Water Resilience Oriented Planning for Park City

Responding to Climate Threats and Human Activities

Project Statement

In recent years, with the rapid development of urbanization and other external socio-economic disturbances and influences, many problems have arisen in the urban ecological environment. Along with the frequent occurrence of extreme rainfall events, how to realize sustainable urban development has become an urgent goal of current planning research, and the concept of resilience provides a positive viewpoint. Loudi City, as the center city of the ChangZhuTan urban agglomeration, is of great significance to the construction of the ecological reserve system in Hunan Province. The plan carries out rainfall inundation analysis and ecological resilience analysis based on local data, and conducts special designs for three types of green spaces, namely ecological, agricultural and parks, oriented to water safety resilience. The relevant strategies refer to previous resilience studies and BMPs to create a safe, comfortable and accessible blue and green space for the citizens of Loudi.

Project Narrative

1 Overall Plan

The research scope of this design includes 500km2 of Loudi city area , of which the central city area is 181.04km², in order to build a water resilient city with interwoven blue and green spaces. In the blue space, 80.9km2 Shufumiao wetland, two first-class rivers of Lianshui and Sunshui and three tributary water systems are planned in an integrated way to create three different functional types of shoreline. These include 70.8km of natural river shoreline, 26.9km of soft and hard river shoreline and 38.3km of civic activity shoreline. In the green space, it will be laid out in a typological manner, constructing 15 comprehensive parks, 57 community parks and 91 pocket parks, forming a green space network system that covers and radiates the entire city. In addition, 343.5 km of multi-functional greenways were created along roads, waterways and other linear spaces.

2 Water Resilience Analysis

The regional water environment risk analysis is based on a variety of quantitative models to identify areas of insufficient water resilience, high water risk and water resource degradation in the study area and to propose targeted restoration planning strategies for efficient regional water system management. In particular, the project has calculated the Rainfall Erosion Index (RERI) to reflect

the effects of rainfall quantity and intensity on soil erosion processes, the SCS model to calculate total surface runoff, delineated the multi-stage floodplains in the study area, and the MaxEnt model to investigate the relationship between disaster-prone areas and natural and anthropogenic factors, and to simulate and predict disaster risks in the study area.

3 Ecological Network Analysis

The construction of the regional resilience network mainly includes the identification of ecological sources, the construction of different types of resilience areas and the simulation of ecological corridors. By comparing the simulated ecological network with the actual situation, it can be a good guide for urban planning practice and bridge the gap between the existing planning and urban development. Among them, the ecological sources in the study area are mainly the regional large green area and the water source protection area. The resilience surface of the study area is formed by overlaying the results of the ecological resilience assessment and the water risk assessment (previous section), where the ecological resilience assessment mainly focuses on the three aspects of resilience, adaptation and restoration of the study area. The project classified the final ecological corridors into categories based on their ecological value and construction cost. Meanwhile, taking into account the production, ecological and livelihood needs of the city, the project also identified several stepping stones along the corridors to strengthen the resilience of ecological networks and improve the capacity of ecosystem services.

4 Ecological Green Space Strategy

The water resilient ecosystem in the site will be implemented in three stages, gradually improving the regional blue and green network environment, and realizing the healthy and sustainable development of Loudi City. Stage 1: Based on the natural environment. A blue-green system was built along the main river to improve the ecological environment of the site, including the design of five cultural landscape nodes. Stage 2: Strengthen the link between the green belt, build a multi-level park system according to different land use methods, improve the landscape system, and activate the entire site. Stage 3: Through the integration of multiple elements such as wetlands, rivers and parks, the urban water resilience system is built. At this stage, efforts will be made to enhance the interaction between the various elements and maximize the ecological value.

5 Productive Green Spaces Strategy

Terrace is a stepped farmland built along contour lines on sloping land. It plays a significant role in water storage, soil preservation and production increase. The first strategy expresses that in the process of terracing construction, it is necessary to build terracing according to local conditions; The second strategy expresses that in the process of planting, the structure of terrace should be improved reasonably and the terrace management should be carried out. For example, the terraced field is combined with the water cellar, and the planting ditch is combined. At the same time, it is also an important measure to establish a terrace ridge parallel to the contour line. In terms of management, natural agricultural methods should be used, pesticides should be used less, and collective management should be adopted. In addition, planting different types of crops on different terraced levels helps to protect soil fertility and reduce the spread of pests and diseases.

6 Park Green Spaces Strategy

In terms of park green space, it mainly includes six major strategies. The three strategies in the first column are mainly aimed at activating the unloved green open space, including functional compounding, activating park green space, and organically connecting the green waterfront space with other urban Spaces, so that the park green space can effectively serve the surrounding environment. For example, bike lanes and sports facilities are added to the park, and the green space near the water is organically connected. The three strategies in the second column are intended to construct the green space of the park, which mainly include: integrating the green space, constructing the leisure space, and protecting and restoring the overall style of the street space.At the same time, a questionnaire survey was also conducted on the needs of residents of different ages for the time and place of play in the park. According to the questionnaire survey, residents of diferent ages spend different time in parks, most of which are 30-60minutes and 1-2 hours. As a result, people are more in need of parent-child play, recreational activities and other activity places.

7 Conclusion and Vison

Lourdes City through planning is expected to gradually complete the corresponding construction in 2021-2035. Eventually, the demand-supply of water ecological services will reach 90%, the construction of blue-green network will reach 96%, and 12 major parks will be built.

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LOCATION

STUDY SCOPE

52KM² Reserach Area 181.04KM² Central Urban Area

GREEN SYSTEM

13.6KM² Ecological Green Space / 16.2KM² Park Green Space

15 Integrated Parks / 57 Community Parks / 91 Pocket Parks

WATER SYSTEM

80.9km² Shuifumiao Wetland

2 First-order Stream /3 Tributary/136KM River Shoreline

Flood line-Once in 30 years
Water System
Park Green Space
Protective Green Space
Regional Green Space
Farmland
Timberland
Comprehensive Parks
First-class Ecological Corridor
Secondary Ecological Corridor
Water Corridor
First-class Ecological Core
Secondary Ecological Core

Bixi River
Shizi mountain
Xiyang mountain
Lianshui River
Xiyang River
Lianshui Park
Railway Station
Shuiyang New District
Shentong Wan
Shima Park
Louxing Park
Zhushan Park
Shuifumiao Reservoir
Xiannv Zhai
Sunshui Park
West Railway Station
Baimu mountain
Sunshui River
High speed Railway South Station
Gaotie Park
Lou Shao Railway Park Belt
Yongchang River

N

0 1.25 2.5 5KM

MASTER PLAN

CURRENT STATUS AND PROBLEMS

The landscape of the suburban natural environment: climate change and anthropogenic impacts

Surface runoff

Landslides and habitat destruction

Shrinkage of natural habitats
Soil erosion on mountains
Landslide disaster caused by rainfall

Downtown

Extreme rainfall flooding of cities

Increase in urban hard subsurface
Significant heat island effect
Extreme rainfall and flooding

Mengfeng Mountain

Stepped fields

Villages

50-year flood line

Rural wastewater discharge

Random discharge of domestic sewage
Lack of flush toilets in houses
Outdated sewage treatment technology

