

Application and Research of Edible Plants in Urban and Rural Green Space Planning—A Case Study of Luoping County

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Abstract: At present, the problem of urban disaster avoidance is increasingly concerned by the whole society. Serious urban disasters not only cause the destruction of buildings and structures, but also cause other secondary disasters or derivative disasters. Luoping County belongs to Qujing City, Yunnan Province. Taking Luoping County as an example, this paper makes a field survey of 6 townships in 4 towns and 3 streets in Luoping County, and comprehensively discusses the application of edible plants in urban and rural green space planning by using various methods. In this paper, the application of families, genera and species, and the application of edible plant families, genera and species in disaster-avoiding green space in Luoping County were analyzed. Based on the research results, some opinions and suggestions are put forward: relevant personnel should pay attention to the excavation and promotion of edible garden plant resources in disaster-avoidance green space, and pay attention to the combination of disaster-avoidance green space plant application, so as to maximize the comprehensive function and landscape of disaster-avoidance green space plants. In order to provide some reference for the application of urban green space plants to avoid disasters.

1. Introduction

In recent years, the western cities of China have suffered catastrophic damage in geological disasters, and the problem of urban disaster avoidance has been paid more and more attention by the whole society. Serious urban disasters not only cause the destruction of buildings and structures, but also cause other secondary disasters or derivative disasters [1]. Generally speaking, the direct loss caused by the earthquake itself is often less than the indirect loss caused by the secondary disasters caused by the earthquake [2]. Among them, there are great hidden dangers of geological disasters in Yunnan Province. Historically, Lijiang, Lincang, Yuxi, Pu'er and other cities and surrounding areas have experienced high-level and strong damage disasters. It is the primary producer of plant ecosystem, which deeply influences the ecological environment of the earth [3]. The genetic resources and species diversity of plants have irreplaceable ecological, economic and cultural values, and are also valuable resources for the survival and development of human society. At the same time, the unique plant community, as the only green infrastructure with vitality, also played a major role in dealing with disasters [4]. Therefore, on the basis of the general ecological aesthetic function of green space, it is necessary to further expand the composite function of green space and maximize its comprehensive benefits. Enrich the composition types of urban green space, and enhance the popularization, education and characteristics of green space. However, urban green space for disaster prevention is a refuge to ensure citizens' safety, and it also meets the needs of landscape greening and citizens' outdoor activities. At present, it is attracting increasing attention in China. Reasonable selection of green space plants for disaster prevention is one of the important ways to realize urban disaster prevention function [5]. The application of edible plant landscape to avoid disasters is a new design approach. Disaster-avoiding edible plant landscape refers to the landscape constructed by edible plants for human beings, that is, it can obtain direct economic benefits by planting fruit trees, vegetables and herb gardens in cities. It refers to a new type of landscape that is innovatively developed on the basis of using all kinds of existing facilities in urban plots and according to the principle of sustainable development theory. Giving full play to the disaster prevention and mitigation functions of selected tree species in urban green space and

incorporating urban disaster prevention and mitigation planning is one of the contents that should be considered in green space system planning.

Aiming at the functions of disaster prevention and mitigation in urban green space, it is only through reasonable and perfect selection and configuration of disaster-avoiding plants that can be effectively realized [6]. Therefore, in the planning and design of urban green space system for disaster prevention, it is necessary to scientifically and effectively select and configure the plants, which will provide favorable conditions for the effective development of urban disaster prevention and avoidance. By artistic collocation of fruit trees, vegetables, herbs and other elements in agricultural production, and paying attention to the combination of color, shape, texture, height and other aspects, it can present a landscape effect different from general conventional greening plants [7]. At the same time, edible plants in urban green space can be eaten in an emergency when the food supply is blocked, and some species have the characteristics of tall trees, thick crowns and developed roots, which are considered as one of the most important plant types in green space to avoid disasters. Therefore, the study of edible plants in disaster-avoidance green space can provide guidance for the selection of urban disaster-avoidance green space plants, and has practical significance for improving the comprehensive disaster-prevention and risk-avoidance ability of cities, perfecting the functions of urban green space and promoting the sustainable development of cities [8]. 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, which belongs to Qujing City, Yunnan Province, with a total area of 3,025 square kilometers, 75 kilometers wide from east to west and 99 kilometers long from north to south; Among them, the mountainous area accounts for 78%, and it has jurisdiction over 3 streets, 4 towns and 6 townships. Taking Luoping County as an example, this paper discusses the application of edible plants in urban and rural green space planning.

