



生态问题导向的城市绿地 系统规划建设模式探索 ——以太原城市为例

The Research on Urban Green
Space System Planning and
constructible mode form the
Angle of Ecological Question
view: Case Study of Taiyuan City

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1

引言

Introduction

城市是一个复杂的巨系统，城市绿地系统是城市中唯一以自然生态为主体的物质空间 ----Hunter C , Shaw J

The city itself is a complex giant system. Urban green space is the only physical space mainly dependent on natural ecology in the city ----Hunter C ,Shaw J

- 当今绿地系统规划已经发展到从本体走向与城市空间互动的阶段 .

Current systematic planning of green space has evolved into the interactive stage with urban space.

- 城市发展过程本身就是一个不断消耗自然资源，不断给自然带来胁迫乃至会带来生态风险的过程。

The development of a city will naturally consume a lot of natural resources, pose continuous threats to nature and even bring about ecological risks.

- 不同城市由于各自的地理区位、资源禀赋、发展模式、产业结构等各异，所面临的生态问题相去甚远。

In addition, different cities are confronted with diverse ecological issues due to different geographical locations, natural resources, development patterns and industrial structures.

- 有针对性的绿地系统才是“地域性”的。

Only the green space system with targeted construction objective can have its regionalism.

2

系统辨别的生态问题分析

Analysis of Ecological Problems of Systematic Identification

城市生态问题基本思维方式类似我国中医式的系统思维，就是对城市种种现象和过程进行“望、闻、切、问”，然后抓主要问题，即影响生态环境的核心因子，然后提出应对性措施。

Its basic theory is similar to the four diagnostic methods in traditional Chinese medicine, namely “inspection, olfaction, auscultation and inquiry”. By applying these methods to diverse phenomena and processes in the development of the city, it finds out the core problems, namely key factors that influence the ecological environment and then puts forward relevant measures to cope with these problems.

1

因子辨识分析

Identification of factors

2

生态足迹及水资源承载力研究

Shortage of water resources and deterioration of water environment

2.1——因子辨识分析

Identification of factors

1

大气环境恶劣

2

水资源缺乏和水环境恶化

3

绿地少、自然生态服务差

太原市地处太原盆地北端，城市东西两山耸立，中间汾河纵贯，本为山清水秀之地，但由于资源无序开采以及工业、尤其是重工业的发展，目前太原是国内环境污染最严重的城市之一。

Taiyuan is located in northern part of Taiyuan Basin. In the east and west part of the city stand two hills. Feihe River runs through the center of the city. It used to be a beautiful place famous for its picturesque landscape. However, due to irrational exploitation of resources and the development of industry, the heavy industry in particular, Taiyuan has become one of the most seriously polluted cities in China

本研究认为制约太原生态环境水平的不在于系统的整体发展状态，而在于制约系统的“短板”。从各项指标来看，气、水、绿三者水平低下是制约太原城市生态环境的主要因子：

The research contends that the factors that restrain the ecological environment don't lie in the overall development state of the system but the "short slab" that confines the system. In accordance with diverse indicators, the main factor that hinders the urban ecological environment in Taiyuan lies in the low quality of air, water and green space.

2.1——因子辨识分析

Identification of factors

1

大气环境恶劣

全国能源重化工基地，能源结构以煤炭为主，污染物排放量大、污染源密度高。

Taiyuan boasts national energy and heavy chemical industry base. Its energy structure is dominated by coal which emits large quantities of pollutants and causes serious pollution.

2

水资源缺乏和水环境恶化

城区内工业布局不合理，最主要的是太原钢铁厂布局在城市北端（是太原主导风向上风向和汾河上游），并一时难以搬迁。

Due to historical reasons, industrial layout in the city proper is not so rational. The most important reason is that Taiyuan Iron and Steel Plant is located in the north of the city (The wind blows in the direction of Taiyuan city proper and the upper reaches of Fenhe River). It can't be relocated at present.