Irrigation channel

P

N

Fertilization and water pollution

Soil pollution due to over-fertilization
Eutrophication of water
Pollution of drinking water sources

Sun Shui River

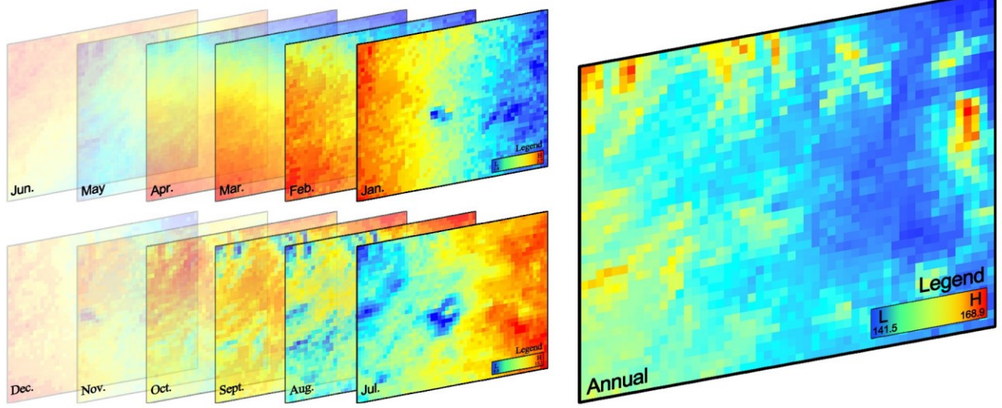
30-year flood line

Regional water environment risk analysis

Identifying areas of high water resilience through multiple quantitative analysis models

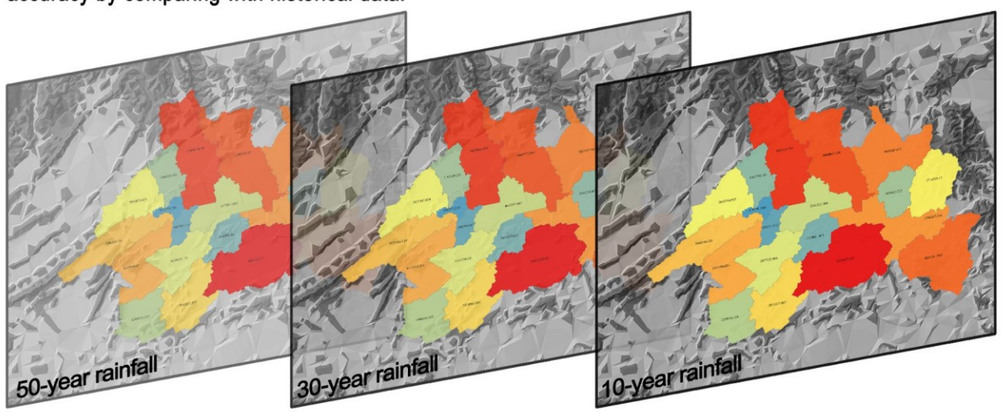
Rainfall erosivity analysis.

The Rainfall Erosivity Index, which reflects the contribution of rainfall amount and intensity to the soil erosion process, is calculated using the Wischmeier method and rainfall data.



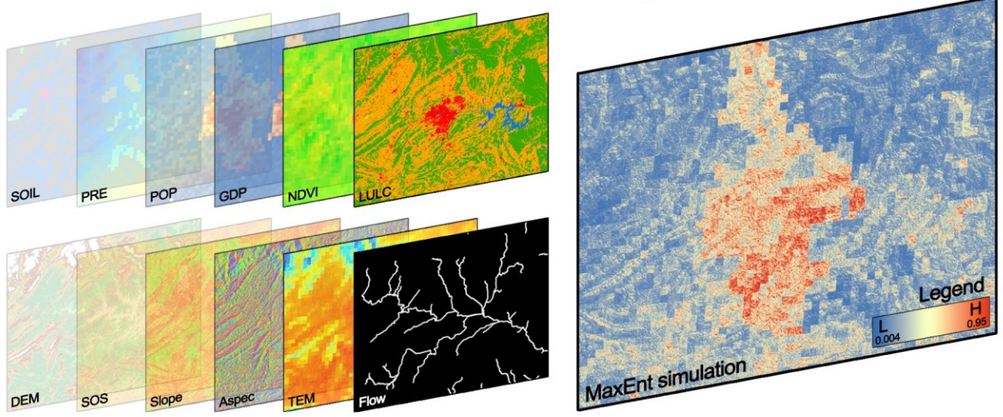
Surface runoff analysis based on the SCS model.

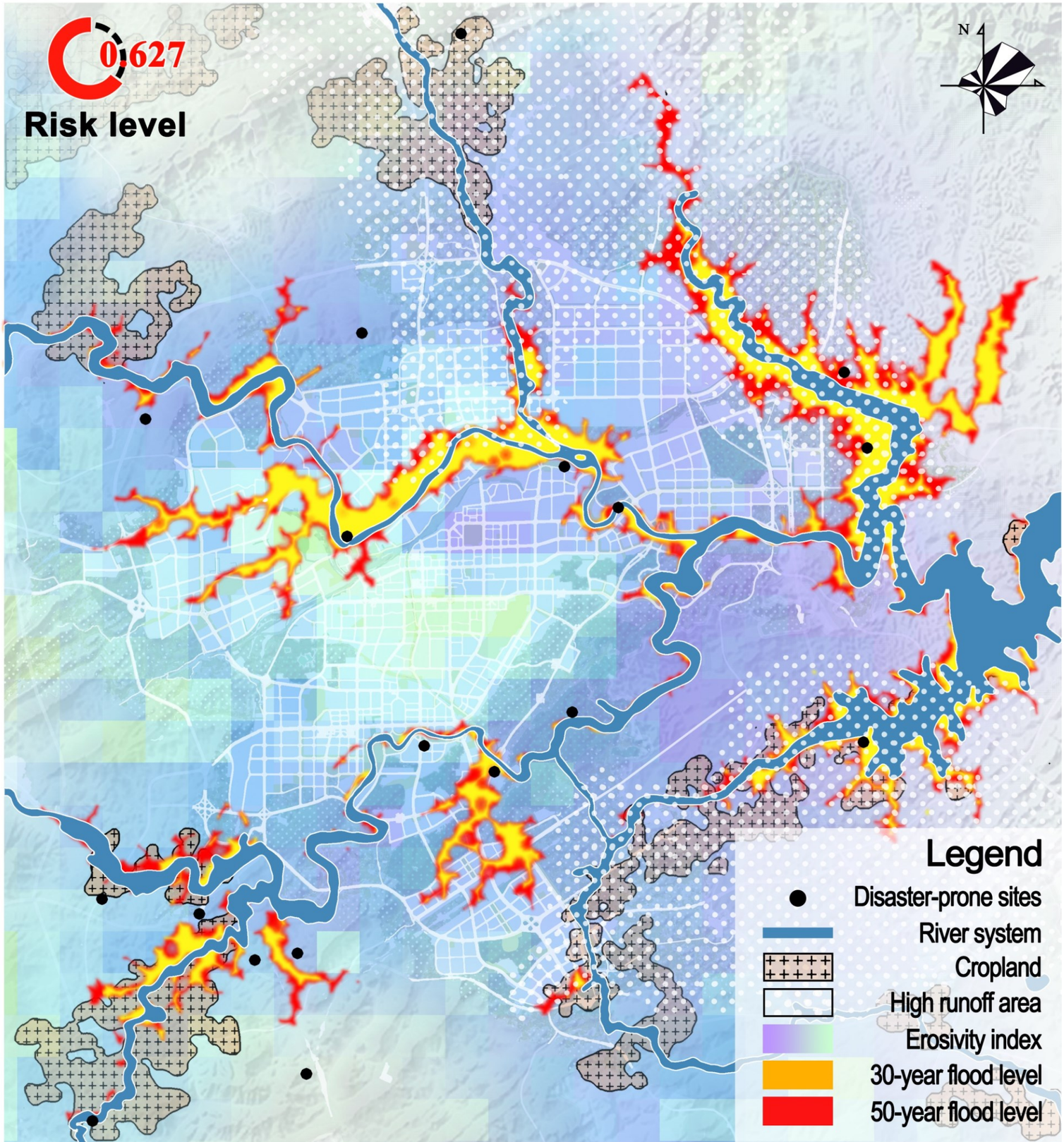
Using the SCS model and rainfall data to calculate total surface runoff, delineate flood zones, and calibrate accuracy by comparing with historical data.



