

## Application and Research of Present Plants Based on Urban and Rural Green Space System Planning—A Case Study of Luoping County

Liu Shan, Wen Xiaohong, Yang Fan

College of Landscape and Horticulture, Yunnan Forestry Technological College, Yunnan, 650000 China

**Keywords:** Urban and rural green space; Garden plants; Luoping County

**Abstract:** The planning of urban and rural green space system is to make a qualitative, positioning and quantitative overall arrangement for various urban and rural green spaces, to form a green space system with reasonable structure, so as to realize the ecological protection, recreation, leisure, social and cultural functions of green space. Plants are the most important part of urban and rural green space system. Based on this, this paper takes Luoping County as an example to conduct a field survey of garden plants in parks, protection, ancillary (roads, communities, units) and other types of green spaces in Luoping County, and discusses the relevant issues of garden plant application based on urban and rural green space system planning. This paper introduces the regional overview and research methods of Luoping County, analyzes the current situation and growth habits of landscape plants in Luoping County, the applied families and genera of landscape plants, the extensive application and growth of landscape plants, and the ornamental characteristics of landscape plants. At the same time, based on the research results, it proposes to strengthen publicity and education and improve the awareness of participation in protection; Suggestions on scientific and rational development and utilization.

### 1. Introduction

Plants are the primary producers of ecosystems and have a profound impact on the Earth's ecological environment. Plant genetic resources and species diversity have irreplaceable ecological, economic and cultural values, and are also valuable resources for the survival and development of human society. However, some scientists inferred from previous investigations that the earth is facing the sixth mass extinction [1]. According to the data of the World Conservation Union, China is the country with the richest species of wild plants, with more than 30000 kinds of higher plants. China's wild plants account for 10% of the world's total, ranking third in the world [2]. There are great differences between urban and rural ecological environment and natural ecological environment. The special urban and rural environment not only has strict requirements on the selection of urban and rural garden plant species, but also makes urban and rural garden plants have great particularity compared with natural plants [3]. Since the reform and opening up, China's urbanization process has been accelerating, and the environmental and ecological requirements for urban and rural areas have been increasing. The administrative departments have taken various policies and technical measures to strengthen the maintenance of urban green space, and at the same time, they have carried out large-scale construction of urban and rural green space, which has rapidly increased the per capita green space [4]. But there are also some problems in this process. Therefore, it is of practical significance to study the related problems of landscape plants under the urban and rural green space system planning.

As a component of urban and rural ecosystems with self purification and automatic regulation capabilities, green space plants play an irreplaceable role in maintaining urban and rural ecological balance and improving urban ecological environment [5]. However, with the rapid population growth and technological progress, the demand for resources is growing. Human activities have led to the gradual increase in the rate of extinction of species. At the same time, with the increasingly frequent economic development activities, forests, grasslands, wetlands, etc. are decreasing, while the behavior of digging and selling plant resources in the wild is frequent [6]. Plant ecology is a science that studies the relationship between plants and between plants and the environment. Its

research contents mainly include the adaptability of plant individuals to different environments and the impact of the environment on plant individuals, the formation and development process of plant populations and communities in different environments, and the role of plants in the energy flow and material cycle of the ecosystem [7]. For plants, all the factors in the space around their living places, such as climate, soil, biology, etc., are the plant environment. The factors analyzed from the environment are environmental factors, among which the factors that have an effect on biology are ecological factors. The impact of various ecological factors in the environment on plants is comprehensive, that is, plants live in comprehensive environmental factors. Based on this, this paper takes Luoping County as an example to discuss the related problems of landscape plants based on urban and rural green space system planning.