3

绿地少、自然生态服务差

从城市空气的自净能力来看，太原三面环山，地貌形态极不开阔，静风频率占20-30%，年平均风速不大，极不利于空气流通。

From the perspective of self-purification capability of urban air, Taiyuan is surrounded by hills on three sides. Therefore, the view is greatly spoiled. The frequency of static wind accounts for 20-30%. The annual average wind speed is not detrimental to air circulation.

2.1——因子辨识分析

Identification of factors

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大气环境恶劣

2

水资源缺乏和水环境恶化

3

绿地少、自然生态服务差

太原属于水资源严重不足地区，是国内最为缺水的城市之一。全市人均占有水资源量为山西省人均占有水资源量的31.2%，是全国人均占有量的6.0%，是世界人均占有量的1.4%，季节性降雨不均衡现象加剧了太原城市水资源供给的压力。

On account of severe shortage of water resources, it's recognized as one of the most water-scarce cities in China. The per capita water resource occupancy rate accounts for 31.2% of that in Shanxi Province, 6% of national water occupancy rate and 1.4% of the world. The imbalance of seasonal rainfall aggravates the supply of urban water resources.

不合理建设模式加剧了水资源的短缺：地下水是太原市的主要供水源，全市平均年超采地下水资源量1.1299亿立方米，严重超采导致区域地下水位持续大幅度下降，且严重水污染问题已经导致可用的水资源量进一步减少。Irrational construction pattern has also exacerbated the shortage of water resources. The underground water is the main source of water supply in Taiyuan. About 112.99 million cubic meters of underground water is overexploited annually. Severe overexploitation results in the continuously sharp decline in regional underground water level. Apart from that, severe water pollution has resulted in further decrease in utilizable water resources.

缺水问题已经成为严重制约太原经济发展和社会进步的门槛和瓶颈。Water shortage problem has become a serious threshold and bottleneck that constrain the economic and social development of Taiyuan.

2.1——因子辨识分析

Identification of factors

1

大气环境恶劣

太原处于北方寒冷性气候和亚热带气候区交汇处，温差大，夏热冬冷气候的气候特征使之区域生态能力、城市景观等方面均先天不足。

Taiyuan is located in the junction of northern cold climate and subtropical climate. Temperature in the daytime and at night changes sharply. The climatic characteristics of hot summer and cold winter result in its deficiency of ecological capability and urban landscape.

2

水资源缺乏和水环境恶化

太原城市绿地建设受用地紧张的限制，规划绿地被侵占十分严重，人均公园绿地不足5平方米/人，并且绿地大多以草坪为主，乔灌木搭配不够，园林植物单一。绿地复合程度低，生态效果不佳。

As urban green space construction in Taiyuan is restricted by limited land, much of the planned green space has been severely occupied. Per capita park green space is even less than 5 square meters /person. The green space composite is rather low and ecology effect is far from satisfactory.