Risk simulation based on the MaxEnt model.

Incorporate disaster-prone points and natural and anthropogenic factors causing disasters into the MaxEnt distribution model to simulate and predict the disaster risk in the study area.



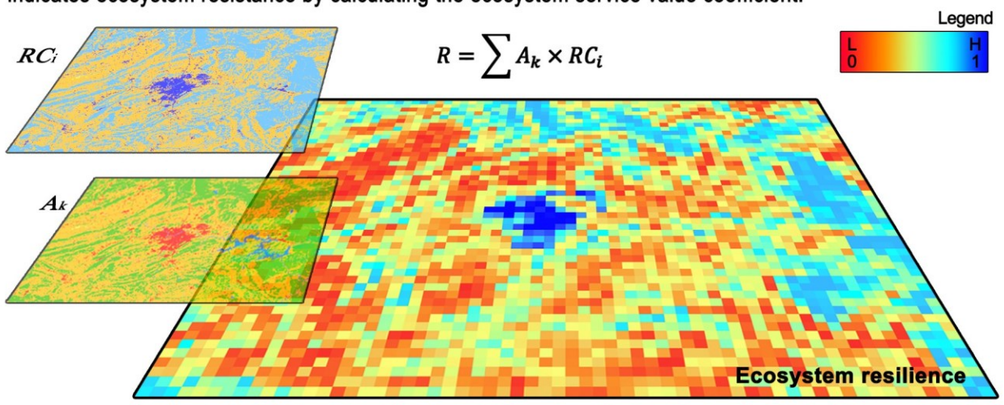


Construction of ecological resilience network

Integrating ecological resilience and water risk assessment to construct a water resilience network

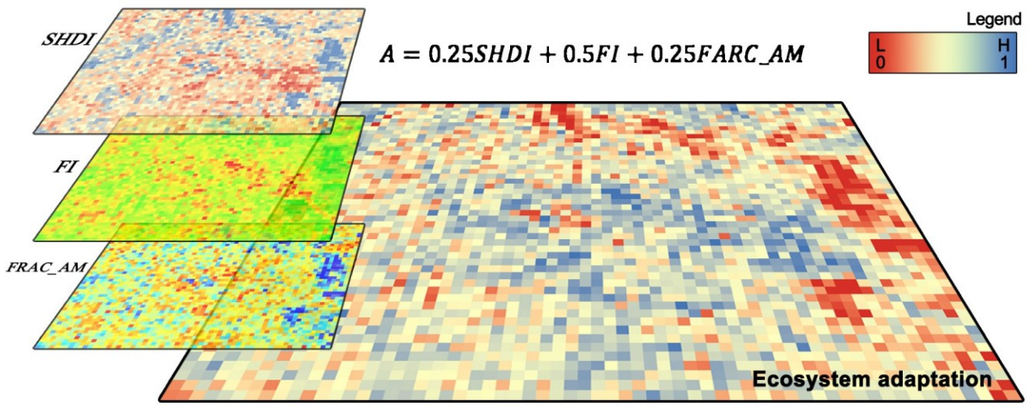
Ecosystem resilience assessment (R)

Resistance refers to the ability of an urban ecosystem to withstand external disturbances. The study indicates ecosystem resistance by calculating the ecosystem service value coefficient.



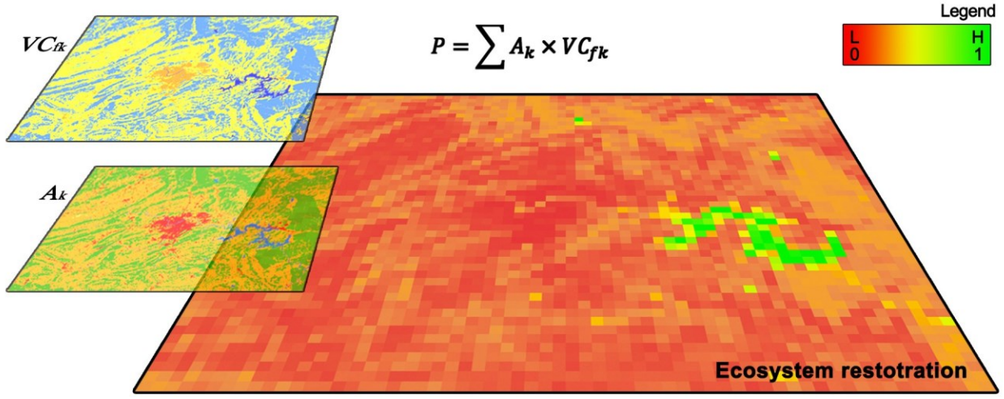
Ecosystem adaptation assessment (A)

