

REGENERATION OF CULTURAL LANDSCAPE

INHERITANCE AND DEVELOPMENT OF TRADITIONAL
ECO-WISDOM OF POLDER LANDSCAPE IN YANGTZE
RIVER REGION, CHINA

KULTÚRTÁJ-MEGÚJÍTÁS A JANGCE FOLYÓ MENTI POLDERTÁJ FEJLESZTÉSE AZ ÖKOTUDATOS TÁJGONDOZÁS HAGYOMÁNYAINAK MEGÚJÍTÁSÁVAL

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ABSTRACT

As an important form of land utilization and agricultural production along Yangtze River in Anhui Province, the polder constitutes the typical cultural landscape in the course of interactions between local residents and the great nature. The geographical conditions composed by the polders, the dams and the water network, the people and other living things in such an environment form the social ecological system (SES) together, which has not only constituted the local landscape with great regional characteristics, but played significant social and economic roles in history. Nowadays, the transform of land use results in confliction between the traditional eco-wisdom of polder landscape and the construction of new town in this area.

To make reconnection, the paper summarizes the mechanism of the traditional polder landscape, which consists of three subsystems of stormwater management, land use and community. Based on that, regenerative strategies of planning and design are proposed in the case of Hangbu New Town in Shucheng County of Anhui Province. The conclusion can be drawn that the eco-wisdom of polder landscape still shows its strong vitality in proper planning strategies, and landscape regeneration should integrate economic, environmental and social efficiency together for the development of new towns.

Key words: landscape architecture; landscape regeneration; ecological wisdom; polder landscape; stormwater control; ecological security pattern

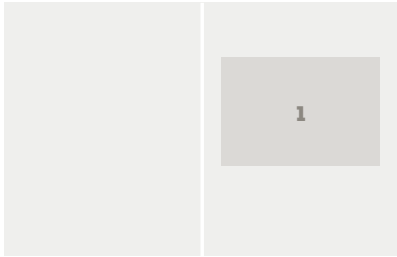
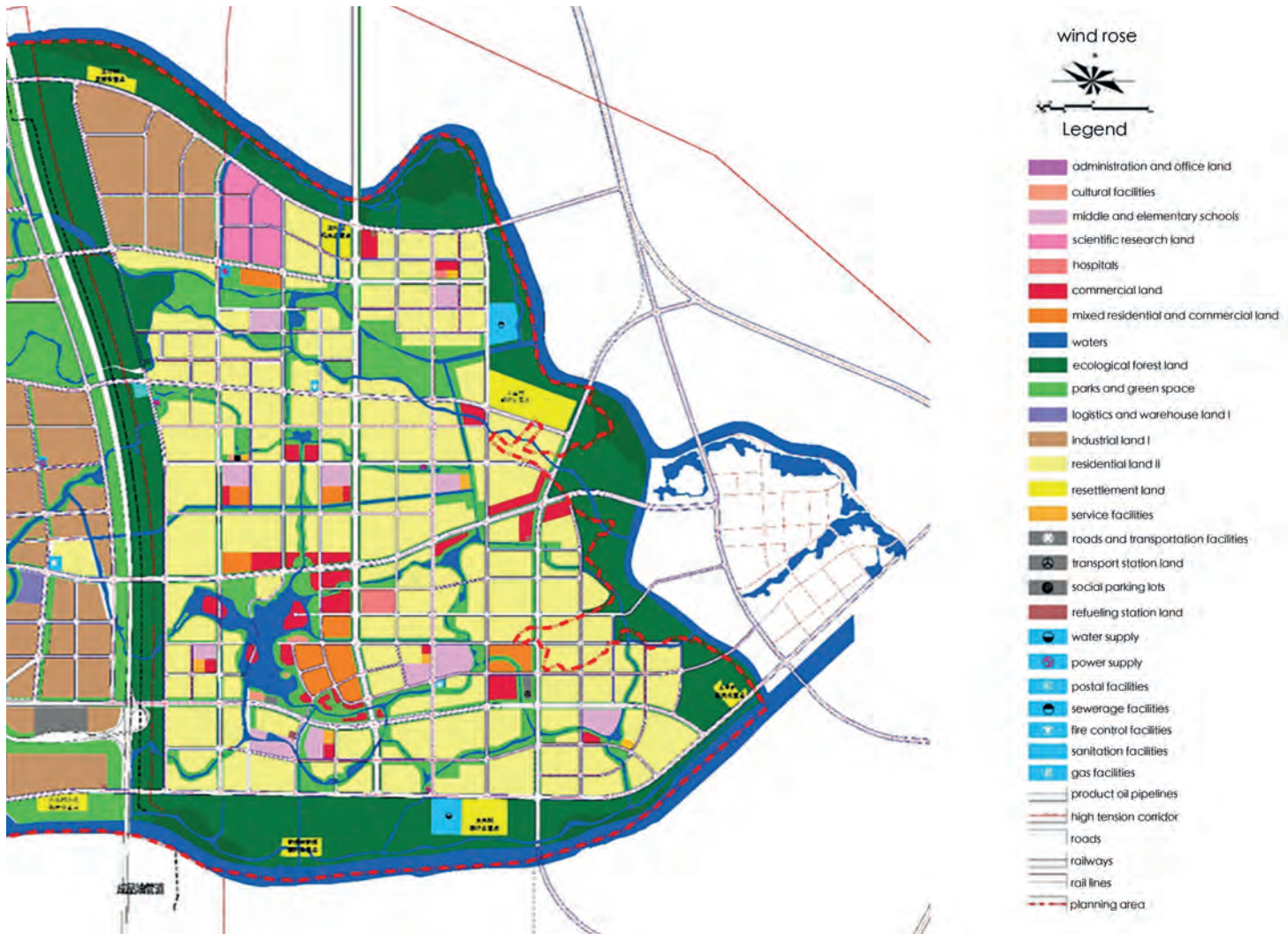


Fig. 1: Land use plan of Hangbu New Town



1. INTRODUCTION

Polder is an important agricultural landscape by transforming the capricious swamp into stable and fertile land, and imposed influences on regional production, hydrology infrastructure and town planning.¹ It is the wise response of ancient Chinese to the lowland environment in Yangtze River Watershed. It is a low-lying tract of farmland enclosed by dikes that form an artificial hydrological entity, meaning it has no connection with outside water other than through manually operated devices.² In the view of nowadays theory, it is a typical total human ecosystem, which integrates human systems and natural system together at the highest level.³ The system acts like an organism, all

the elements of the system work properly and symbiose harmonically.

