Ecological planning of the urban residential area for the sustainable development

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Abstract. Residential area is closely related to human living environment, and the construction of ecological residential area has become an important part of current architectural research. Studies on the landscape planning and design development direction of urban ecological residential area from the perspective of sustainable development were made in this paper, and then taking the planning and design project of "Cihu Lake Peninsula of Country Garden " in Huangshi city of China as an example, discussions about how to adjust measures to local conditions, put people first and keep pace with the times in landscape construction of eco-residential area were also present. This study provides reference for the combination of theory and practice of eco-residential planning and design.

1. Introduction
With the increasing environmental problems in the world, the urban ecosystem is increasingly fragile, and the residential environment is also facing many problems [1]. In recent decades, researchers at home and abroad have begun to pay attention to improving the living environment and realizing sustainable development. Therefore, ecological residential area has become the primary goal of urban residential area construction at home and abroad, and ecological residential area planning has also become a hot topic of research.

In the residential area planning design, instead of abandoning the artificial environment and natural environment antagonistic relationship, it should make the living environment integrated harmoniously with the natural environment, which is guided by the natural integrity and continuity of natural process. The urban eco-type residential area adopting this design concept is an ideal urban residential area with highly unified and sustainable development of natural ecology and human ecology, natural environment and artificial environment, material civilization and spiritual civilization.

2. The connotation of urban ecological residential area

2.1. Adjusting measures to local conditions
The respect and exploration of the local natural conditions, such as the climate and ecology, the historical and cultural conditions, are not subjective creations of the designers, but a comprehensive analysis of the living function and rules of the residential areas [2]. Only through systematic study of natural and human conditions, scientific grasp of modern production technology and comprehensive consideration as well as based on local specific conditions, respect the regional climate and the customs and culture, can we integrate the ecological concept into the details of planning and design and create a high-quality residential area with meticulous creation. Therefore, in the design of ecological residential areas, the primary task is to analyze the local natural factors, functional factors, ecological factors, human factors, spatial factors, technical factors, etc., and to make ecological planning and design suitable for the region in consideration of its unity, integrity and continuity.
2.2. People oriented
"People-oriented" is not a slogan of designers, nor a gimmick of developers. To truly achieve "people-oriented" firstly is to ensure the safety and health of residents, including traffic safety, personal safety and public health. In addition, to pay attention to environmental conditions, including clean and quiet environment, fresh air and clear water. Moreover, to ensure the quality of social interaction including harmonious, fair and mutual respect among neighbors, and pride in residential areas. And to ensure the enjoyment of leisure and entertainment, aesthetics and existing unique cultural and environmental resources, including the surrounding natural environment and cultural environment.

The ecological residential area is not just a visual form on the surface, but a material and emotional exchange generated from the harmonious relationship between human and architecture. Therefore, in the planning and design of ecological residential areas, people orientation is mainly reflected in residents' material and spiritual enjoyment, security and convenience of living, and the safety, convenience and comfort of their residences are guaranteed to the greatest extent. Considering the physiological and psychological needs of different groups of people, designer should enrich the functions and ornamentation of leisure facilities and service facilities, so that the old, middle-aged and young people will all feel physically and mentally pleasant. In addition, designers should also pay attention to the harmony and unity of the environment and the surrounding environment, such as the size, scale, details, texture, color and other forms of beauty.

2.3. Keeping pace with the times
Keeping pace with the times in the planning and design of ecological residential areas is to adopt appropriate new materials and technologies to achieve sustainable development. First of all, the whole life cycle of the architecture, from the initial planning and design to the subsequent construction, operation and management and final demolition, should be paid enough attention. The relationship between the building materials and the surrounding environment should be fully considered, and detailed layout should be made in the design stage to ensure that the materials and processes do not bring loads to the environment. Secondly, learn from advanced experience at home and abroad, optimize the allocation of water circulation and air circulation in the region, and maximize the saving and use of local materials and resources. Thirdly, intelligent technology and intelligent system should be reasonably adopted to improve the safety, comfort and convenience of residential areas. Therefore, keeping pace with the times in the planning and design of ecological residential areas is embodied in mastering relevant technologies and cutting-edge design, making efficient and rational use of resources, saving energy, land, water and talent, minimizing the impact on the environment, and providing high-quality living, working and activity space for residents.