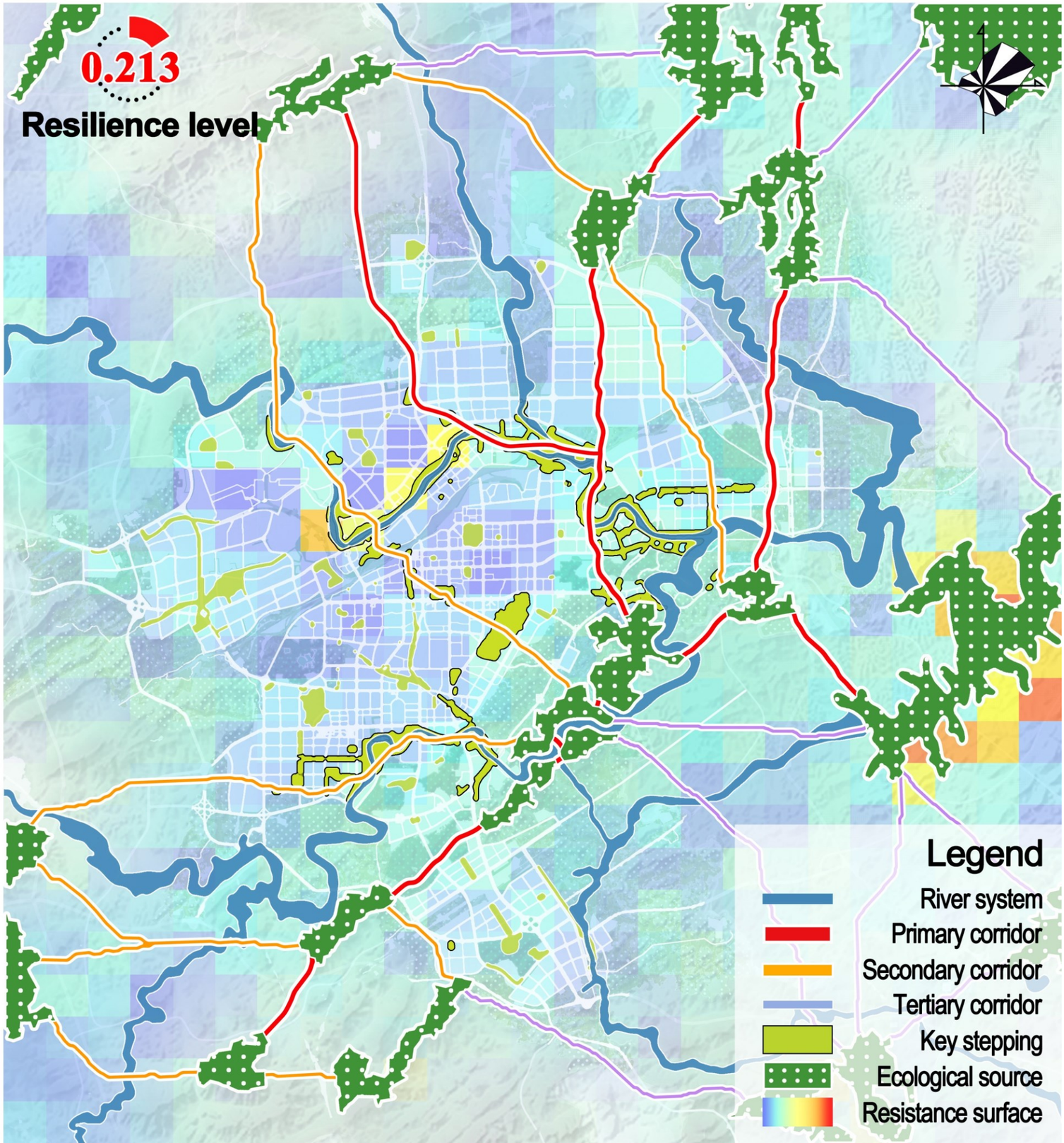
Adaptability refers to the stability of the landscape structure within an urban ecosystem. The study indicates ecosystem adaptability by calculating landscape indices.



Ecosystem restoration assessment (P)

Restoration refers to the ability and potential of an urban ecosystem to recover to its original state after experiencing harm, calculated with reference to the ecological elasticity coefficient.

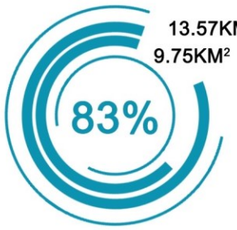




CLASSIFICATION OF GREEN SPACE TYPES

A city living with the river: from isolation to openness and sharing

ECOLOGICAL GREEN SPACE



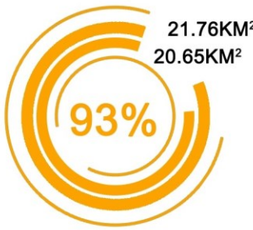
Enhanced ecological services and carbon sequestration capacity

Building water storage spaces to improve water security resilience

Utilizing rich ecological communities to regulate the water cycle

The area of ecological green space in the core urban area has increased to 13.57km², and the proportion of sponge green space renovation has reached 83%.

PRODUCTION GREEN SPACE



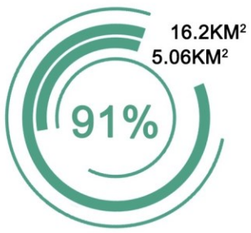
Water from agricultural irrigation canals is biologically purified and recycled.

Country roads are gradually improved to increase park accessibility and food transportation efficiency.

A multi-stage water system is installed in the terraces for rainwater collection, storage and utilization.

Permanent farmland is protected in the production green space plan, and water purification and recycling within the terraces is 93% and 85% respectively.

PARK GREEN SPACE



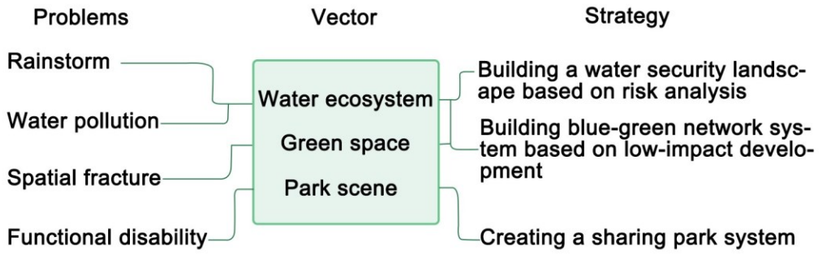
The surrounding mountains and the rivers that flow through the city together frame the city's landscape

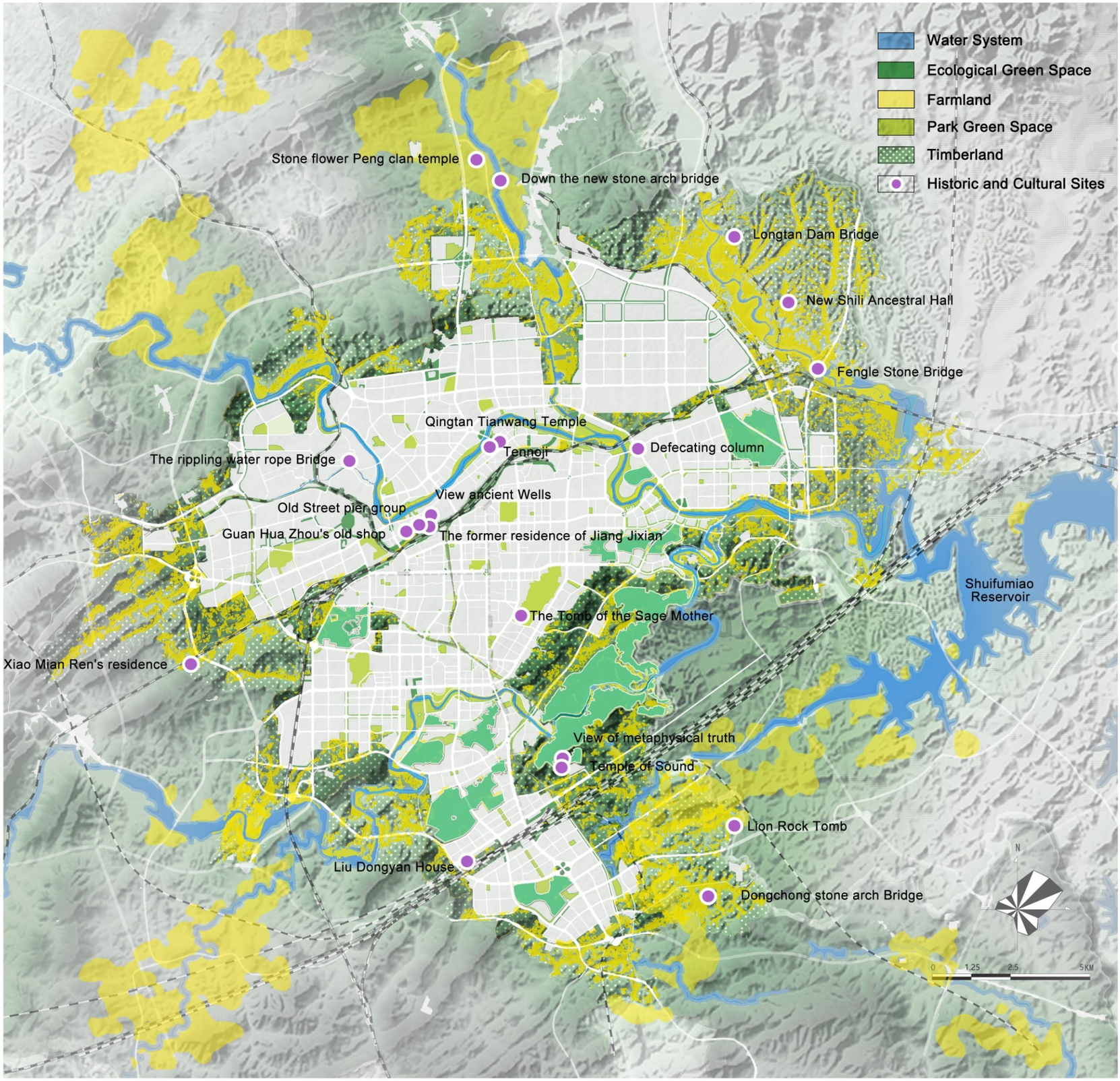
The park's green space is rich in trees, shrubs and grasses with a reasonable planned percentage.