As a representative vernacular landscape type especially in Dutch lowlands and Yangtze River Delta in China, polder has been studied from different perspectives through synchronic and diachronic research. Based on historical context research and diachronic comparison, Chinese scholars study the formation and historic evolvement of polder landscape, different parts of its structural components, functions on agricultural production, ecology and culture, and the impacts on regional land use patterns as well as the characteristics of settlement distribution.^{1,4-6}

Synchronic research focuses on the pattern of landscape space, the natural context and the mechanism of hydrology,

1 Guo W, Hou X L. *Dredge, Drain and Reclaim: Landscape Analysis of Polder Model in Dutch Lowlands*[J]. *Landscape Architecture*, 2015①:16-22.

2 ZHUANG Huaifeng. *Cult ivation of Diked Paddy - Fields in Ancient South - East China and Their Effects on Ecological Environment*[J]. *Journal of Chinese Historical Geography*, 2005①:87-94.

3 NAVEH Z. *The total human ecosystem: integrating ecology and economics* [J]. *BioScience*, 2000(4): 357-361.

4 Hou X L, Guo W. *Polder Landscape Study Discussion on Form, Function and Impact*[J]. *Landscape Architecture*, 2015.

5 Guo W, Hou X L. *Dyke, Reclamation and Settlement: Landscape Architectural Analysis of Polder Landscape in Xiaoshao Region*[J]. *Chinese Landscape Architecture*, 2016(7):41-48.

6 Guo W, Hou X L. *Land from the Sea: Landscape Architectural Analysis of Lake Bed Polders in North Holland during Golden Age*[J]. *Chinese Landscape Architecture*, 2015, 31(7):97-101.

and the assessment as an important part. Considering the differences among contexts, Chinese scholars concentrate on regional ecosystem service⁷ such as Taihu Basin⁸ while foreign scholars' place more importance on polder management of Dutch lowlands such as risk resilience⁹⁻¹² and spatial quality provision.¹³ Recently from a more comprehensive perspective of landscape architecture, scholars pay more attention on the cultural and aesthetic value in the preservation of polder beside ecological functions.¹⁴ Typological methods are used in the analysis of structural characteristics and spatial design disciplines, which are critical to polder transformation,¹⁵ but the role that polder landscape plays in new town planning and its land use is still lack of attention.

With the continued process of urbanization in China, there will soon be more and more new towns constructed on the polders in Yangtze River Watershed. Essentially speaking, same as the ancestors making polders, the purpose of the construction activity is also to improve the environment on the land that is not suitable for living, and to pursue happiness. Traditional ecological wisdom is a summary of agricultural social experience, and the construction of a new town will bring a change in the way of land-use. Nowadays, the transformation of land-use from polder to new town results in neglecting of the traditional eco-wisdom, normally the polders are transformed in the way as if they have never existed during the land formation. Therefore, the construction of new town is facing many challenges:

- a) Aggravation of flood risk. As the polder is abandoned, a large amount of farmland will be replaced by construction land, which in turn, will cause the infiltration of the land surface reduce sharply. As a result, the risk of flood is aggravated.
- b) Decrease of biodiversity. The destruction of the natural environment caused by construction activities

is inevitable. When we remove the polders, the original ecosystem is also destroyed. It will result in the reduction of regional biodiversity.

c) Impact on settlement mode. Compared with the past, the rapid increase in the number of people living in residential areas will make the traditional low-density mode of human settlement no longer applicable.

All of the above show that the large-scale construction activities in polder areas fall into the dilemma of losing the guidance of traditional ecological wisdom. Can we inherit and develop the traditional polder eco-wisdom to make a sustainable new town? Before answering this question, the following issues should be taken into account:

- a) How to deal with the problems brought about by new town planning as well as formulate ecological and sustainable planning?
- b) Is the traditional ecological wisdom still applicable for guiding the construction of a new town?
- c) If it is still applicable, how to make it adapt to the new context of urban construction?

This paper tries to answer the above questions based on a case of planning. The site locates in Shucheng County of Anhui Province, which is in eastern China. Polder landscape is the typical feature of this area. The developer and local government invited the research team, to give advices and provide consultation service to the construction of here mentioned Hangbu New Town.

2. TRADITIONAL ECO-WISDOM OF POLDER LANDSCAPE IN YANGTZE RIVER REGION

The Yangtze River Watershed had been exploited long ago, it can be traced back to AD 140 according to documentary records. Polder landscape, as the typical feature of this area, also

7 Wang J Q, Tang C H, Yan W T. Mechanism and Pattern of Polders in the Yangtze River Delta: Effective Physical Form for Ecosystem Services Provision[J]. *Landscape Architecture*, 2018(1).

8 Dong C, Gao J. Assessment for polder water ecosystem service functions in western part of Taihu basin[J]. *Journal of University of Chinese Academy of Sciences*, 2014.

9 Manen S E V, Brinkhuis M. Quantitative flood risk assessment for Polders[J]. *Reliability Engineering & System Safety*, 2005, 90(2):229-237.

10 Guo W, Hou X L. The Analysis on Flexible Strategies of Flood Control in Netherlands Delta[J]. *Landscape Architecture*, 2016(1):34-38.

11 Cremers, Jan; Bekker, Sonja; Dekker, Ronald. / *The Dutch polder model: Resilience in times of crisis. Talking through the crisis: social dialogue and industrial relations trends in selected EU countries.* editor / Igor Guardiancich; Oscar Molina. Geneva: ILO, 2017. pp. 189-212.

12 Barendregt A, Wassen M J, Smid J T D. Hydroecological modelling in a polder landscape: a tool for wetland management[M]// *Landscape Ecology of a Stressed Environment*. Springer Netherlands, 1993:79-99.

13 Nillesen A L, Kok M. An integrated approach to flood risk management and spatial quality for a Netherlands' river polder area[J]. *Mitigation & Adaptation Strategies for Global Change*, 2015, 20(9):949-966.

