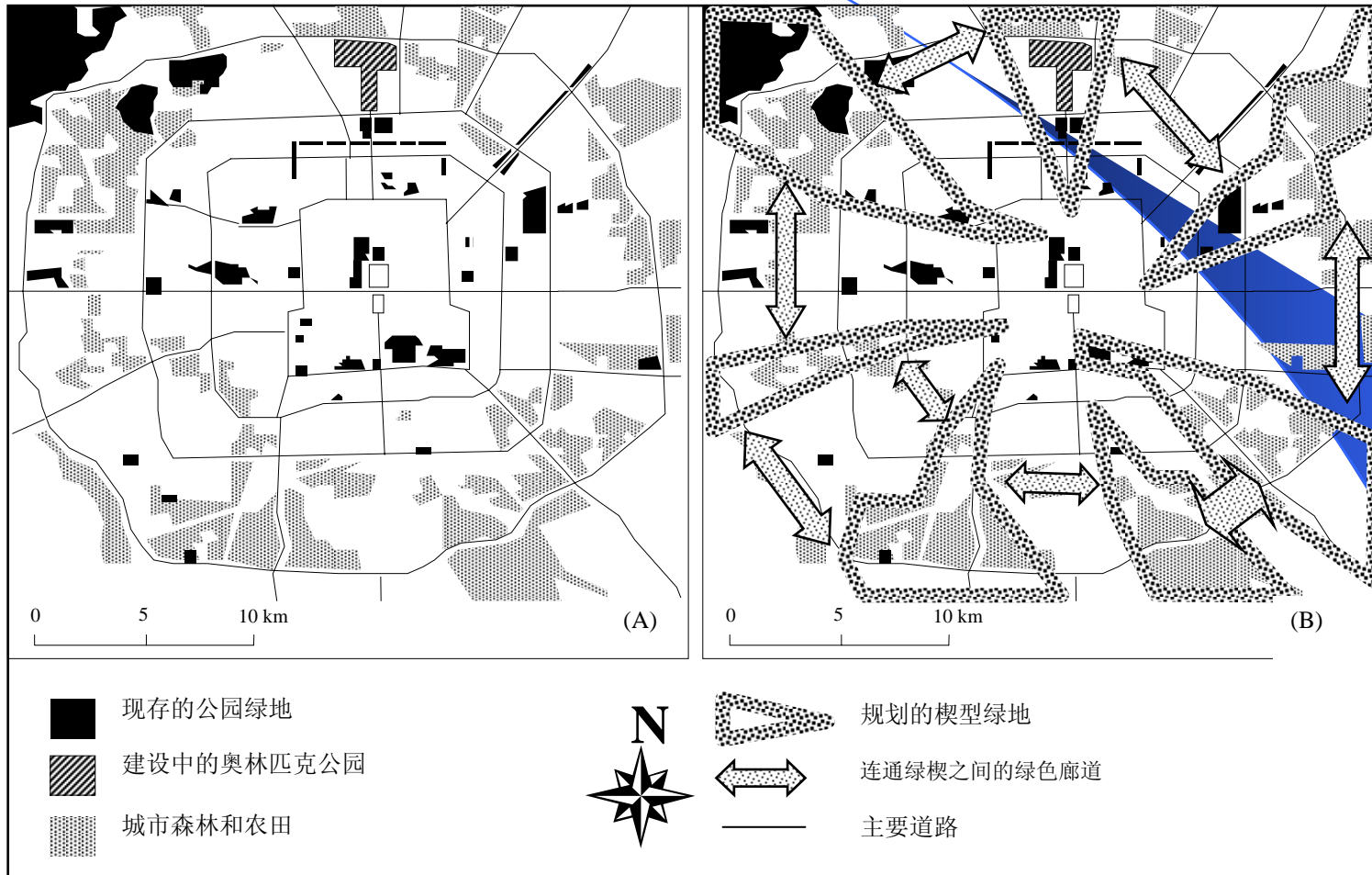
3. Case studies of different scales of urban green space



Table 1
 Ecological principles and requirements for the urban greening in Beijing Province