The park is well-serviced and people can socialize and play in it.

157 city parks are planned for the project, with a total park area of 16.2km².The coverage rate of the service radius of park green space has reached 91% .

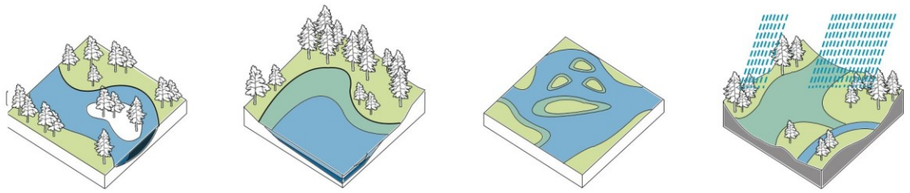
TECHNOLOGY ROUTE





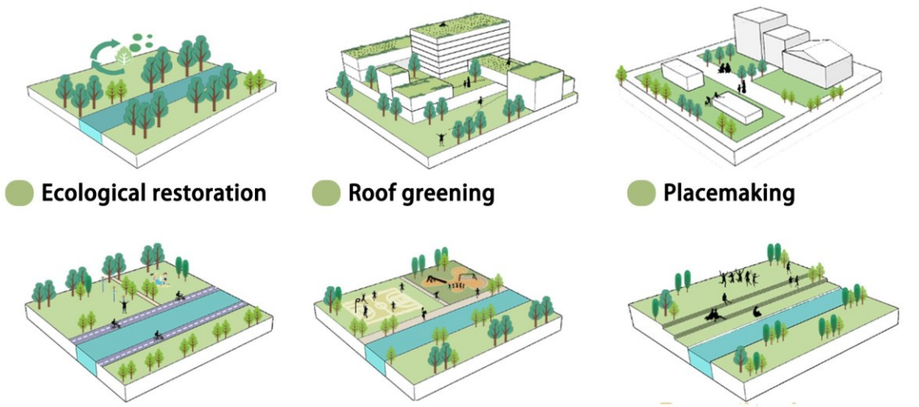
URBAN GREEN SPACE PROMOTION STRATEGY

ECOLOGICAL PLANNING



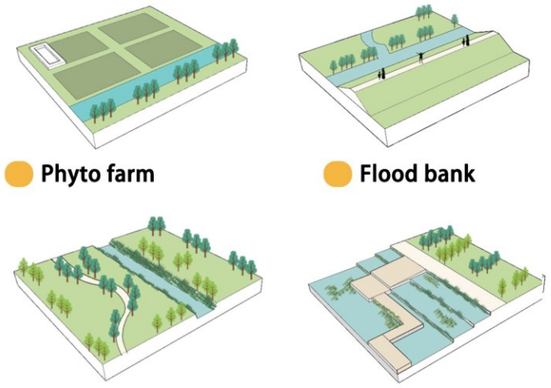
- Widen river course
- Waterfront renovation
- Water purification wetlands
- An urban flood park
- Protect wildlife
- Collects rainwater
- Add rain gardens
- Shoreline remediation

GREEN SPACE SHARING



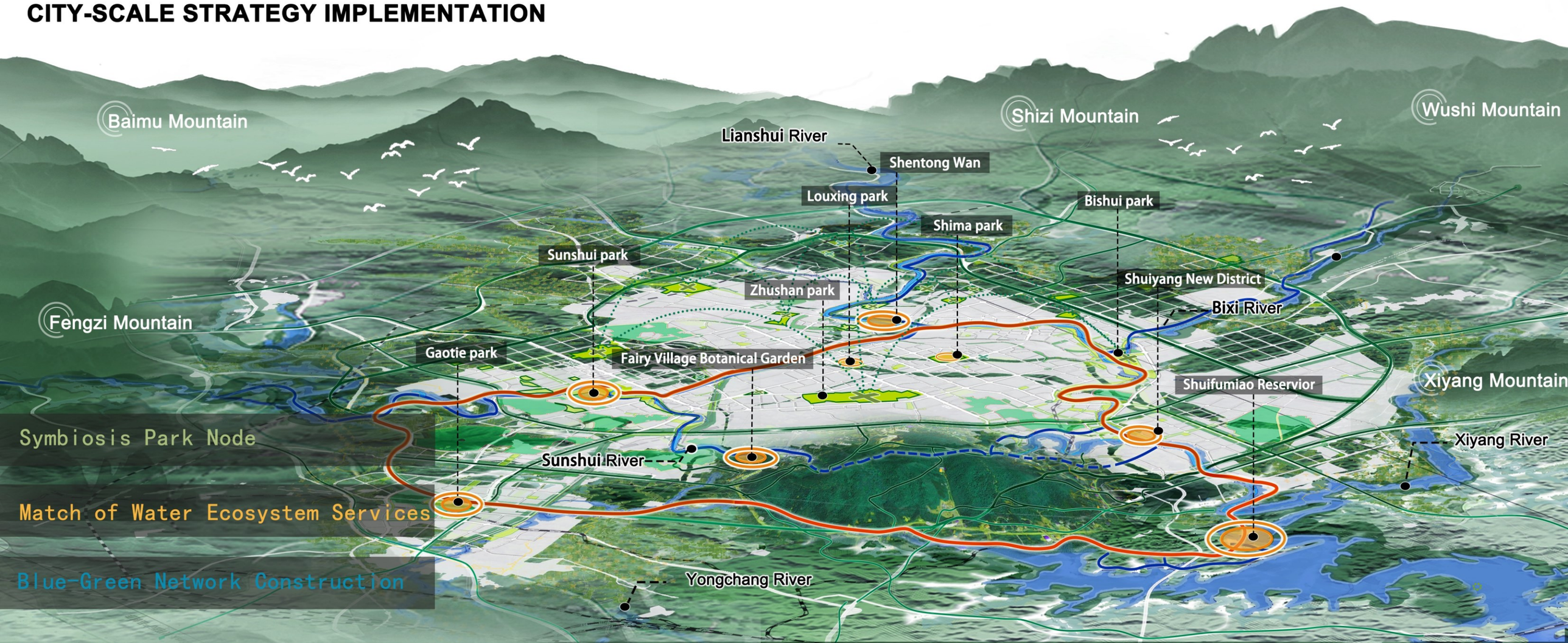
- Ecological restoration
- Roof greening
- Placemaking
- Bikeway along the river
- Functional recombination
- Recreational green space