14 Liu T, Dan-Zi W U. Study on the Vernacular Landscape in the Perspective of Landscape Architecture—Taking the River Network Plain in Taihu Basin as An Example[J]. *Chinese Landscape Architecture*, 2014.

15 Nijhuis S F, Han B. Polderscapes: The Landscape Architecture of the Dutch Lowlands[J]. *Landscape Architecture*, 2016.

has a long history in this area. It can be found as the pattern on ancient tablets or as official records in local historical County Annals. As a historical living environment of local residents, it is also a typical cultural landscape that reflects the traditional eco-wisdom of Chinese. In this paper, the traditional eco-wisdom of polders is expounded in three aspects: flexible stormwater management, efficient land-use, and polder-based community.

2.1 FLEXIBLE STORMWATER MANAGEMENT

The uneven distribution of rainfall in various seasons and areas is the biggest problem for agriculture in Yangtze River Region. Usually, there is drought in the spring and flood in the summer. As a result, water resources should be rationally allocated to avoid disasters and increase harvest. Polder is just the proper system to manage water resource—it consists of dikes, ditches and water conservancy facilities. Dike is a key component to protect farmland. The peripheral dike is the first line of defense, increasing its height and thickness can help link up the whole polder area; for the inner area, dikes of different heights will be built according to the elevation of site, so as to divide the polder into many retaining sectors. In this way, the stormwater will only flow over one or a few sectors instead of the whole farmland being flooded. The ditches around or in the polders are also very important. Their function is to drain water, sometimes even to store or retain the water. Transportation is available in some wide ditches or channels. Facilities such as watergates and waterwheels are controllers of the whole system. This hierarchical structure (Dike + Ditch + Facility) will effectively improve the flood control capacity and further strengthen the resistance to natural disasters.

2.2 EFFICIENT LAND-USE

In addition to the use of lower land as farmland, the ancient Chinese also knew how to use every patch of land in polders. Planting on dikes is a key technology for the land-use of polder. It is of great value for bank reinforcing, production, ecology, and aesthetics. Tree roots deep in the bank have a strong soil-fixing effect to resist the erosion of rainwater. Sometimes, people plant trees along the banks to make the soil compacted, and then build and connect the dikes after years. Fruit trees or mulberries are a good choice since they have economic value at the same time. Some other common economic plants are *Arundo donax*, *Zizania latifolia*. These trees and shrubs along or on dikes connected as a green network, it combines with the farmlands, creating the traditional wood-farm ecological communities. Finally, the polder landscape is also a place of scenic beauty to Chinese, many well-known poets wrote lots of beautiful poems in the history.

2.3 POLDER-BASED COMMUNITY

People built their houses on the dikes, created unique settlement patterns. For instance, Wei Guo researched on the settlement forms in Xiaoshao polders, summarized three patterns.¹⁶ Residents in polder areas also developed their unique customs and culture through thousands of years. In the polder area of Furong, residents worship Chen Chou, a local polder coordinator in the Ming dynasty, who had outstanding political achievements on stormwater control. After his death, a memorial temple was built for residents to worship him, and folk tales regarding to his achievements had been handed down since then. Nowadays, residents around Chaohu of Anhui Province, remain the custom of building tombs on dikes to

16 GUO Wei, HOU Xiaolei. *Dyke, Reclamation and Settlement: Landscape Architectural Analysis of Polder Landscape in Xiaoshao Region*[J]. *Chinese Landscape Architecture*, 2016(7):41-48.



Fig. 2: Master plan of Hangbu New Town

Fig. 3: Hierarchical sponge city system in Hangbu New Town

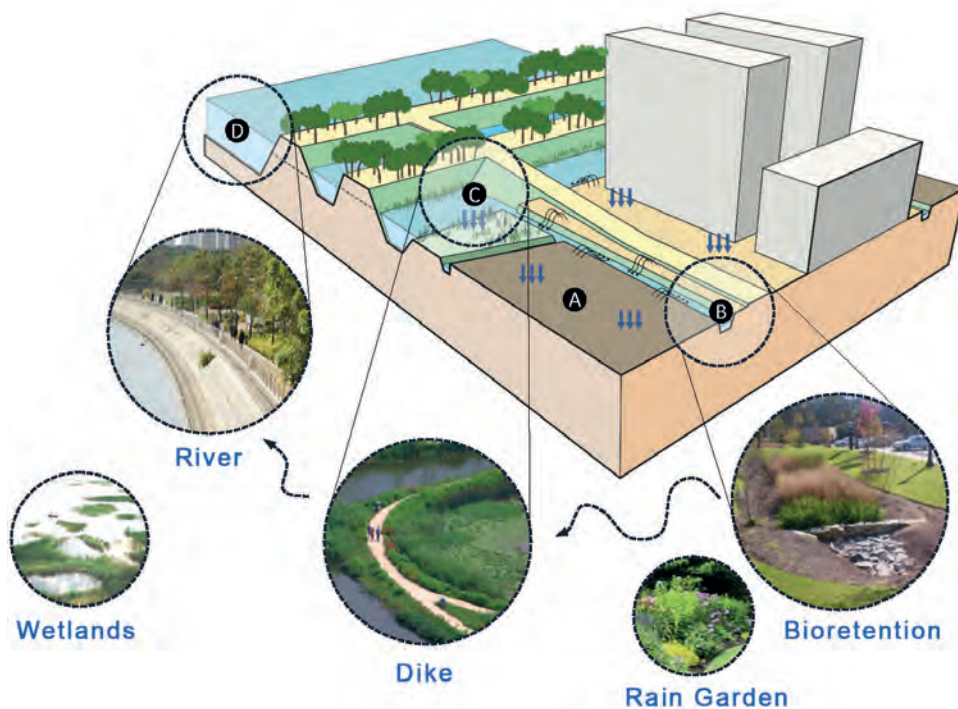
avoid flooding. In addition, it also reflects that polder system is closely associated to local residents from life to death. From the view of governance, residents of the district will allocate the amount of labor on the embankment maintenance based on the distance between the residence and the embankment or the number of privately owned farms. During the Song dynasty, there was a polder chief system, which took the responsibility for the supervision and implementation of maintenance.