3

绿地少、自然生态服务差

2.1——因子辨识分析

Identification of factors

1

大气环境恶劣

2

水资源缺乏和水环境恶化

3

绿地少、自然生态服务差



2.2——生态足迹及水资源承载力研究

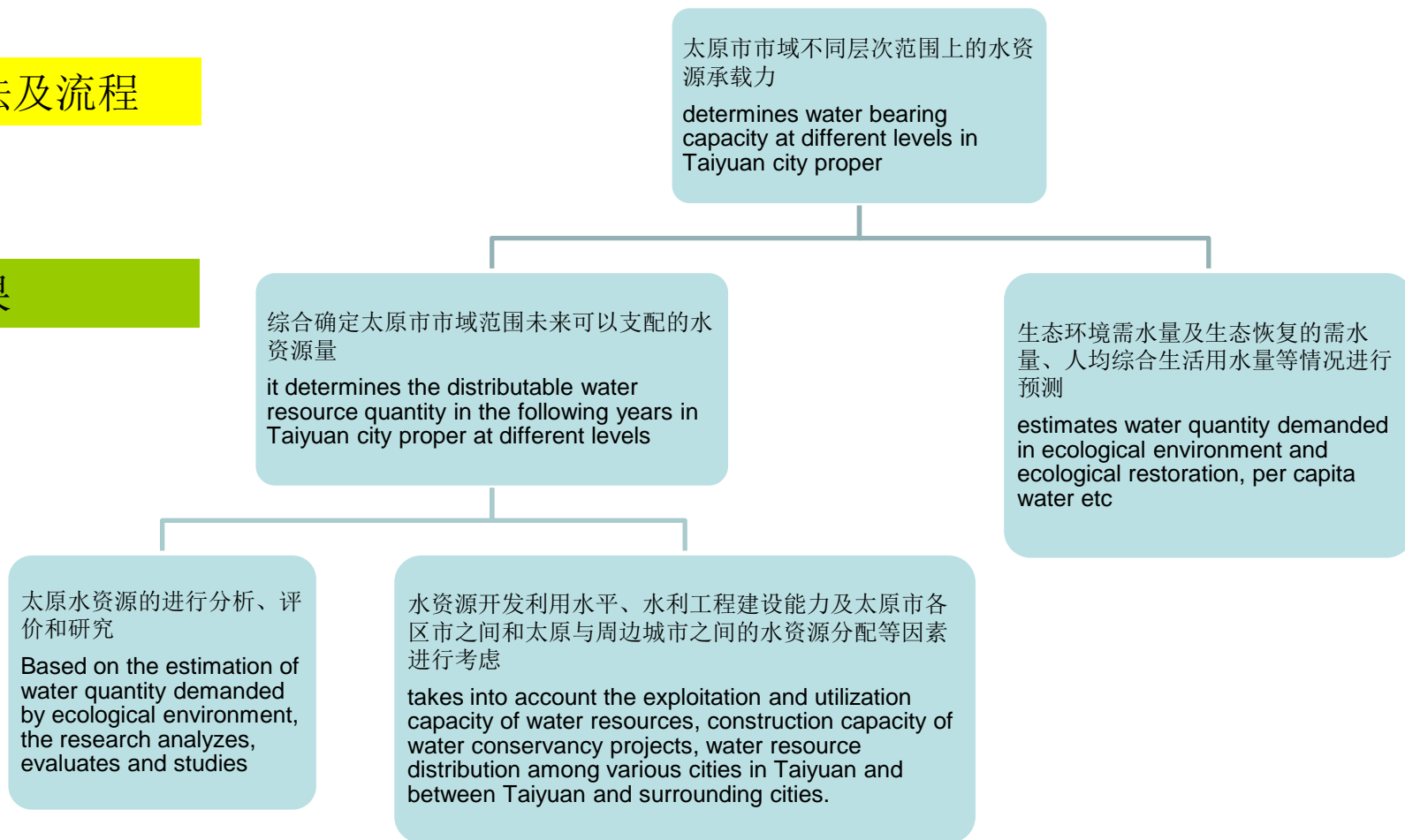
Shortage of water resources and deterioration of water environment

1

研究方法及流程

2

研究结果



2.2——生态足迹及水资源承载力研究

Shortage of water resources and deterioration of water environment

1

研究方法及流程

2

研究结果

太原市区的人均生态足迹需求为1.4698ha/人，生态承载力为0.3909ha/人，人均生态赤字达1.0789ha/人。这一数字高于我国的生态赤字0.4ha/人。太原市域水资源所能承载的适度人口规模为350万人，这个数据基本上与2001年第五次人口普查的数据持平（334.40万人）。仅从水资源容量这项来看，太原城市已经超载。

Based on the above information, the research draws a conclusion as follows: Demand from per capita ecological footprints in Taiyuan city proper: 1.4698ha²/person, ecological bearing capacity: 0.3909ha²/peron, per capita ecological deficit: 1.0789ha²/person. The data are much higher than the national ecological deficit 0.4ha²/person. The appropriate population scale that water resources in Taiyuan city proper can bear is 3.5 million. The data basically levels off that (3.344 million) of the fifth census conducted in 2001. Water resource bearing capacity alone demonstrates that water consumption in Taiyuan has outpaced its actual bearing capacity.