BMPs



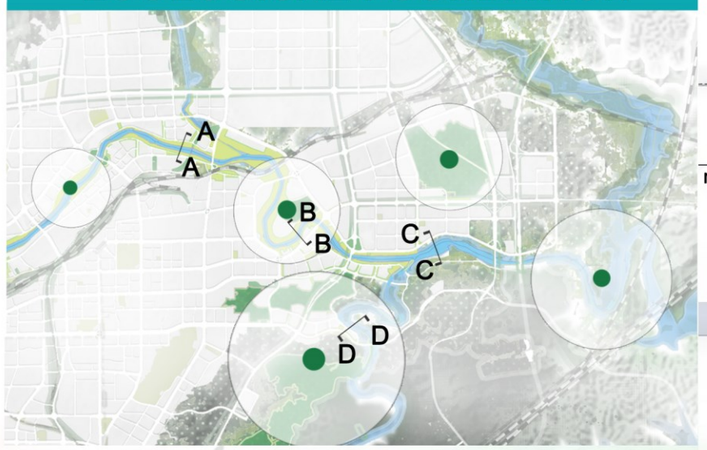
- Phyto farm
- Flood bank
- Urban greenways
- Catchment basin

CITY-SCALE STRATEGY IMPLEMENTATION

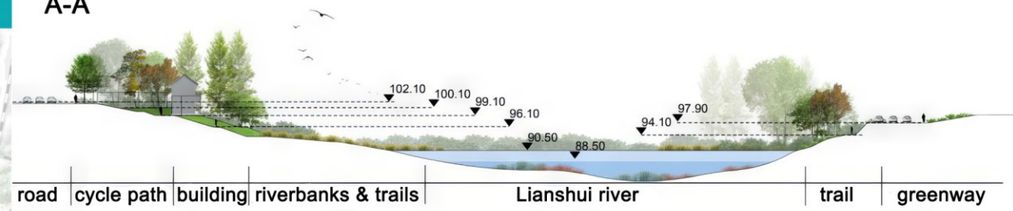


ECOLOGICAL GREEN SPACE

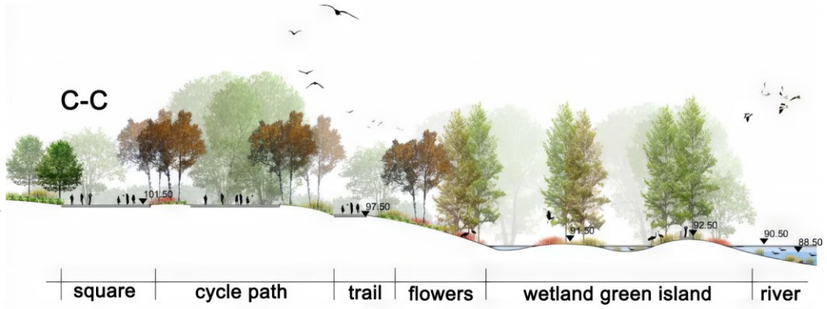
ECOLOGICAL FOUNDATION



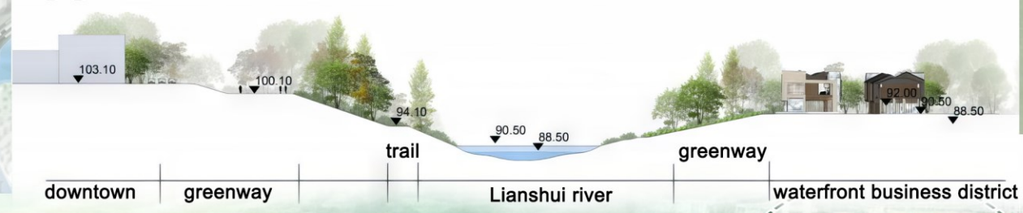
A-A



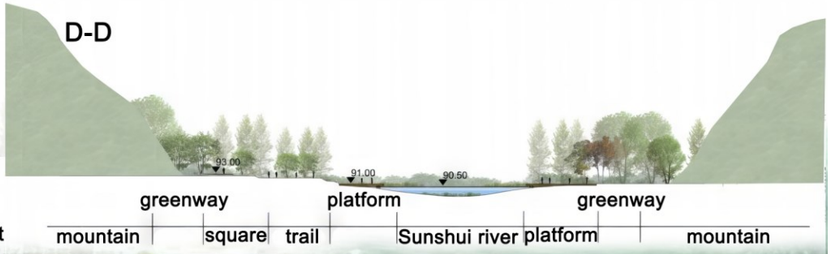
C-C



B-B



D-D



Riverside Ecological Corridor

Sunshui River

Jianglong Park

Xiannvzhai Ecological Land

Dabuqiao Ecological Land

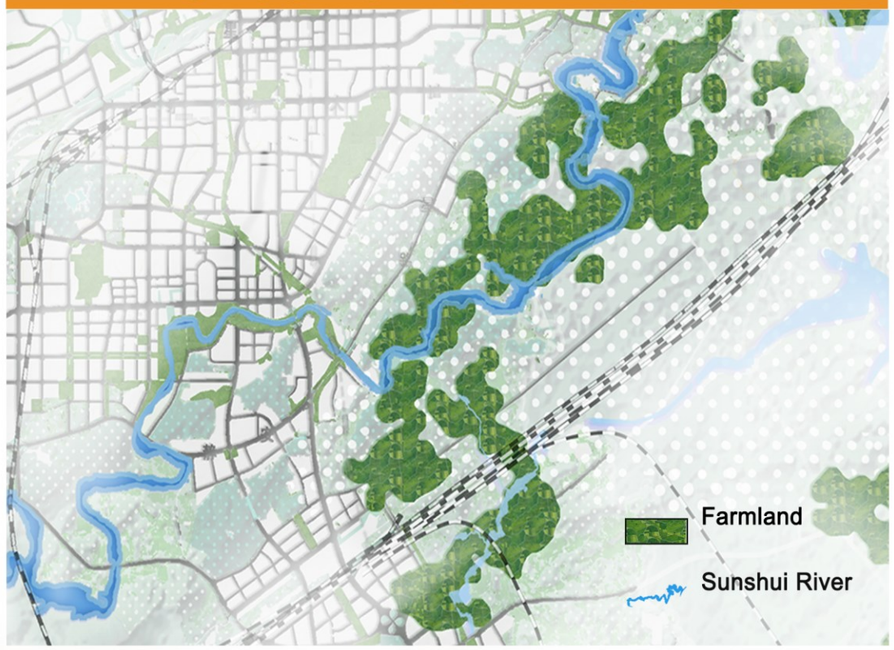
Lianshui River

White Egret Bay Peninsula

Reservoir Direction

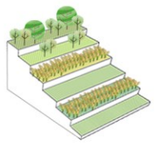
PRODUCTION GREEN SPACE

PRODUCTION GREEN SPACE



TERRACE

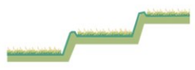
Adapt to local conditions to prevent soil erosion