In summary, it shows that the coupling development of the three subsystems, economy, society and environment, is the driving force for the virtuous circle of the entire polder landscape system. Polder dikes can effectively prevent storm-water from taking away the nutrients in the soil, as a result, it contributes to good agricultural production. At the same time, polder, as wetland, has the most distinct land-water edge effect and is rich in biodiversity. The banks provide growing space for various trees, those economic tree species not only provide residents with additional income, but also reinforce the dikes so that keeping them from storm-water erosion. Polder landscape protects the safety of local residents; in return,

local residents are the maintainers of polder landscape system. People spontaneously formed temporary groups to work together to repair dikes and defend against floods and droughts at the critical juncture. As for environment benefits, the efficient flow of materials and energy in the system ensures the functions of ecosystem.

3. POLDER LANDSCAPE REGENERATION IN NEW TOWN PLANNING

The case in this paper is Hangbu New Town in Shucheng County of Anhui Province. It is a polder area surrounded by Fengle River, Hangbu River and wetlands. Between the two rivers, most riverways of Fengle River are natural; while riverways of Hangbu River are more artificial with lots of ponds, the lower courses of both rivers run into Chaohu Lake, an important big lake in the eastern part of China. Due to social development, part of the function of polder system has disappeared, for example transportation function of the main channels. Further more, due to the impact of fast urbanization, most of the local residents moved to cities, especially the young people who themselves



work in cities, leaving their parents and children living in the hometown. As a consequence, the polder settlements are declining. The unpleasant discharge of domestic garbage and sewage, as well as the siltation of the ditches, caused the status of the current water bodies to be extremely poor.

Local government and developers aimed to change the current situation. The comprehensive planning for the new town illustrated the ambition of the developers. As seen in the land use plan (Fig. 1), there is a road grid in the new town that has no relation with the network of dikes, but green spaces are carefully planned based on it. My research team proposed a sketch of new plan for the new town, which considered coordinating the road network with the original polder landscape (Fig. 2). Unfortunately, it was not accepted since the higher government has already authorized the comprehensive planning. However, our ideas to keep the polder system changed the developers' mind, they invited us to make a new scheme to utilize the polder system based on the comprehensive planning of the new town. In our proposal, we developed a series of strategies to merge the polder system

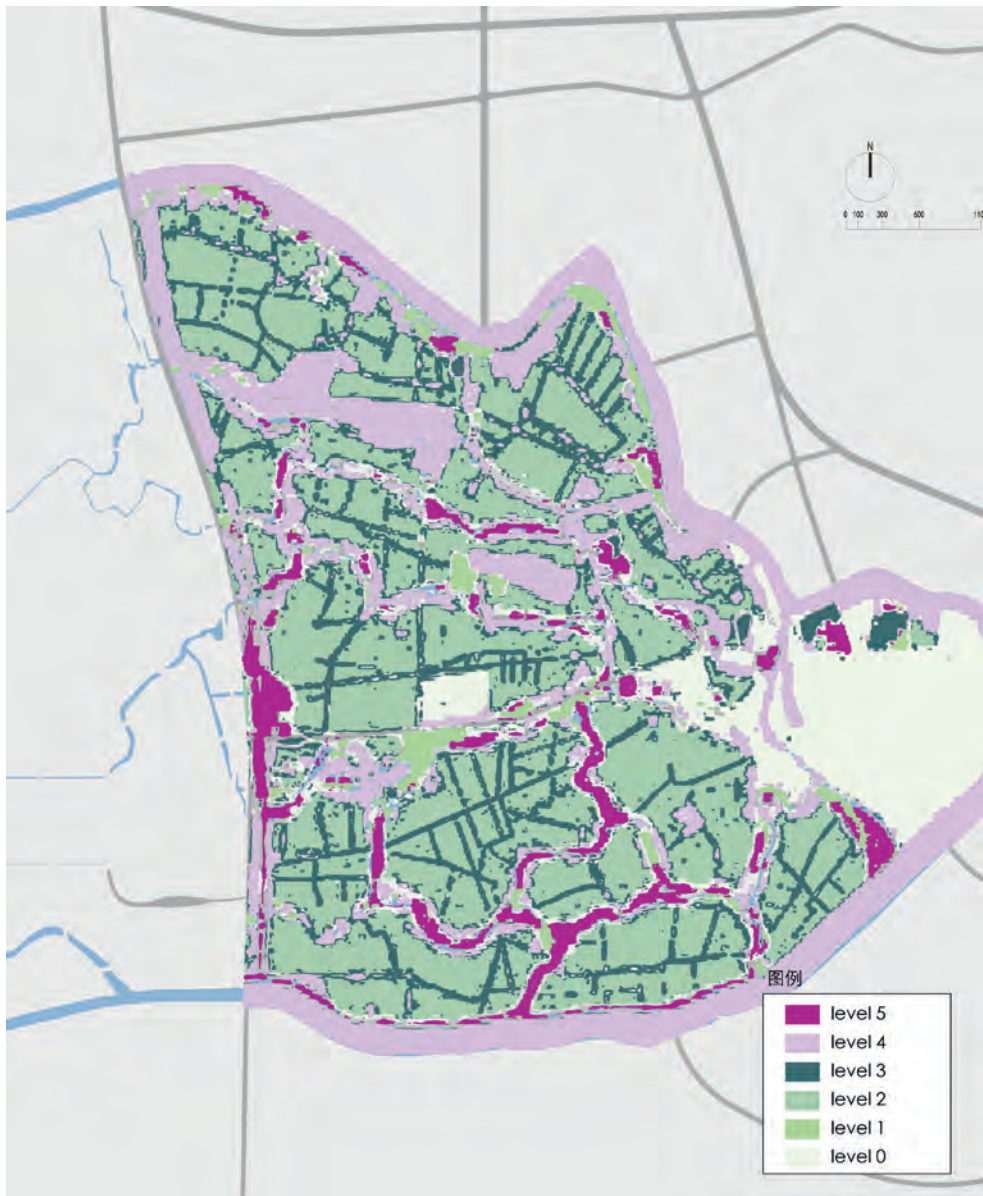
into the road grid, and to regenerate the polder landscape in new town. The paper introduces briefly as follows:

3.1 LOW IMPACT DEVELOPMENT

Since the polder landscape has always been using to prevent and control flood and waterlogging disasters in the history, it can also be used the same way nowadays in the new town. According to the low impact development (LID) concept in stormwater management, we set up LID solutions by reusing and restoring the polder system.