3

目标导向型绿地规划系统发展模式研究

Research on development pattern of target-oriented green space planning system

绿地组织不仅需要应对有机疏散城市空间结构的需要，还需应对当前制约太原城市环境质量的因子提出应对性措施。

urban green space organization shall not only target at organic decentralization of urban space structure but also put forward countermeasures against factors that restrain the urban environment in Taiyuan

1

建构城乡共建共稳的绿地系统，重点建设山体平原交汇处区域
Construct green space system for the urban and rural development and stability, focus on the construction where hills and plains join.

2

强化东西向绿色廊道，降低大气污染影响
Strengthen east-west green corridors to reduce the impact of atmospheric pollution

3

提高绿量，从量到质提高城市绿地生态服务
Improve green quantity and the quality of urban green space ecological services

3.1——建构城乡共建共稳的绿地系统，重点建设山体平原交汇处区域

Construct green space system for the urban and rural development and stability, focus on the construction where hills and plains join.

1

建构城乡共建共稳的绿地系统，重点建设山体平原交汇处区域

针对太原实际情况，一是建议将市郊绿地系统融入到城市绿地系统中去，形成完整有机的城市绿地系统大框架；

First, it's recommended that the green space system in outskirts be integrated into urban green space system. And combined to form a complete and organic framework of urban green space system.

2

强化东西向绿色廊道，降低大气污染影响

二是重点突出山体平原交汇地带的绿地功能。

Second, it's advisable to highlight green space function where hills and plains join.

3

提高绿量，从量到质提高城市绿地生态服务

规划建议充分发挥市郊晋祠一天龙山风景区、崛围山风景区等生态效用，结合山体森林、田园景观、文化遗产和现代化苗木生产，建构交相辉映的综合绿色生态系统。

The planning gives full play to the ecological function of Jinci-Tianlongshan scenic spot and Juweishan scenic spot in the outskirts of Taiyuan by combining integrated green ecosystem of forests in hills, rural landscape, cultural relics, and modern nursery stock production.

3.2——强化东西向绿色廊道，降低大气污染影响

Strengthen east-west green corridors to reduce the impact of atmospheric pollution

1

建构城乡共建共稳的绿地系统，重点建设山体平原交汇处区域

2

强化东西向绿色廊道，降低大气污染影响

3

提高绿量，从量到质提高城市绿地生态服务

规划控制两条大型城市隔离带，一条自太钢西侧现状森林公园向西延伸，第二条为南部新区北段的高压走廊。

Plan two large-scale urban isolation belts. One green corridor extends from the current forest park west of Taiyuan Iron and Steel Plant to the western part and the other is the high-voltage corridor located northern part of the newly developed area in the south of the city.

这类地域以提高自然群落多样性、增加空气净化能力、增加调节城市小气候能力、提高必要动物的生物场景为主要目的。

This district is mainly aimed to improve the bio-diversity, increase the capacity of air purification, enhance the capability of adjusting micro-climate of the city and provide necessary habitats for animals in the wild.