Principles and requirements	Connotations
1. Structure and function	1.1. Changes of greenstructure can cause changes in function 1.2. Fragmented and isolated greenspace should be integrated into a network
2. Clarity and consistency of greenspace system	2.1. An easily-communicable long-term vision 2.2. An integrated greenspace, division into landscape units with special names and character
3. Functional and ecological diversity	3.1. Landscape units and greenspaces combine several ecological functions, and are not mono-functional 3.2. Richness of visual experience
4. Biodiversity and ecoservices	4.1. Enhance ecosystem services by high greenspace quality and diversity 4.2. Improve specific conditions for endangered species by reducing negative effects on their habitat (e.g. linkage of fragmented habitats), and by adopting strict regulations for protection
5. Accessibility for the public	5.1. Bridge separating elements such as road arteries, railroad tracks, river or drainage channels 5.2. Build a network of footpaths and bicycle routes 5.3. Interlink the main attractions and recreation areas to high quality public transport, in order to avoid ecological deterioration of sensitive areas by car transport and parking
6. Distribution of greenspace	6.1. Public parks close to high-density residential areas 6.2. No pollution in fresh air-generation zones and fresh air corridors 6.3. Noise protection
7. Integration and transformation	7.1. Integration of existing elements: surface water, woods, small parks, and villages 7.2. Consider growth and change of plants
8. Acceptance and implementation	8.1. Improve general acceptance of the concept by public participation 8.2. Publicize the concept through the media 8.3. Involve decision makers and the public as a strong driving force 8.4. Promote greenspace development not only as a restriction against over development, but – in a positive sense – as an essential strategy for quality of life and enrichment of nature ingredients 8.5. Use the entire range of available legal and fiscal instruments to protect the green system against over-development. Seek financial contribution from land owners and companies who could gain major benefits from the green system