1) Using polder dikes as flood preventing system

Existing peripheral dikes are all kept and reinforced to prevent the flood from Fengle River and Hangbu River. We raised the flood control standards of the dikes from one in 30 years to one in 50 years, since the situation is much worse than before. For the inner dikes, firstly they should be adjusted and adapted to the planned road network. The elevation of the top of the inner dikes is 3.5 to 4.0 meters higher than most of the elevation of those roads. We checked all the crossings of the inner dikes and planned



roads, calculated the slopes of the road while adjusting them to meet the dikes at the crossing, so that almost all the inner dikes can be retained. Secondly, new dikes are added to connect with the old ones, thus 16 flood retaining sectors are set up. By reusing the existing polder dikes, a safer flood preventing system will be set up for the new town.

2) Dredging ditches as retaining & drainage system

Modern cities use underground pipelines as drainage system. It is suggested

to apply multi-methods in stormwater management according to LID, especially rain gardens and bioretention in green lands. In the proposal, we restored the channels and ditches not only to drain away the rainwater to rivers, but also to retain the runoff in the rain-storm. The main concern of keeping all the ditches is land use efficiency. Since the ditches locate in the green land, our proposal is easy to be accepted by the developers. Aesthetics is another aspect that we considered, it can be resolved by design skill, as we will explain later.

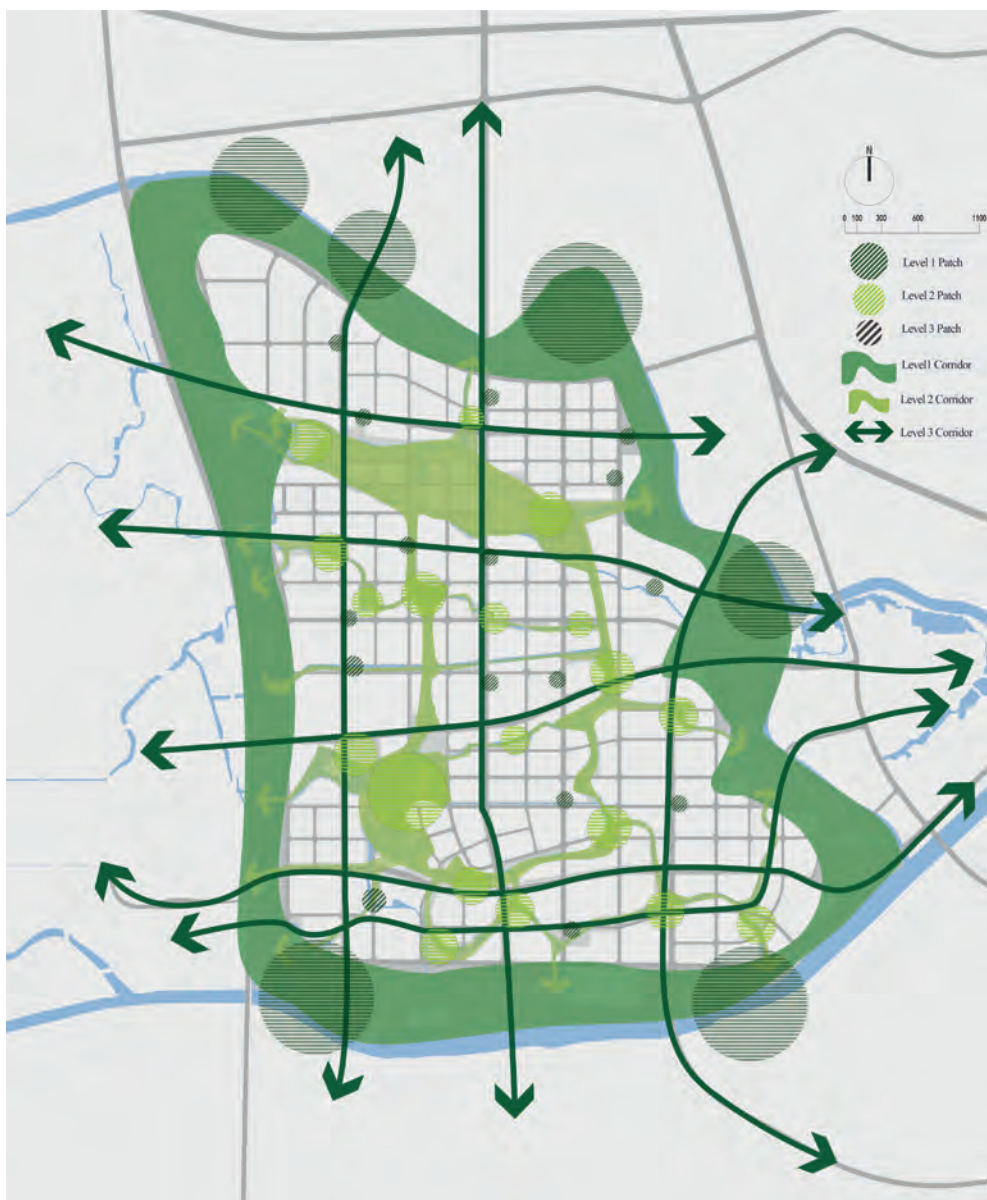


Fig. 4: Ecological Importance Assessment
Fig. 5: Greenway network of Hangbu New Town

3) Hierarchical sponges city system

Sponges city is a similar concept with LID, which is initiated in China. Based on the flood preventing and drainage system that consists of the dikes and ditches retained, combined with multi-level ecological retention system to achieve drainage, self-discharge, and natural infiltration, the proposal suggests to establish a hierarchical sponges city system.

The first level is the whole new town. Besides enclosed by peripheral dikes, the new town is also divided

into three districts by the main dikes and ditches inside. Drainage and irrigation station is planned in each of the three districts. The extra water will be carried to the drainage and irrigation station and finally pumped into Fenge River and Hangbu River. Several large wetlands are also planned along the peripheral dikes, which originally are the lower lands or ponds of Kutang.