3.3——提高绿量，从量到质提高城市绿地生态服务

Improve green quantity and the quality of urban green space ecological services

1

建构城乡共建共稳的绿地系统，重点建设山体平原交汇处区域

2

强化东西向绿色廊道，降低大气污染影响

3

提高绿量，从量到质提高城市绿地生态服务

城市绿地是城市中唯一的自然生态系统，只有提高其单位面积对人类的贡献和对污染的降解，才能有效缓解人类对自然的胁迫。

Urban green space is the only natural ecosystem in a city. Only by improving the contribution of per capita area to human beings and degradation of pollution can threats to nature posed by human beings be effectively alleviated

4

重点生态区划的空间模式

Spatial pattern of regionalization of Major ecological regions

规划研究中提出城市生态敏感重点建设区的概念并进行区划。

The concept of ecologically sensitive areas has been put forward in the planning and focused on the regionalization

1

东西山区生态敏感区

Ecologically sensitive regions in the east-west mountainous areas

2

山体、水系边缘生态敏感区

Ecologically sensitive areas in hills and water edges

3

以晋阳城遗址为代表的人文资源生态敏感区

Ecologically sensitive areas represented by Jinyang site

4.1——东西山区生态敏感区

Ecologically sensitive regions in the east-west mountainous areas

1

东西山区生态敏感区：

包括太原城市周边山地，是太原城市最直接的生态屏障，该区是全市水源涵养地，涵养全市可利用的水资源的80%左右；又是空气净化及气候调节区和太原城市的空气库；是建设城市生物多样性的主要来源。

It includes mountainous areas around Taiyuan. They are the most direct ecological barriers in the city. The region provides water resources for Taiyuan and about 80% of water resources are available in this region. At the same time, it serves as air purification and climate regulation zone as well as the air base of Taiyuan. It provides main sources for the construction of urban bio-diversity.

2

山体、水系边缘生态敏感区

3

以晋阳城遗址为代表的人文资源生态敏感区

4.2——山体、水系边缘生态敏感区

Ecologically sensitive areas in hills and water edges

1

东西山区生态敏感区

东西山体、汾河、冲沟等自然生态地貌单元是太原城市宝贵的自然资源，同时具有特殊的生态学意义。均划定相应地保护范围作为城市自然生态网络的一部分保护下来。

East-west hills, Fenhe River, gullies and some other natural ecological geomorphic units are precious natural resources of Taiyuan. They are of particular ecological significance. Relevant preservation scope shall be marked out as part of urban natural ecological network.

2

山体、水系边缘生态敏感区

3
以晋阳城遗址为代表的人文资源生态敏感区

4.3——以晋阳城遗址为代表的人文资源生态敏感区

Ecologically sensitive areas represented by Jinyang site

1

东西山区生态敏感区：

2

山体、水系边缘生态敏感区

3

以晋阳城遗址为代表的人文资源生态敏感区

这类生态敏感区除了按照现有的历史文化和历史名城的保护法规进行控制外，可以适当扩大建筑物周围的自然生态绿地的保护范围，以增加对自然风险和人为干扰的抗风险能力。

Apart from current rules and regulations prescribed to preserve the existing historical culture and city in the ecologically sensitive area, the preservation scope of natural ecological green space around the buildings can be properly expanded so as to increase anti-risk capacity against natural risks and man-made interference.



太原市城市生态分区图
The urban ecological zoning plans for Taiyuan

5

蓝脉绿网的建设模式

Research on Construction Pattern of blue skeleton and green network

“蓝脉绿网”是规划构想的线性生态格局，也是将相对隔断的生态架构进行网络化、促使其稳定性增强的手段。也是城市规划建成区内部生态建设最重要的骨架。

Blue skeleton and green network is the linear ecological pattern conceived in the program and serves as the approach of networking relatively isolated ecological structure to enhance its stability. It's also the most important framework of internal ecological construction in the urban planning area to be built.

1

冲沟绿带廊道建设

Construction of Green Corridors along Gullies

2

绿色分隔带建设

Construction of Isolation Greenbelts

3

绿色道路廊道建设

Construction of Green Road Corridor

4

蓝脉廊道修复性建设

Restorative Construction of Blue Skeleton Corridor

5.1——冲沟绿带廊道建设

Construction of Green Corridors along Gullies

1

冲沟绿带廊道建设

太原城市中冲沟和汾河形成自然的双向垂直关系，形成周边山体和城市中水体联系的自然廊道。不良建设行为对其破坏影响较大。

Gullies and Fenhe River in Taiyuan city proper are naturally vertical in both directions, constituting the natural corridor that links surrounding hills and water bodies in the city. Poor construction practices influenced their destruction.