3. Practice in ecological planning of urban residential area

![Fig 1. Aerial view of Cihu Lake Peninsula of Country Garden](image)
3.1. Project background and overview
The Cihu Lake Peninsula of Country Garden Project is located in Huangshi City, which is close to a rare inner-city ecological lake named Cihu in China. The whole project is located on the south lakeshore of Cihu lake, adjacent to the Cihu wetland park in the west as shown in Figure 1. The project covers an area of 22.9 hectares with a building area of about 600,000 square meters and a plot ratio of 2.62. The total number of semi-detached villas, small and high-rise villas is 3400, with 3 floors, 10 floors and 11 floors respectively. There are no super high-rise buildings. Cihu Peninsula residential area is a top luxury residential project built by Country Garden on the bank of Cihu Lake in Huangshi, the vice central city of Wuhan. In addition to the strong brand guarantee of country garden, luxury community, old-age real estate, waterscape real estate and ecological livability are its project features. In the process of planning, humanized design and extreme construction technology were introduced into the community. This project is the closest to the lake in the whole Huangshi area and even in the whole country. The nearest place is only 55 meters, which is a real front line near the lake.

3.2. The ecological residential area planning of Huangshi Cihu Lake Peninsula of Country Garden
Cihu Lake Peninsula of Country Garden is located on the south lakeshore of the Cihu which is in the shape of peninsula with a plat terrain. And the view is excellent, because of three sides facing the lake. In the heart of the bustling city, a piece of heaven and earth is opened up where the original ecological lake is embedded in. It nearly takes 1 kilometers of natural ecological landscape along the lakeshore with watery blue reaching far beyond the horizon. In addition, the location of Peninsula is adjacent to the Cihu lake wetland park where it can be said that it looks like the new lung of the city, breathing with the city. Moreover, the surrounding public service facilities are relatively complete, such as education, medical care, commercial services, financial posts, telecommunications, municipal public administration, cultural and sports services and other supporting services are all within a service radius of 1km, which is the best combination of convenience, comfort and tranquility. The house types include three bedroom A109 square meters, three bedroom B123 square meters, three bedroom C125 square meters, four bedroom A142 square meters, four bedroom b143 square meters, four bedroom C189 square meters, five bedroom a262 square meters, five bedroom b273 square meters, five bedroom c278 square meters, villa a273 square meters, villa B278 square meters, villa c706 square meters, seven bedroom 706 square meters and other different types, which can meet the require of different families.

3.3. Low plot ratio and high afforesting rate
As shown in Figure 2, the buildings of Cihu Lake Peninsula of Country Garden are not more than 11 floors. The planning plot ratio of 2.62 and afforesting rate of super elevation 52% gets the whole city proudly. The villas with 3 floors are built up near the lake in the residential district planning and design which, on the one hand, can ensure the residents sufficient sunshine and good ventilation. On the other hand, can segregate the residents from the city’s main road. This means that it protects the people away from noise, harmful gases and soot pollution. The project planning is mainly based on native tree species and adjusts measures according to local conditions to do their best to reserve the original vegetations. Planting trees depend on the seasons and are use of gently slope revetment afforestation and focus on the safety, functionality and aesthetics. The planning also adopts new technologies in order to give people a sense of comfort, including three-dimensional greening and roof greening to protect the privacy of residents, reduce the urban heat island effect and improve the quality of housing. Living in such a high greening rate of the community, owners can easily see the green scene, which will make their mood better. In addition, the places where a large number of plants are planted are usually the communication space and activity place for residents. Owners can walk, rest, play cards and chess in their spare time, which virtually enhances the feeling between neighbors. Green plants can also purify the air through photosynthesis, so that people who have been in the noisy city for a long time can enjoy a green and healthy life after work, which also makes the residential area more attractive.
3.4. Organic architecture and intelligent decoration