The second level is the 16 flood retaining sectors or units in the three districts. Each sector is surrounded by existing dikes and ditches just



Fig. 6: Plan of green space in Hangbu New Town (flood adaptability is fully considered)

like the whole town. This nested structure forms an ecological security pattern, which is the typical character of the polder landscape.

The third level is the neighborhood. Pervious surface and rainwater collection are suggested in the construction. Rain garden and ecological retention ditches are planned in the neighborhood. Stormwater and living grey water in the dwelling unit (A) is discharged into the ecological detention zone (C) formed by the ponds of Kutang and Putian through the third-level ecological ditches (B) inside the neighborhood, where the water can be fully infiltrated; and at the same time, the accumulated surplus is either eliminated through the drainage pumping station, or eliminated through self-draining, or through the inflow of natural wetlands to the river (D) around the new town (Fig. 3).

3.2 ENHANCEMENT OF ECOLOGICAL BENEFITS

As illustrated in the map of ecological importance assessment (Fig. 4), the edge of each flood-retaining unit of the polder has the highest ecological importance. There are dikes with trees planted, ditches and ponds along the dikes forming the wetlands in polders. Thus, protecting the dikes and ditches will not only create the LID system in the new town, but also enhance the ecological benefits for the new town.

1) Protection of biotopes

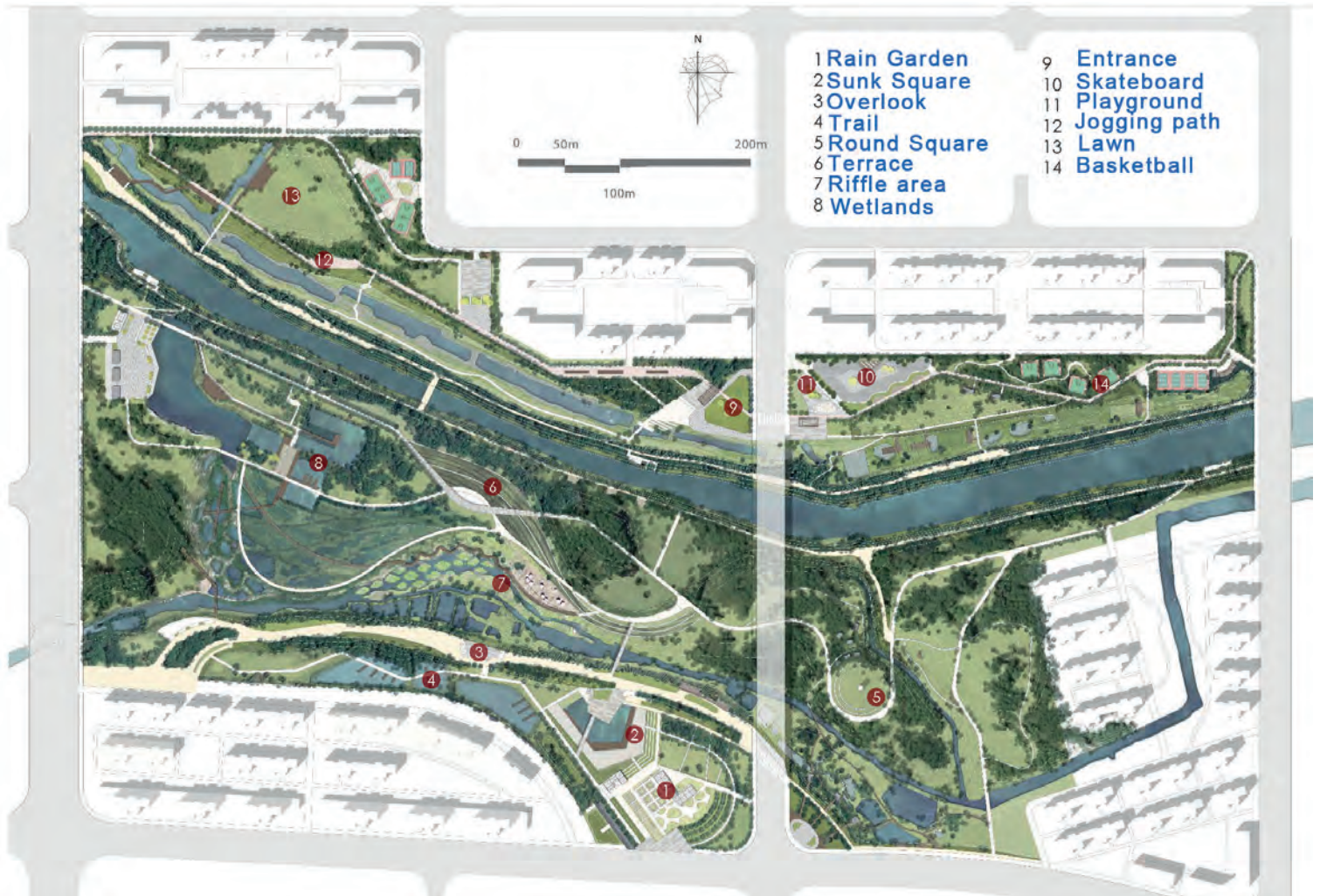
It is beneficial to protect the biodiversity of the new town by preserving the habitat and plant community on the dike and providing supporting ecosystem services. In our proposal, the retained dikes bring the new town 55 hectares of green space. Status quo of these greenbelts covered by growing well woods consisting of *pterocarya stenoptera*, *broussonetia papyrifera*, they are the natural habitat of many wild birds and small animals. In addition, the concept of small animals' passageway is also proposed in the planning, to reduce the interference of urban roads to the original animal activities.

2) Wetlands system

By protecting the existing dikes and the ponds of Kutang, planning new wetlands at the lower places, we established a wetlands system in the new town. Several large artificial wetlands are planned along the peripheral dikes, they synthesize the function of saving, retaining and purifying the stormwater, as well as the country parks for the residents.

3) Greenway network

Similar to the hierarchical sponges city system, we proposed a greenway network in the new town planning (Fig. 5). The first level, a green belt of 300-800 meters wide is planned along the peripheral dikes, including the large artificial wetlands embedded in. The



second level is to connect the dikes and ditches retained by new planned green spaces, the flood adaptability of which is fully considered in planning and design (Fig. 6). The third level is the green land in the neighborhoods, urban parks, as well as road green spaces grid.