+ slope gradient · cistern · grass waterway · Ridge of field · Biological control · Different kinds of crops · Collective management

Strategy 1:
The type of terrace is selected reasonably

Slope 3°-8°
Slope terrace

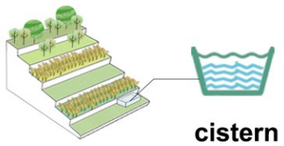


Slope <15°
Horizontal terrace

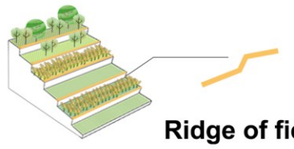
Slope 15°-25°
Terrace on a separate slope

Slope 15°-25°
Reverse slope terrace

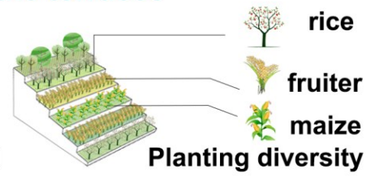
Strategy 2:
Improving terrace's structure and managing the terraces



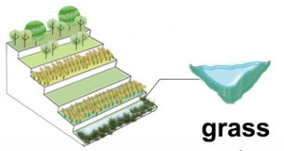
cistern



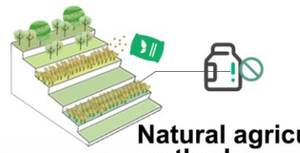
Ridge of field



Planting diversity



grass waterway

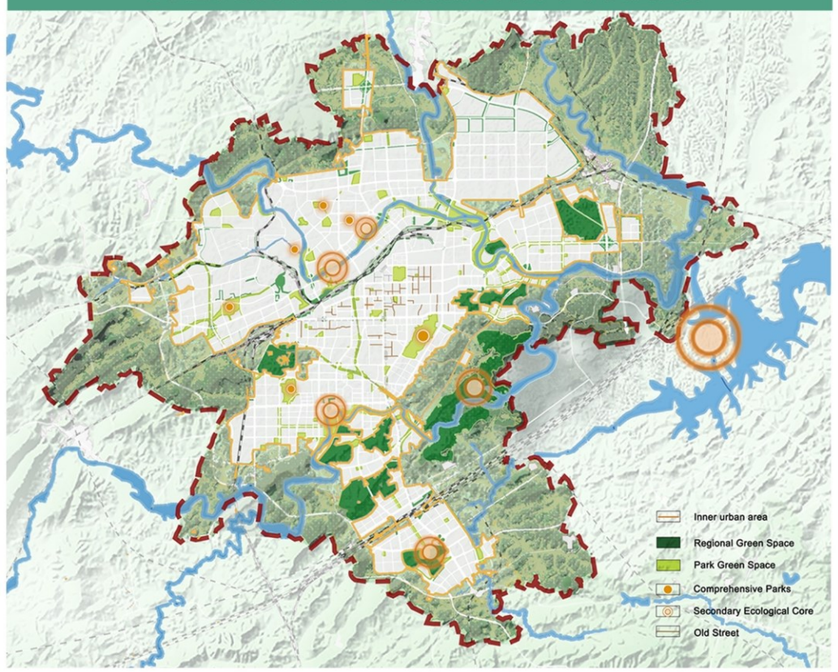


Natural agricultural method

Collective management

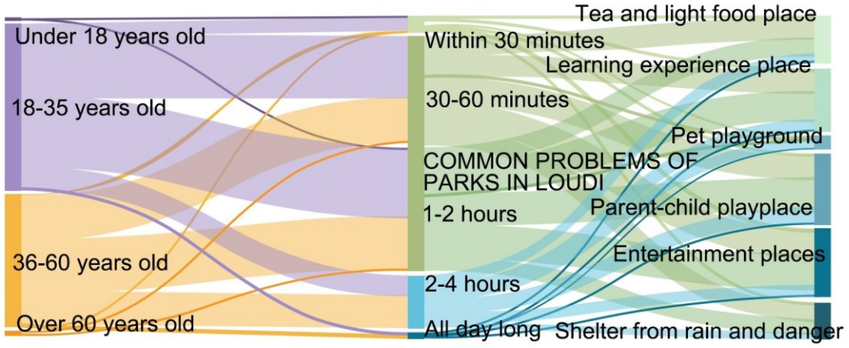
PARK GREEN SPACE

URBAN AND COMMUNITY PARKS

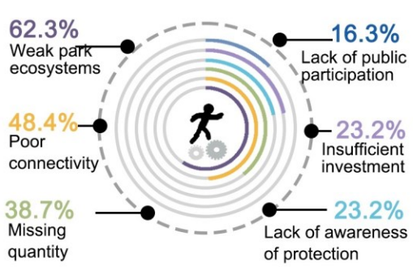


According to the questionnaire survey, residents of diferent ages spend different time in parks, most of which are 30-60minutes and 1-2 hours.As a result, people are more in need of parent-child play, recreational activities and other activity places.At the same time, the park should be appropriate to add sports venues,shelter and rest