Green wedge based on landscape ecology



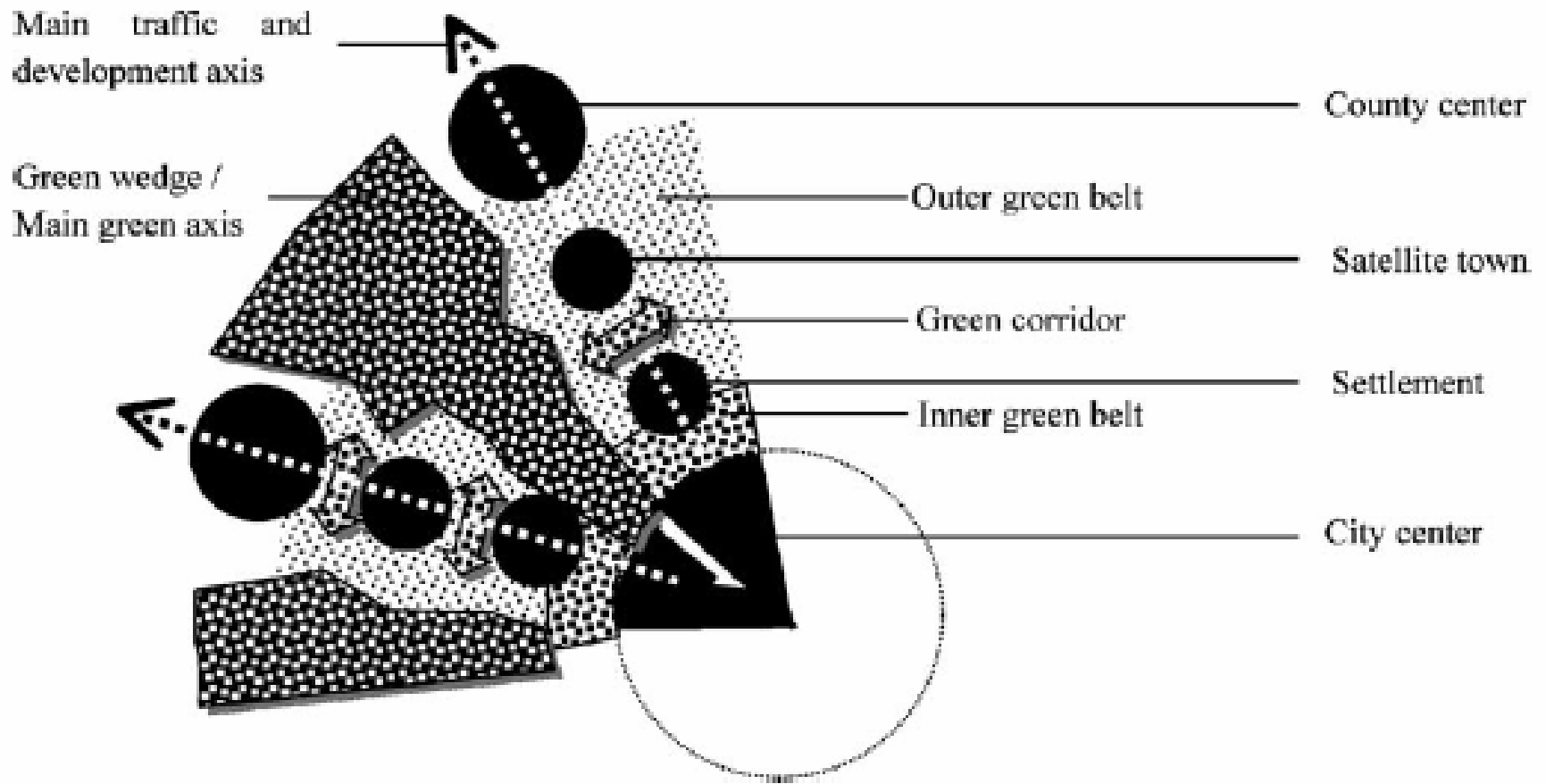
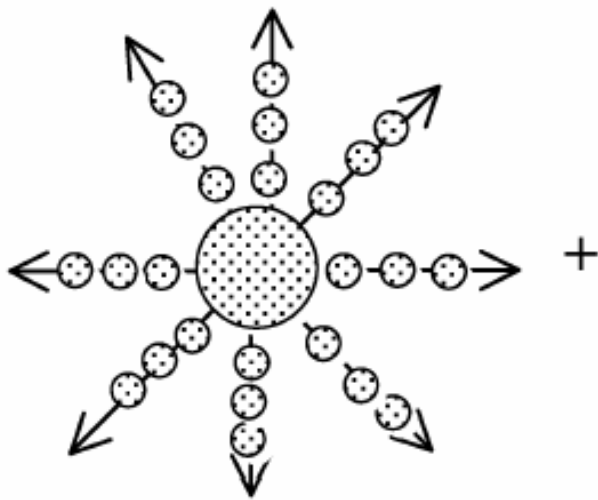
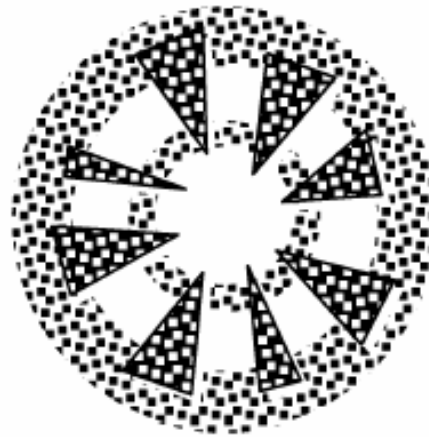


Fig. 7. The settlement and greenstructure proposed at the city scale for the future development of Beijing.



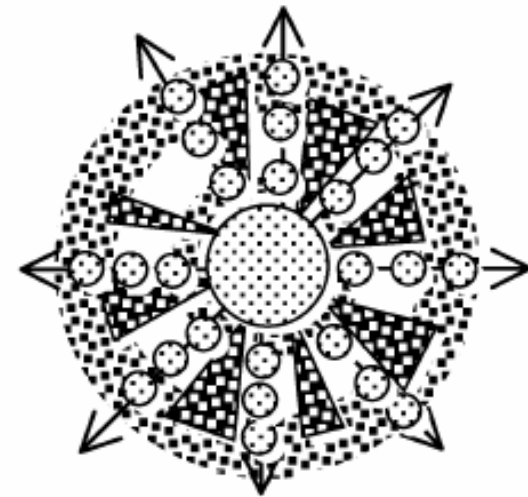
Traffic axis with settlement nodes

+

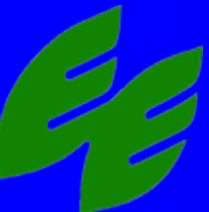


Greenbelts and green wedges

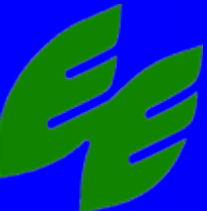
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Forest Greenbelt pattern