3.3 OPEN RESIDENTIAL COMMUNITY

The residential pattern of the new town is based on the spatial structure of polder landscape. Inside is residents' living and working space, outside is the recreation spaces, such kind of "cell-like" morphology is an innovation of residential community. It has several advantages:

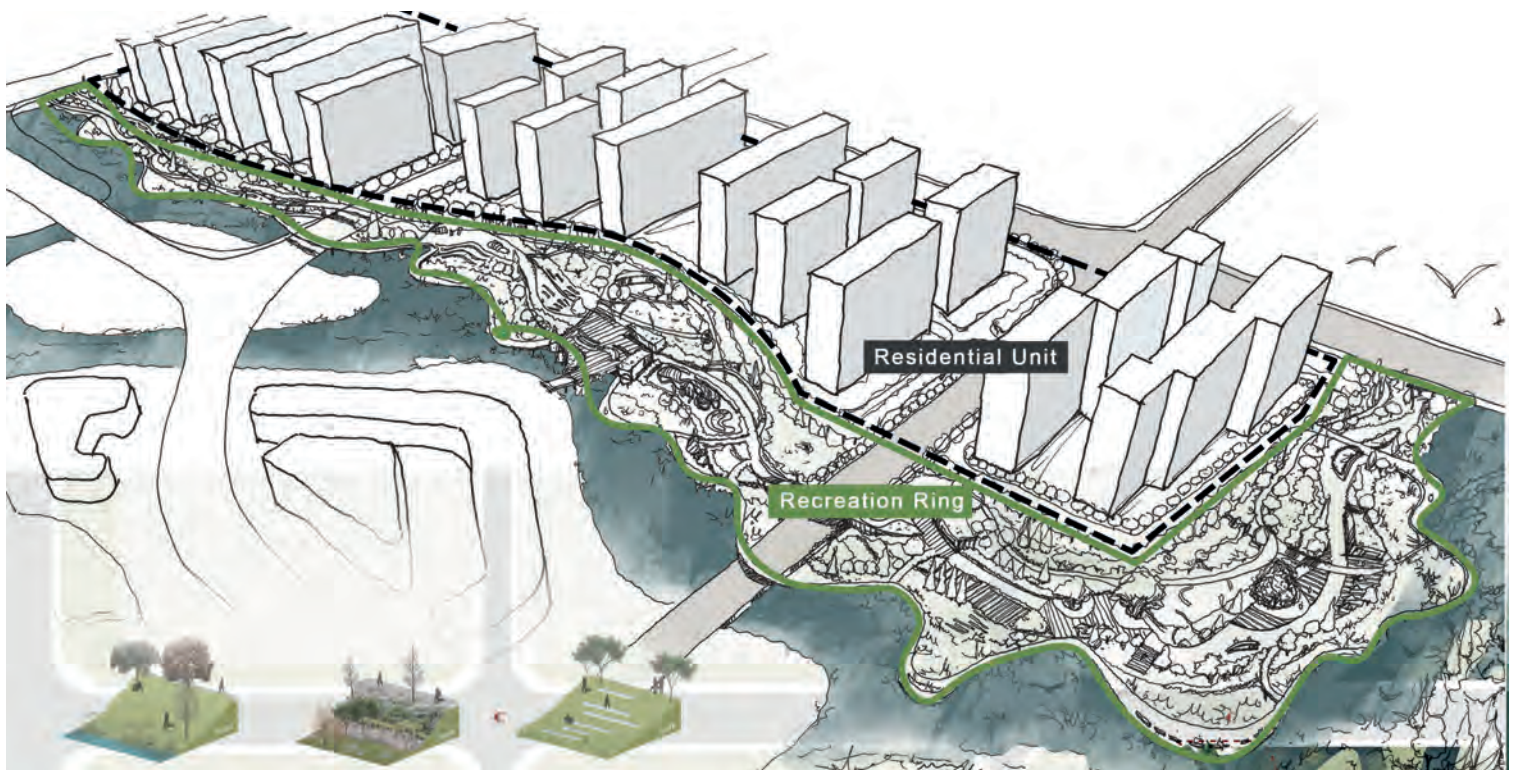
a) Comparing to the traditional inward neighborhood, the new pattern puts the necessary service facilities of living in the neighborhood, while the amenities and recreational spaces around (Fig. 7). It is more open and promotes sociability.

b) These linear green spaces are also urban parks. Higher accessibility and reasonable distribution provides the residents with more convenience.

c) It also makes full use of the existing landscape resources. It integrates blue and green with dikes and ditches surrounding neighborhood, providing residents with an open space network close to nature and helping them relax their mind and body.

d) Taking "cell-like" groups as units can carry out more accurate flood control and risk avoidance planning.

Fig. 7: Bird view of residential pattern in Hangbu New Town



For example, special emergency evacuation zones are designated on the dikes of each group, and materials for emergency are prepared in advance.

4. CONCLUSION

John Lyle once used “floated seeds” as a metaphor for development and utilization of the land. Only based on the deep understanding of ecosystem, the development can be deeply rooted, acts as “living organism”, adapts to the changes of the land, performs its own regeneration.¹⁷ Currently, new town construction focuses only on economic growth, but ignores the objective rules of interaction among economic, environmental, and social aspects. It caused damage to

ecological security pattern, intensified the tension between man and the nature. This paper argues that the effective ways to solve this dilemma is to realize the landscape regeneration, strengthen the function of ecological system such as adaptation, resilience, restoration and growth. The premise is the understanding of the continuous driver and mechanism of regeneration. ©

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¹⁷ LYLE J. *Design for human ecosystems: landscape, land use, and natural resources* [M]. Island press, 1999.