## 2. Survey and method of investigation area

### 2.1. Survey area profile

Yunnan is located in the plateau area, and the air is dry and thin. Besides, the sunlight in various places increases or decreases with the change of the sun's altitude angle, it is also affected by clouds and rain [8]. Luoping County, belonging to Qujing City, Yunnan Province, is located between  $103^{\circ}57' \sim 104^{\circ}43'$  east longitude and  $24^{\circ}31' \sim 25^{\circ}25'$  north latitude. The county has a total area of 3,025 square kilometers, 75 kilometers wide from east to west and 99 kilometers long from north to south. Jurisdiction over 3 streets, 4 towns and 6 townships. The geological structure of the county is complex, with the highest elevation of Baila Mountain being 2468m, and the lowest elevation of Lubuge Township being 722m, with a relative height difference of 1746m. In addition, Luoping County has successively won the city business cards such as "Top 100 Tourism Counties in China", "Advanced County for Grain Production in China", "the largest county for tobacco production in China" and "National Civilized County". Figure 1 shows the overview of vegetation in Luoping County.



Figure 1 Overview of vegetation in Luoping County

#### 2.1.1. Investigate regional climate

The eight rivers in the south of Luoping County belong to the tropical climate of South Asia, and the rest are plateau monsoon climate [9]. Affected by warm and humid air currents in summer, there

are many heavy rains and rainstorms; Controlled by the stationary front of Kunming in winter, it often rains continuously. The annual average rainfall is 1743.9mm, which is one of the rainy areas in the province. The annual average relative humidity is 85%, the annual average sunshine hours are 1685 hours, the annual average temperature is 15.1°C, and the annual average frost-free period is about 280 days. The climate in Luoping is mild, with an average temperature of 15.2°C and a frost-free period of 280 days. The accumulated active temperature is high and the rainfall is abundant, with an annual rainfall of 1700 mm [10]. There are many kinds of biological resources and relatively rich plant germplasm resources in China. Figure 2 shows the local breeze formed in the garden green space during the day.

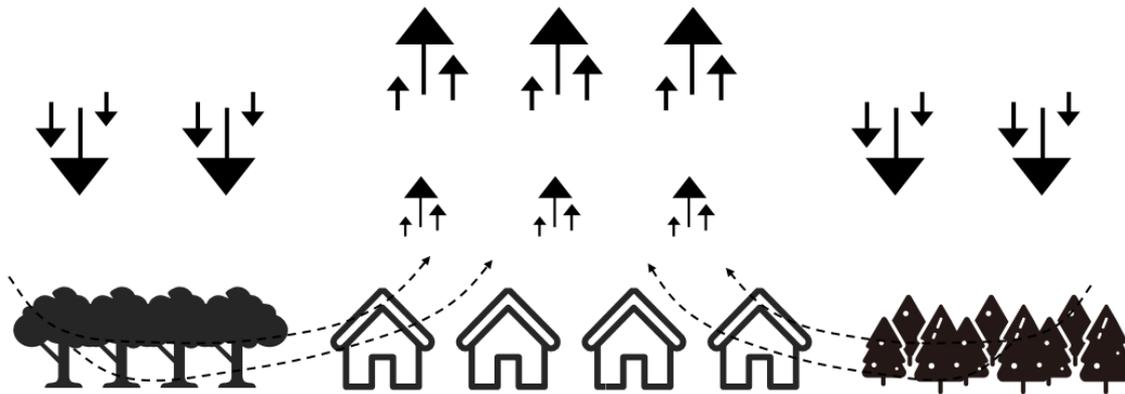


Figure 2 The local breeze formed by the garden during the day

### 2.1.2. Field of investigation

In this paper, the garden plants in parks, shelters, ancillary (roads, communities, units) and other green spaces in Luoping County were investigated on the spot. According to the current situation and distribution of the survey objects, the survey categories are divided into key surveys and general surveys. Focus on the investigation of plant species with small number and relatively narrow distribution area; Generally, the survey focuses on plant species that are widely distributed.

## 2.2. Investigation method

### 2.2.1. Literature consulting method

Collect and read a large number of cases, academic journals, documents and books on the application of urban garden plants, and make rational use of network resources to collect the latest research progress. In addition, the case is studied and analyzed, the experience and lessons are summed up, and the knowledge of relevant theoretical disciplines is understood to form a system, which serves as the theoretical basis for the research.

### 2.2.2. Traditional current situation investigation method

Based on the collected relevant data and theoretical basis, the total distribution area and population of the target species in the investigation area are obtained by accumulating the distribution area and population number of each point in the investigation area.