Organic architecture is a faction of modern architectural trend, represented by American architect F.L. Wright, who regarded architecture as an organic life and in the process of continuous development [3], [4]. Organic architecture is an emotion planted in the nature of life and natural forms. It can draw nutrition from the vitality of the natural world and its various biological forms and processes. Cihu Lake Peninsula of Country Garden adopted the concept of organic architecture to form a harmonious and symbiotic relationship between the building and the surrounding environment, and to meet the requirements of sustainable development in four ecological systems, namely, the systemic view of the integration of nature and man, the natural-view of “Nature, the principles of”, the economic view of wonderful workmanship excelling nature and the humanistic view of human-oriented. Cihu Lake Peninsula of Country Garden was in combination with environmental terrain and user demand with fully considering the natural and human factors and the layout of the planning and architectural appearance towards family harmony with surrounding environment. Strictly control the space of high-rise buildings was to ensure sunshine time, and a large number of environmental protection materials, local materials and high cost-effective materials and intelligent decoration were adopted to truly achieve coordination and symbiosis between architecture and environment.

Moreover, intelligent decoration was widely used in residential planning and design. That is to say, integrate modern information technology into the home decoration project to make the family decoration and functional information combination [5]. The traditional water meter, electricity meter, gas meter and so on were independently controlled by the community center, so that people do not need to spend time for checking the meters or paying fees. All the necessary wires and networks were preinstalled in advance and it also has the function of real-time monitoring and alarming and reacting intelligently according to different alerts. The finished residence with intelligent decoration is helpful to users to reduce the pollution and disputes in the process of individual household decoration.

3.5. Rain and sewage diversion and low carbon emissions

Due to the light pollution of rainwater, it can be directly discharged into the urban river after diversion, and then it can be used as natural landscape water after natural precipitation, and it can also be used as urban municipal water for spraying roads. Therefore, the use efficiency of surface water can be improved when rainwater flows into rivers through purification and buffering. At the same time, the sewage is discharged into the sewage pipe network and treated by the sewage treatment plant to realize the regeneration and reuse of sewage. The biggest advantage of rain and sewage diversion is that it can speed up the sewage collection rate, improve the sewage treatment rate, avoid the pollution of sewage to river and groundwater, significantly improve the urban water environment and reduce the cost of sewage treatment. Another advantage of rainwater and sewage diversion is that it is convenient for rainwater collection and utilization, centralized management and discharge, and reduces the impact of water quantity on the sewage treatment plant, so as to ensure the efficiency of the sewage treatment
plant. In this way, the application of rain and sewage diversion technology will greatly improve the environmental quality, grade and property management level of residential areas, and effectively improve the living environment and quality of life of owners. The rain and sewage diversion system were planned and set up to collect the domestic sewage in the region through the sewage pipe network and transfer it to the sewage plant for centralized treatment and discharge after reaching the standard. In addition, rainwater was collected by rainwater pipe network and then recycled for green irrigation in the district. Besides this, low-carbon emission and environmental protection policies were carried out to the end in the planning by using central heating to reduce air pollution. The garages were equipped with charging piles for electric vehicles and new energy vehicles to facilitate green travel and separation of people and vehicles was made above and below ground so as to improve air quality. The diversion of rain and pollution and low carbon emission in the planning and design of ecological residential area on the Cihu Lake Peninsula of Country Garden had become a landmark demonstration project for the transformation of resource-exhausted city.

Fig 3. Schematic diagram of rain and sewage diversion

4. Results
Ecological design of the Cihu Lake Peninsula of Country Garden emphasizing the mutual fusion and mutual effects and a harmonious relationship between man and nature, clever solved the problems such as energy-saving, land-saving, water-saving and environmental protection. The main idea of the design was to make use of natural ecological process and law of recycling to achieve the sustainable development of human and nature harmonious coexistence, and eventually improve the quality of human living, working, leisure, learning and entertainment, which has important theoretical and practical significance for the sustainable development of residential areas.

5. Summary
As is well known, the carrying capacity of natural resources is limited. Therefore, planning for residential areas shall reasonably determine the population density of residential areas and the intensity of land use. The planning and design of ecological residential areas should make the best use of natural resources such as land, sunshine and water. People should spare no effort to conserve non-renewable resources and guarantee the regulation and self-purification of the natural ecological system and minimize the influence of living activities on the environment. It is in order that urban residents live more comfortably, conveniently and ecologically. Only in this way can we achieve the harmonious coexistence of man and the nature.

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7. References

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