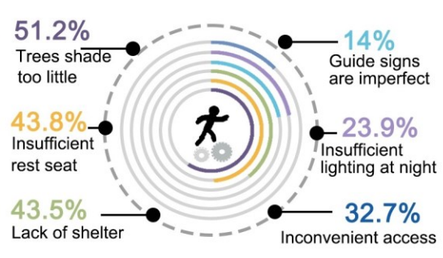
TIME AND PLACE NEEDS OF RESIDENTS OF DIFFERENT AGES TO PLAY IN THE PARK



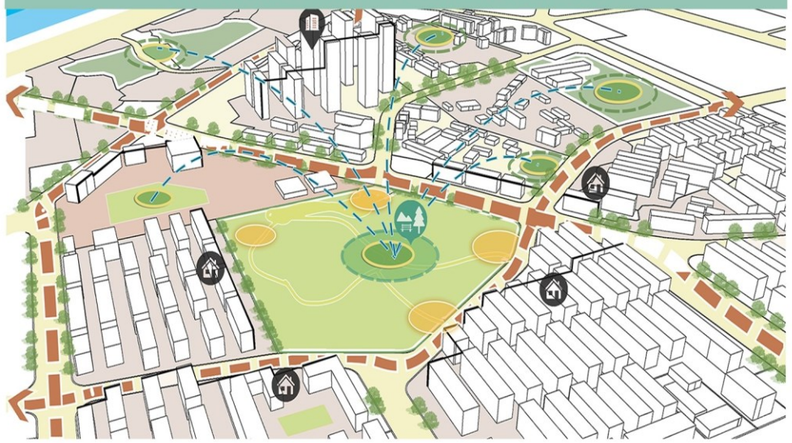
COMMON PROBLEMS OF PARKS IN LOUDI



THE INCONVENIENCE OF GETTING FROM HOME OR WORK TO A NEARBY PARK

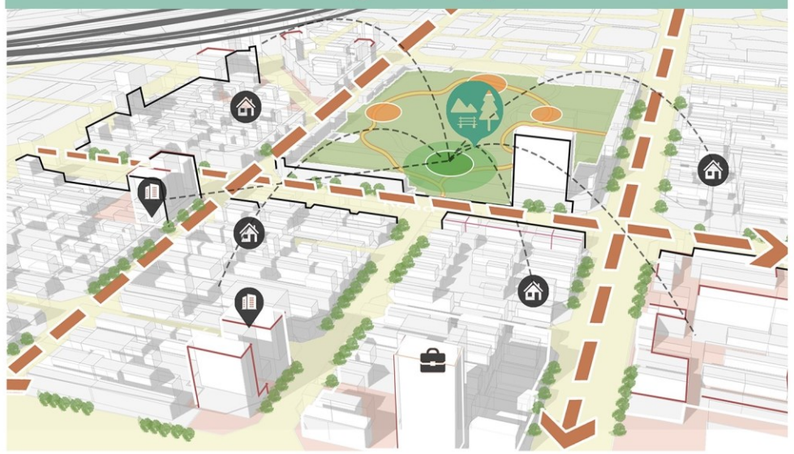


Functional recombination



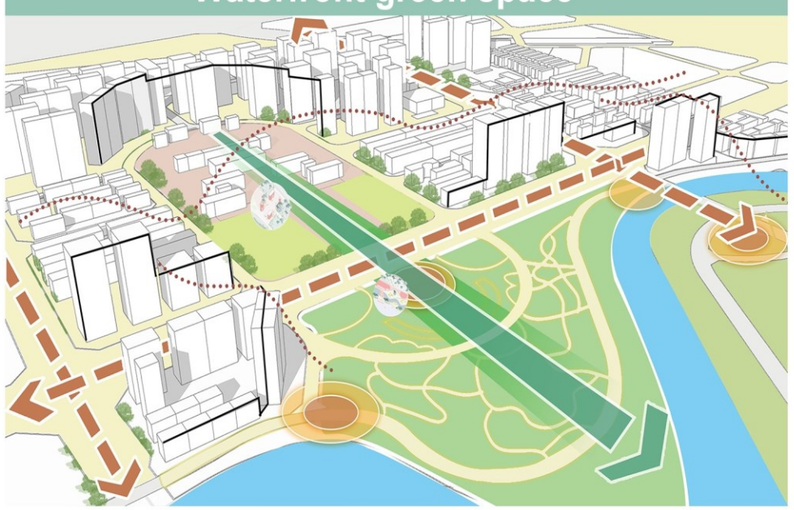
Integration of green space

Activate green space



Placemaking of Green leisure space

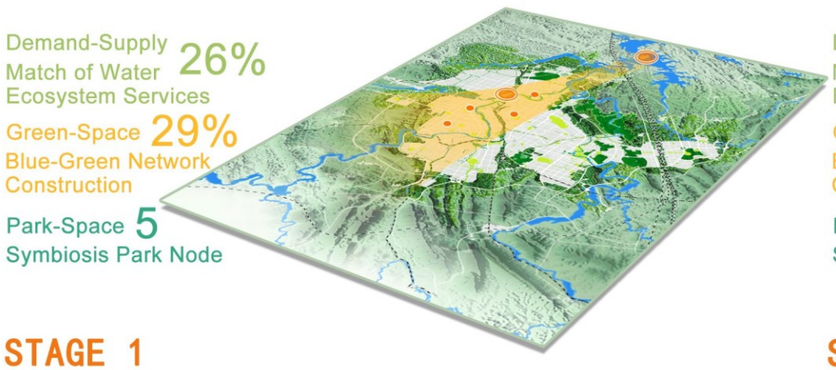
Waterfront green space



Protection and restoration of the overall style

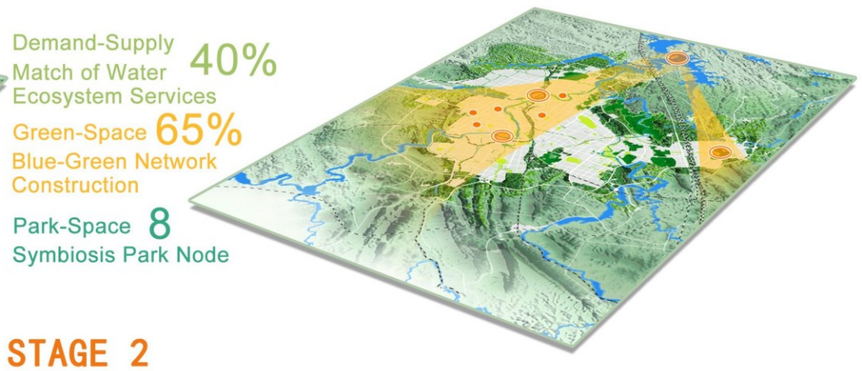
VISION

This water resilient ecosystem will be implemented in phases to gradually improve green space and ecological sharing. Improve the regional blue-green network environment and realize the healthy and sustainable development of Loudi. Gradually improve the green, ecological and shared environmental benefits of the new city.



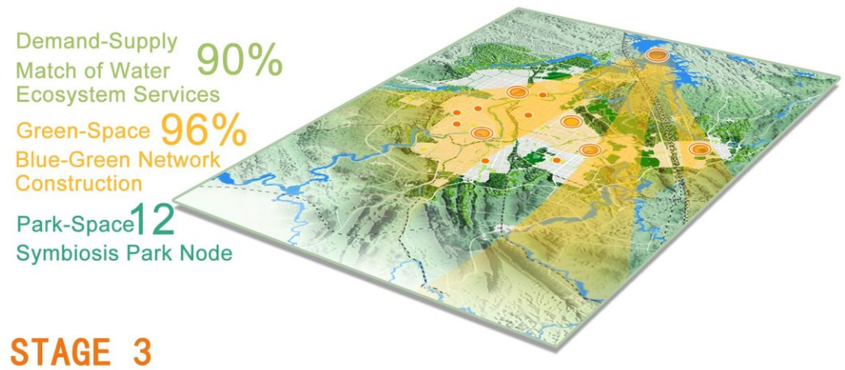
STAGE 1

Based on the natural surroundings. we construct the blue-green system along the main rivers,trying to improve the ecological environment of site. 5 cultral scenic nodes are designed with open spaces.



STAGE 2

We strengthen the horizontal connection between green belts, and implant multi-level park systems according to different landuse. We try to perfect landscape system and activate the whole site.



STAGE 3

We will build a water resilience system for urban areas through the mutual integration of multiple elements such as wetlands, rivers, parks, and cultivated land. In this phase, we will strive to enhance the interaction between the elements and maximize the ecological value.