### 2.2.3. Interview method

Interview relevant residents, experts and other personnel, and collect objective and unbiased factual materials according to the respondents' answers, so as to accurately explain the totality to be represented by the sample. This method has good flexibility and adaptability.

## 3. Survey result

### 3.1. Analysis on the present situation and growth habits of garden plants

Plants living in the natural environment are bound to be affected by the external environment.

However, not all environmental factors have an effect on plants, and the factors that have an effect on plants are called ecological factors. Based on the on-the-spot investigation in Luoping County and the analysis of the investigation results, it is concluded that there are 113 families and 235 genera of garden plants in the built-up area of Luoping County. There are many kinds of applied plants, which can basically reflect the characteristics of monsoon forest plants in the north subtropical zone where Luoping County is located.

According to the growth habits, there are 163 species of arbor belonging to 115 genera in 56 families, accounting for 49.24% of the total species, including 89 evergreen plants and 73 deciduous plants, with the ratio of evergreen to deciduous being about 55: 45. There are 14 small tree species belonging to 7 families, 14 genera, accounting for 4.23% of the total species, 7 evergreen plants, 7 deciduous plants, and the ratio of evergreen and deciduous leaves is about 1: 1. There are 96 shrub species belonging to 68 genera, 37 families, accounting for 29.00% of the total species, including 59 evergreen plants, 35 deciduous plants, and the ratio of evergreen and deciduous leaves is about 63: 37. There are 71 species of herbs belonging to 47 genera in 18 families, accounting for 21.45% of the total species, among which there are more perennial herbs and less biennial ones. There are 10 species of vines belonging to 7 families, 10 genera, accounting for about 3.14% of the total species, and 5 species belonging to 4 genera in 1 family, accounting for about 1.51% of the total species of bamboos.

Among the 331 species of plants, according to evergreen and deciduous branches, there are 196 evergreen plants, accounting for 59.21% of the total plant species, 112 deciduous plants, accounting for 33.84% of the total woody plants, and the ratio of evergreen and deciduous plants is about 64:36. There are 31 perennial plants, accounting for 9.37% of the total plant species, 4 annual plants, accounting for 1.26% of the total plant species, and 2 biennial plants, accounting for 0.63% of the total plant species.

### **3.2. Analysis of applied families and genera of plants in gardens**

The most widely used family in Luoping County is Rosaceae, with 31 applied species, accounting for 9.37% of the total species. There are 15 applied species of Gramineae and Moraceae, accounting for 4.53% of the total species. There are 14 applied species of Palmae, accounting for 4.23% of the total species; There are 12 applied tree species in Oleaceae, Magnoliaceae and Leguminosae, accounting for about 5.97% of the total tree species. There are 10 applied tree species of Compositae, each accounting for about 3.02% of the total tree species; There are 8 applied tree species in Lauraceae, Pinaceae and Liliaceae, each accounting for about 2.42% of the total tree species. There are 6 applied tree species in Cupressaceae, Labiatae, Ulmaceae and Rutaceae, each accounting for about 1.81% of the total tree species. There are five applied tree species in Malvaceae, Caprifoliaceae, Amaryllidaceae, accounting for about 1.51% of the total tree species. There are 4 applied tree species in Ericaceae, Araliaceae, Salicaceae and Euphorbiaceae, each accounting for about 1.21% of the total tree species. There are three applied tree species of Lagerstroemia, Buxuriaceae, Araceae, Sapindaceae, Agave, Strychnaceae, Rhamnaceae, Aceraceae, Rubiaceae, Solanaceae and Cruciferae, each accounting for about 0.91% of the total tree species. Orchidaceae, Juglandaceae, Apocynaceae, Hamamelidaceae, Meliaceae, Podocarpaceae, Verbenaceae, Vitaceae, Chelidoniaceae, Cyperaceae, Theaceae, Nephritis, Pomegranate, Diospyros kaki, Celastraceae, Berberidaceae, Spinosaceae, Iridaceae, Arunaceae, Araceae, Taxodiaceae and Ilex. Banana, Papilionidae, Papilionidae, Papaya and other families are rarely used.