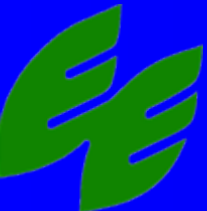


4. Urban forests in China



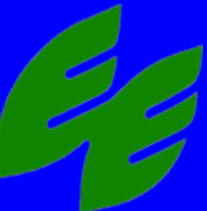
TYPE, STRUCTURE, AND FUNCTION OF URBAN FOREST IN CHINA

- **Built-up area forest.** It includes trees, shrubs, flowers and grasses. It is usually made up of public parks, gardens, and road trees. It has the function of providing comfortable habitation and maintaining people's body and mind health. Vertical greening such as roof garden and wall greening should be adopted to reduce the "heat island" effect in build-up area.



TYPE, STRUCTURE, AND FUNCTION OF URBAN FOREST IN CHINA

- Suburb forest. It locates between the urban center and the outskirts. It includes tourism forest, shelter forest, commercial forest, timber forest and firewood forest. It has the function of maintaining balance of urban ecosystem, providing tourism place and all kinds of forest byproducts. It also offers the services for the living, culture and production in built-up area.



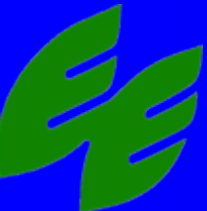
TYPE, STRUCTURE, AND FUNCTION OF URBAN FOREST IN CHINA

- **Outskirt forest.** It locates in the outer space of a city. It is composed of forest parks, greenbelts, greenways, etc. Its main body is timber forest, water conserving forest and shelter forest. It can shape good urban landscape form, improve urban environment, evacuate urban population, and prevent urban excessive sprawl. Outskirt forest should be connected with neighborhood greenspace to form ecological network, which is useful for people and wildlife.



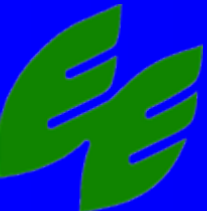
DEVELOPMENT PATTERNS OF URBAN FOREST IN CHINA

- **“Forest City” pattern**
- “Forest City” pattern is that forests are brought into city and city is located in forests. “Forest City” is regarded as the most economic and effective means of improving urban environment quality. Up to now, there are three “Forest City” in China, which are Changchun in Jilin province, Fuxin in Liaoning province and Loudi in Hunan province.



DEVELOPMENT PATTERNS OF URBAN FOREST IN CHINA

- “Garden City” pattern
- “Garden City” is an urban development pattern which is based on urban natural and geographic feature, distributional character and social economic status. It is evaluated and approved according to ten criteria established by China Construction Ministry. By the end of 2000, 19 cities had been named national garden city, including Beijing, Hefei, Zhuhai, Dalian, Hangzhou, Shengzhen, Maanshan, Weihai, Zhongshan, Nanjing, Nanning, Xiamen, Qingdao, Puyang, Shiyan, Foshan, Sanming, Qinghuangdao, Yantai and Shanghai (Pudong district).



DEVELOPMENT PATTERNS OF URBAN FOREST IN CHINA

- **“Ecological Economics” pattern**
- “Ecological Economics” pattern is that ecological benefits of urban forest should be fully exerted. At the same time, we should get economic benefits from urban forest. Tianjin city and Quowo county in Shanxi province are the symbol of this kind of pattern. In Tianjin, a ton of wood for newspaper is produced every year by using planting technology of high density and too short cut period. This pattern not only enhances the forest coverage of the urban and rural area and improves the urban environment, but also brings great economic benefits.



DEVELOPMENT PATTERNS OF URBAN FOREST IN CHINA

- **“Forest Greenbelt” pattern**
- “Forest Greenbelt” pattern is that large-scaled forest greenbelt is planned and constructed around the urban area in order to limit the urban excessive extension and improve urban environment (Figure 1). It also can produce great economic benefit for farmers of the suburb area. Tianjin, Harbin, Benxi, Guiyang, Jinan, Hefei, Xi’an, Beijing and Shanghai are the symbol of this kind of pattern.