2

绿色分隔带建设

规划建议在规划建成区外围冲沟廊道两侧绿带宽度至少控制在600米以上，进入城区可以逐步减少，最小宽度不小于30米，在冲沟边缘结合公园绿地建设，形成收放有致的绿色空间体系。

3

绿色道路廊道建设

it's recommended that the width of greenbelts on both sides of external gully corridor should exceed 600 meters. It can be decreased gradually in the city proper with a minimum width of 30 meters or above. The construction of edges of gullies and green space in the park can be combined to form a local flexible green space system.

4

蓝脉廊道修复性建设

5.2——绿色分隔带建设

Construction of Isolation Greenbelts

1

冲沟绿带廊道建设

规划两条大型绿色分隔带：现状森林公园扩建为太钢和城区自建的大型防护绿地、城南新区和城区防护绿地结合晋阳湖作为大型绿地公园，构建城区绿地系统。

Two large-scale isolation greenbelts are also included in the program of ecological construction. The current forest park can be expanded into large protective green land of Taiyuan Iron and Steel Plant and the downtown area. Protective green space in the new district south of the city and the downtown area can be combined with Jiyang Lake as a large scale green space park, constituting the green space system in the city proper.

2

绿色分隔带建设

3

绿色道路廊道建设

规划建议太原上述两个廊道宽度控制在1200米以上，以形成城市内部生境，增加城市内部生物多样性。

It's advisable to build the above-mentioned two corridors in Taiyuan at a width of over 1,200 meters to constitute urban internal habitat and increase internal bio-diversity.

4

蓝脉廊道修复性建设

5.3——冲沟绿带廊道建设

Construction of Green Corridors along Gullies

1

冲沟绿带廊道建设

2

绿色分隔带建设

3

绿色道路廊道建设

4

蓝脉廊道修复性建设

目前太原城市环境污染较重，城市生物多样性脆弱，道路绿化带的主要功能应定位在环境保护和生物多样性保护上，为动植物迁移和传播提供有效的通道，使城市内廊道与廊道、廊道与斑块、斑块与斑块之间相互联系，成为一个整体。因此，建议在下层次规划设计、重点考虑如何实现上述目的并将之法规化。

At present, urban environment in Taiyuan is seriously polluted. Due to the fragile bio-diversity, the major function of road greenbelts shall focus on environmental protection and bio-diversity conservation to provide effective channels for the migration and reproduction of wildlife and integrate different corridors, corridors and blocks with different blocks. Therefore, it's advisable to take into account above-mentioned objectives in the planning and green configuration at lower levels.

5.4——冲沟绿带廊道建设

Construction of Green Corridors along Gullies

1

冲沟绿带廊道建设

2

绿色分隔带建设

3

绿色道路廊道建设

4

蓝脉廊道修复性建设

规划提出汾河生态恢复性建设具体目标包括：提高防洪排涝功能、修复生态功能（还其碧水长流、低吟浅唱的面目，重塑并提高它在通畅气流、调节气候、水体自净等优化生态环境方面功能）、恢复景观功能等，具体措施如下：

1. 高标准规划、设计、建设和管理蓝道，划定蓝线，控制违章建筑
2. 采用生态方法进行水体修复

The program puts forward specific restoration objectives, i.e., improving flood prevention and drainage, restoring ecological function (to resume its clean water, remold and improve its function in optimizing ecological environment, i.e., air circulation, climate regulation, water purification, etc.) and the restoration of landscape function. Specific measures are as follows:

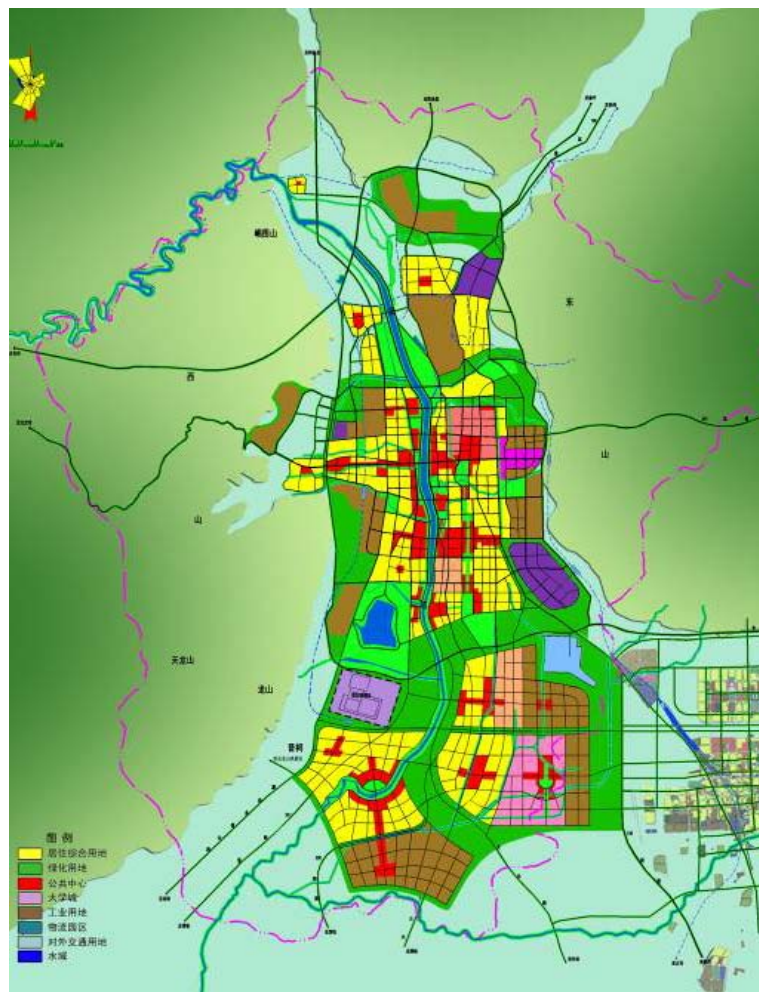
- ① set high standards for planning, design, construction and management of blue roads, set out blue lines and control unauthorized buildings
- ② Restore water by ecological means

5.1 —— 冲沟绿带廊道建设

Construction of Green Corridors along Gullies



太原城市蓝脉绿网生态结构示意图
The Green Network of urban ecological structure for Taiyuan



太原城市空间发展概念规划图
The concept plan of urban spatial development for Taiyuan

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结语

Conclusion

城市绿地系统规划建设并不是提供一种静态蓝图式的空间模式，更不是适用各个城市的“通用”模式，而是应针对每个城市的实际情况，从提高生态环境质量，合理引导城市发展的角度，提出绿地系统的布局及建设重点。

Urban green space systematic planning construction doesn't mean one static blueprint of spatial pattern, nor is it a universal mode applicable to all cities. Instead it targets at the actual situation of a city and puts forward the layout and construction focus from the perspective of improving ecological environment quality, rationally guiding the development of cities.

这种建设模式需要实际建设效果和城市环境质量长期、动态的监控，并建立反馈到绿地系统建设上来的机制，还需要其他规划层次进行衔接、协调和深化。只有与城市发展互动、体现地域性特征的绿地系统才能真正有效的平衡人与自然的的关系。

The construction pattern requires actual construction effect and long-term and dynamic supervision of urban environment quality thus to establish and respond to the mechanism of green space system construction. Besides, it's necessary to combine, coordinate and deepen other levels of planning. Only by interacting with the development of the city can the green space system that reflects regional characteristics effectively balance the relationship between man and nature.

结束

End

Thanks for your attention