Among the genera, Ficus (Moraceae) is the most widely used species, with 12 species, accounting for 2.72% of the total species. Secondly, Pinus (Pinaceae) and Phyllostachys (Gramineae), with 5 applied species, accounting for 1.51% of the total trees planted; There are four applied species of Plum (Rosaceae), Salix (Salix), Ligustrum (Ligustrum), Magnolia (Magnoliaceae), Sakura (Rosaceae), Sage (Labiatae) and Cinnamomum (Lauraceae), each accounting for about 1.21% of the total species. Rhododendron (Ericaceae), Michelia (Magnoliaceae), Hibiscus (Malvaceae), Manglietia (Magnoliaceae), Malus (Rosaceae), Rosa (Rosaceae), Photinia (Rosaceae), Apricot (Rosaceae), Oatmeal (Gramineae), Buxus (Gramineae)

There are 1 species in *Melaleuca* (Myrtaceae), *Platycladus* (Cupressaceae), *Nerium* (Oleaceae), *Trifolium* (Leguminosae), *Syringa* (Oleaceae), *Ilex* (*Ilex*) and *Zanthoxylum* (Rutaceae), each accounting for about 0.30% of the total species.

### **3.3. Analysis of garden plants' extensive application and growth status**

Based on the field investigation of basic green space units in Luoping County, this paper counts the times of the same plant appearing in all basic green space units, obtains the frequency of this plant in the basic green space units in the built-up area, and selects the plants with higher frequency in the basic green space units. The details are as follows: There are 49 kinds of greening plants widely used in the built-up area of Luoping County. Among them, there are 39 kinds of trees that have been used more than 10 times (including 10 times), namely: *osmanthus fragrans*, *Cinnamomum camphora*, cycads, heather, ginkgo, cherry blossoms, cedar, etc. There are 27 kinds of shrubs that have been used more than 10 times (including 10 times), namely: *Ligustrum lucidum*, *bougainvillea*, *rhododendron*, *photinia fraseri*, boxwood, rose, etc. There are 13 kinds of herbaceous plants that have been used more than 5 times (including 5 times), namely: *chlorophytum*, Huang Jinju, and *agapanthus*. There are two kinds of lianas that have been used more than five times (including five times), namely, ivy and wisteria. There are three kinds of bamboo plants that have been used more than 5 times (including 5 times), namely *Dendrocalamus latiflorus*, *Phyllostachys purpurea* and *Phyllostachys rigida*.

### **3.4. Analysis of ornamental characteristics of garden plants**

Foliage plants mainly refer to the shape of ornamental leaves and the different leaf colors in different seasons. The main foliage plants in Luoping County are: *Ligustrum lucidum*, heather, ginkgo, boxwood, etc. There are 22 kinds of flower-watching plants mainly used in the garden, such as *osmanthus fragrans*, privet, red maple, *bougainvillea*, *rhododendron*, cherry blossom, magnolia, willow, plum tree, Yunnan cherry blossom and rose. The main fruit-viewing plants used in green space are: *photinia*, ginkgo, *photinia rubra*, loquat, plum, pomegranate, etc. The main landscape plants used in green space are: cedar, red maple, *Pittosporum fortunei*, Pu Shu, Zizhu, *Platycladus orientalis*, Lohan pine, plantain and so on.

## **4. Comments and suggestions**

For urban residents, the city is like a hot and dry stove, forming a heat island surrounded by rural areas with relatively low temperature, so this warming effect of the city is also called the heat island effect. The garden green space in the city has a strong mitigation effect on the heat island effect of the city. Urban green space is the main natural factor in the city, so vigorously developing urban greening is the key measure to reduce the heat island effect. Although the state has made a long-term plan for the protection and utilization of garden plant resources, in grass-roots work, cadres and the masses generally don't know enough about the importance of protecting garden plant resources. Therefore, relevant personnel should pay attention to it and strengthen the protection and publicity of garden plants. At the same time, to strengthen the protection and utilization of garden plant resources, we must highlight its basic and public welfare orientation. In the future, we must follow up the management and supervision of urban and rural green space system and formulate corresponding laws and regulations; Make corresponding training to improve the quality of administrators; For the management and construction funds of garden plants, a special person is responsible for the system. Landscape spatial pattern is an index to measure the rationality of urban and rural green space layout and the level of urban greening. The tree species allocation of Luoping county green space system should choose tree species with ornamental value and economic value, with ornamental value as the main factor. Combining fast-growing tree species with slow-growing tree species; Combination of evergreen tree species and deciduous tree species; Trees, shrubs and ground cover are combined to create urban greening landscape with rich plant levels. In addition, in order to effectively protect the wild garden plants distributed outside the protected areas, new protected areas or key protected wild plant protection areas should be built, protection signs should