KULTÚRTÁJ-MEGÚJÍTÁS

- A JANGCE FOLYÓ MENTI POLDERTÁJ FEJLESZTÉSE AZ ÖKOTUDATOS TÁJGONDOZÁS HAGYOMÁNYAINAK MEGÚJÍTÁSÁVAL

A Jangce folyó mentén található Anhui tartományban a helyi lakosság a mezőgazdasági termelése során speciális, a helyre jellemző, ún. polder-tájat alakított ki. A polderek (feltöltött területek), a folyó és a gátak az itt élő emberekkel és állatokkal együtt különleges társadalmi - ökológiai rendszert alkotnak. A polder-táj nem csak ökológiai, hanem történelmi szempontból is különleges rendszer is, amely napjainkban a terület beépítése miatt új kihívások előtt áll. A cikk áttekintést ad a polder-táj hagyományos tájhasználatáról, a vízgazdálkodás, a mezőgazdaság és a társadalom szerves egységéről. A világ számos országában vannak ehhez hasonló polderterületek (a legismertebbek Hollandiában), azonban a használat és a fenntartás mindenütt speciális; ez a kutatás kifejezetten a Jangce folyó mentén kialakult tájjal, a hagyományos feltöltött területekkel foglalkozik.

A Jangce menti területek esetében az első és legfontosabb szempont a területek fennmaradása szempontjából az **árvizek kezelése**: az év során egyenetlenül hulló csapadék miatt a tavaszi időszakot a szárazság, a nyarat pedig az áradások jellemzik. A vízgazdálkodás legfontosabb feladata a katasztrófák megelőzése a gyorsan lehulló nagy mennyiségű csapadék esetében és az öntözővíz biztosítása a száraz időszakokban. Az árvíz elleni védekezés legfontosabb eszközei a gátak, az árkok és a víztározók, melyek védik a mezőgazdasági területeket. A külső védőgátak biztosítják a terület általános védelmét, míg a belső, alacsonyabb gátak és árkok védik a mezőgazdasági területeket. A gátak elsődleges feladata a védelem, az árkok a védelem mellett a víz elszívogatását is végzik. A hierarchikus védelmi rendszer (gátak, árkok, tározók) tehát egyaránt szolgálja a védelmet és a csapadékvizek megtartását.

A polderek fenntartásában a megfelelő tájhasználat kiemelkedő sze-

repet játszik. Kínában már egészen a korai időktől kezdve tudatosan törekedtek a polderek átfogó és teljes körű hasznosítására. A gátakra előszere-ttel telepítettek növényeket, hogy a gyökérzet javítsa a gátak állékonyságát, csökkentse az erózióvesztést. Sok esetben először fákat ültettek a folyómederbe a talaj megfogására, és csak évekkel később alakították ki a gátat. Az eperfák, a különböző gyümölcsfák vagy a vadrizs különösen kedveltek voltak, mert a talaj stabilizálásán túl a termés révén jelentős gazdasági hasznot is hoztak. Hasonlóképp a gátakon és a gátak mentén ültetett fák és cserjék, a farmokhoz kapcsolódva, értékes zöldhálózatot hoztak létre, amit a helyi társadalom nagy becsben tartott. A polder-tájalkotta tájkép szépségét számos vers örökítette meg.

A polderek lakói az évszázadok alatt szoros egymásrataltsághoz éltek egymással, hiszen együtt kellett működniük a gát- és csatornarendszer fenntartásában. Így erős, együttműködő társadalmi struktúra jött létre, ami egyes területeken (pl. Furong) mind a mai napig megfigyelhető. Az itt lakó, gazdálkodó emberek ma is együtt élnek a természeti rendszerekkel: a polderek megvédik az itt élőket, míg az itt élők fenntartják a gátakat, csatornákat.

Hogyan lehet a polderek helyreállítását ötvözni új városok építésével?

A cikkben az Anhui tartományban található Hangbu város példáját dolgozta fel a szerző. A poldert, ahová az új város épül, a Fenge folyó, a Hangbu folyó és nedves élőhelyek határolják. A két érintett folyó a Csao-tóba folyik, mely Kína keleti részének egyik legjelentősebb tava. A hagyományos polder-táj az elmúlt évtizedekben részben elveszítette funkcióját, a csatornák közlekedési használata eltűnt, a felgyorsult urbanizáció hatására a falvakból a városokba költöztek az emberek, s így a falvak elnéptelenedtek. A csatornák hulladékkal való feltöltése miatt a vízvisszatartó funkció megszűnt. A város tervezése során a korábbi polder-táj felélesztésére tettek kísérletet. Sajnos a döntéshozók nem támogatták az elképzelést, de ennek ellenére a terv

megváltoztatta a hozzáállást, s új stratégiák készültek a polderrendszer és város szerkezetének összehangolására.

Kis beavatkozású fejlesztés (LID)

A fejlesztés során arra törekedtek, hogy az árvízi védekezés során felhasználják és helyreállítsák a polderek rendszerét. A tervezés során a következőkre törekedtek:

- a gátakat, magasztás után, felhasználják az ármentesítésre, és az új gátakat is a régi rendszerbe integrálják,
- új csatornákat ásnak ki a víz elszívogatására, melyek a folyók áradása mellett az esővizek megtartására is alkalmasak,
- ún. szivacsvárost (sponge city-t) alakítanak ki, ahol a csapadékvíz be tud szivárogni a talajba.

Ökológiai előnyök

Az áradások visszatartásának komoly ökológiai előnyei vannak. A gátakra fákat ültetnek, a gátak közötti poldereken ökológiailag értékes nedves élőhelyek alakulnak ki, melyek az új város számára ökológiai hasznot jelentenek. A gátakkal védett területek 55 ha zöldfelületet jelentenek a város számára, ahol az őshonos növényzet mellett az állatvilág is meg tud telepedni.

A gátrendszer és a Kutang-tó megőrzése, valamint új nedves élőhelyek kialakítása a meglévő nedves élőhelyek megőrzését is elősegíti. A nedves élőhelyek révén javul az esővízmegtartó kapacitás és a víztisztaság is.

A vízvisszatartó hálózattal párhuzamosan egy zöldhálózat kialakítását is tervezik a városban, mely a város teljes területét behálózza és összeköti a környező polderekkel.

Lakónépesség

A polder-tájhoz hasonlóan a város tervezése során a társadalmi kérdésekkel is foglalkoztak, s az új város szerkezete a polderek szerkezetéhez alkalmazkodik. A város belső része a lakó és dolgozó funkciókhoz alkalmazkodik, a külső területek pedig a rekreációs funkciókat szolgálják ki. Ez a szerkezet elősegíti a szomszédos viszonyok kialakulását. ©