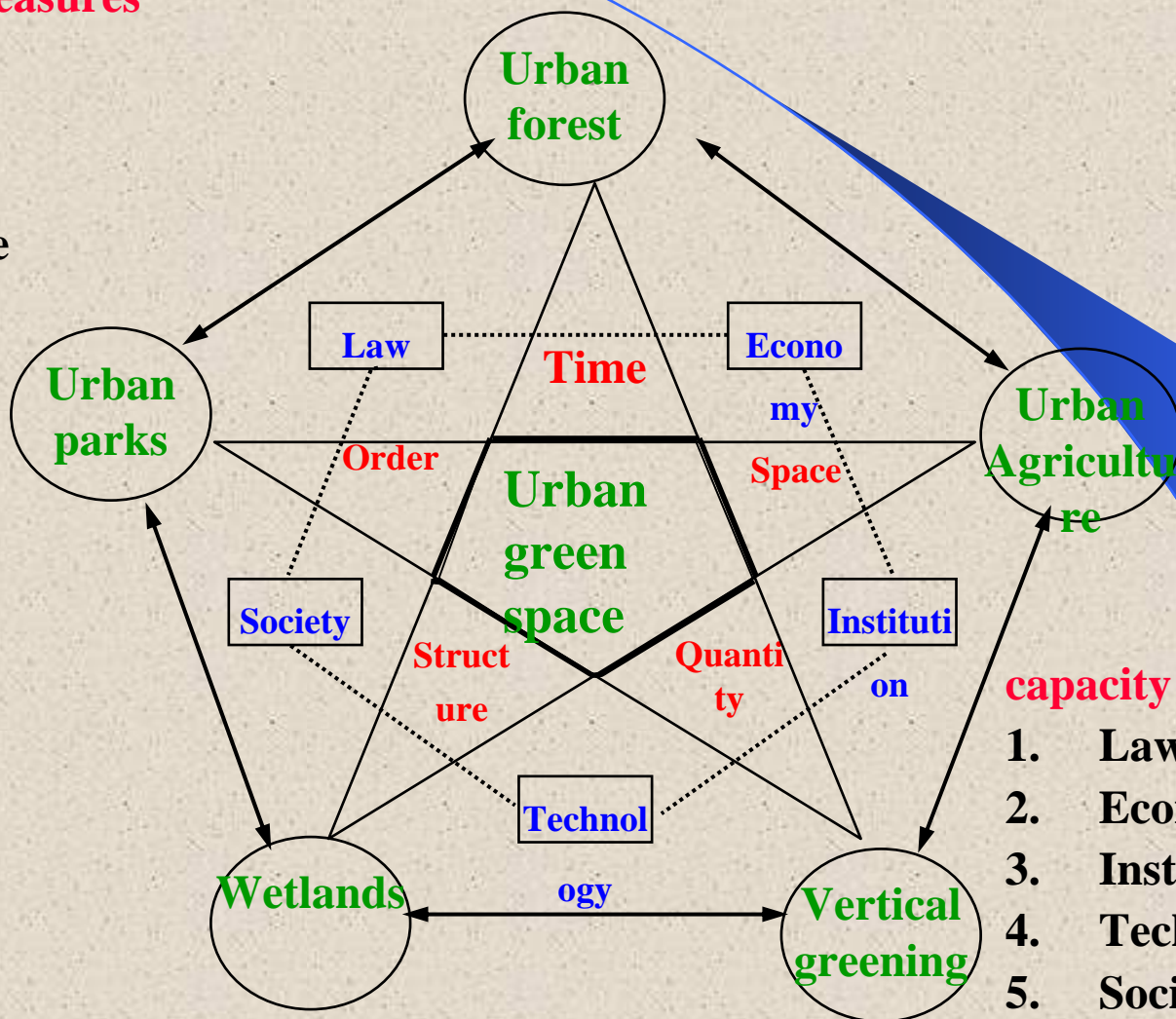
5. Proposals



Regulation measures and integration capacity building

Regulation measures

1. Time
2. Space
3. Quantity
4. Structure
5. Order



capacity building

1. Law establishment
2. Economic means
3. Institution integration
4. Technology application
5. Social participation
6. International cooperation



Proposals

- (1) **Ecosystem service**
- (2) **Green-integration**
- (3) **Ecological planning at different scales**
- (4) **High-technology**
- (5) **combination of government, company, people**
- (6) **coupling of Hardware,software,mindware**
- (7) **Deep research of ecosystem services of green space**
- (8) **Greening diversity of green space construction**
- (9) **Non-built-up area planning**
- (10) **Complex ecosystem management**



Thank you