be set up, and local protection should be implemented. If there is a vacant biodiversity-rich area in the northwest Yunnan nature reserve, build Biluo Snow Mountain Nature Reserve. At the same time, the activities in the scenic area must focus on eco-tourism, with emphasis on popular science education, to prevent ecological damage. The premise of all development activities in tourist areas must be to maintain the sustainable development of ecology.

## 5. Conclusions

Known as the "kingdom of plants", Yunnan is the province with the richest plant diversity resources in China, among which there are 19,365 species of higher plants, accounting for 50.2% of higher plants in China. Luoping County belongs to Qujing City, Yunnan Province. The eight rivers in the south of the county belong to the tropical climate of South Asia, and the rest are plateau monsoon climate. Taking Luoping County as an example, this paper discusses the related problems of garden plants based on urban and rural green space system planning. There are great differences between urban and rural ecological environment and natural ecological environment. The special urban and rural environment not only has strict requirements for the selection of urban and rural garden plant species, but also makes urban and rural garden plants have great particularity compared with natural plants. In this paper, the garden plants in parks, shelters, attached (roads, communities, units) and other green spaces in Luoping County were investigated on the spot, the regional general situation and research methods of Luoping County were introduced, and the status quo and growth habits, application families, application universality and growth status of garden plants, and ornamental characteristics of garden plants in Luoping County were analyzed. At the same time, based on the research results, some opinions and suggestions are put forward. In order to make due contributions to building a powerful country with plant resources and realizing modernization and sustainable development.

## Acknowledgements

General events at school level KY(KB) 202105 Application of edible plants in urban and rural green space planning for disaster avoidance

## References

- [1] Luo Huan, Qin Liting, Liu Kedan, et al. Investigation and Analysis of Alien Invasive Plant Species in Nanning Garden Greenbelt System [J]. *Weed Science*, 2019, 037(004):31-36.
- [2] Yang Wenyue, Li xin, Ye Changdong. Research on the construction of evaluation index system of urban green space system planning [J]. *Planner*, 2019, 35(9):6.
- [3] Liu Jun. Problems and countermeasures of green space system planning in mountainous cities [J]. *China Gardens*, 2017, 33(9):5.
- [4] Zhou Haibo, Guo Xingfang. Innovative trend of green space system planning under the land space planning system [J]. *China Garden*, 2020, 36(2):6.
- [5] Ge Peilin, Guo Liping, Deng Wei. Preliminary study on optimal allocation method of plant communities in urban green space [J]. *Forestry Survey and Planning*, 2019, 44(2):7.
- [6] Zhang Yi, Qiu Jian. Research on integrated transformation of rainwater drainage and storage in Jinsha Archaeological Site Park [J]. *China Garden*, 2018, 34(12):5.
- [7] Zhao Min. Green space planning and plant allocation of cultural tourism scenic spots [J]. *Modern Horticulture*, 2022, 45(12):3.
- [8] Liu Jiamin. Analysis of urban green space system planning in urban planning [J]. *Building Development*, 2020,4 (6): 124-125.
- [9] Du Qiantai. Discussion on Plant Planning of Wetland System Application [J]. *Forestry*

Exploration and Design, 2020, 49(2):3.

[10] Liu Huimin, Gong Siyu, Zou Tiewan, et al. Research on planning urban water-saving green space system based on GIS technology [J]. Journal of Agricultural Engineering, 2019, 35(6):9.