2. Survey and method of investigation area

2.1. Survey area profile

Luoping County, belonging to Qujing City, Yunnan Province, is located between 103°57' ~ 104°43' east longitude and 24°31' ~ 25°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. Among them, the mountainous area accounts for 78%, and has jurisdiction over 3 streets, 4 towns and 6 townships [9]. Luoping County has a high terrain in the northwest, a low terrain in the southeast, a complex topographic and geological structure, and a relatively complete eastern Yunnan plateau in the west and north. Karst faulted lake basin in the middle part; And the eastern part and the southern part are eroded and cut by rivers, forming the landform of middle and low mountains and valleys. The total land resources of the county are 4,428,700 mu. Among them, forestland accounts for 28.5%, grassland accounts for 36.5%, water area accounts for 0.7%, difficult to use land accounts for 6.8%, garden land accounts for 0.2%, and other land accounts for 77%.

2.1.1. Investigate regional climate

Luoping County belongs to Qujing City, Yunnan Province. It is located in the low latitude area, belonging to the subtropical climate zone, with obvious vertical climate change, which is greatly influenced by the terrain. Mountain landforms are complex and diverse, with obvious differences in temperature and precipitation. The eight rivers in the south of Luoping County belong to the tropical climate of South Asia, and the rest are plateau monsoon climate. 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.

2.1.2. Field of investigation

This paper investigates the urban green space in Luoping County, including park green space, production green space, protective green space, attached green space and other green spaces.

Including 3 streets, 4 towns and 6 townships in Luoping County.

2.2. Investigation method

2.2.1. Literature consulting method

Collect and read a large number of cases about the application research of edible plants in disaster-avoiding green space, understand the general situation of the region, yearbooks, and brief history of nationalities, and collect relevant data from various databases, sort out and summarize them as basic data. Master the knowledge of relevant theoretical disciplines, and fully understand the geography, climate, flora and general situation of the study area.

2.2.2. Traditional current situation investigation method

From 2014 to 2021, the urban green space in the study area was investigated on the spot. The urban green space in the study area was investigated by using the "current situation investigation method" of urban green space system planning. The investigation includes the species, quantity, growth status and configuration form of green plants, and samples were collected and photographed on the spot.

2.2.3. Interview method

This paper divides the interview consultation into two aspects: on the one hand, interview with local housing and urban and rural construction, landscape and forestry workers to understand and record the edible knowledge of garden plants. On the other hand, visit local farmers' markets and restaurants to investigate the names, edible parts, edible methods and popularity of local edible plants. A total of 300 people were interviewed, including 190 local residents, 60 government workers, 30 restaurant operators and 20 nursery maintenance workers.

3. Survey result

3.1. Application of families, genera and species in disaster-avoiding green space

In the planning of urban green space to avoid disasters, not only the park green space, but also the school playground, stadium and open-air parking lot can be used as temporary places to avoid disasters. Therefore, in practical work, we should pay attention to the overall planning work, and make rational layout and planning for the existing urban green space, so as to ensure that these sites play a role in avoiding disasters and better ensure people's personal and property safety. Table 1 shows the statistical table of local green space in Luoping County.

Table 1 Statistics of local green space in Luoxian County

Number	Name	location	Green area (m ²)
1	Fukun Road Protective Greenbelt	On both sides of Fukun Road in the built-up area of the county	136954.2164
2	Longmiao Reservoir Protection Green Space	North side of Longmiao Reservoir	1082144.733
3	South Kunming Railway Protection Green Land 1	South side of Nanning-Kunming Railway	11132.13182
4	South Kunming Railway Protection Green Land 2	South side of Nanning-Kunming Railway	822482.8104
5	South Kunming Railway Protection Green Space 3	South side of Nanning-Kunming Railway	504614.2965
6	South Kunming Railway Protection Green Space 4	North side of Nanning-Kunming Railway	102685.571
7	Xicheng community protection green land	North side of Xicheng community	129816.1054
8	County People's Hospital Protection Green Space	North side of inpatient department of county people's hospital	87328.06944
9	Changqing road protection green space	Intersection of Changqing Road and Jiulong Avenue	36651.63924

Through field investigation in Luoping County, it was found that there were 331 species of garden plants belonging to 235 genera and 113 families in Luoping County. 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, among which 89 are evergreen plants, 73 are deciduous plants, and the ratio of evergreen to deciduous is 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. According to evergreen and deciduous species, 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 plants, accounting for 0.63% of the total plant species.

Different types of natural disasters will occur in different forms, causing different degrees of harm, and the emergency measures to avoid disasters are also different. In the actual construction, we should choose according to the actual different disaster avoidance needs, and we can't just choose functional tree species in the same way. Selection of tree species for disaster prevention and hedge green space needs to conform to ecological requirements. Generally, it should conform to the ecological principle of "suitable for the land and trees", conform to the local climatic characteristics and soil natural conditions, mainly native tree species, and some of them adopt introduced and improved exotic tree species to form a plant community with local characteristics.

3.2. Application of edible plant families, genera and species in disaster-avoiding green space

In order to ensure the safety of the affected people in temporary shelters, designers should try their best to arrange the green space for disaster prevention and shelter in urban parks near residential areas. In addition, as far as possible, the green space for disaster prevention and avoidance should be arranged at the edge of each green space and the green evacuation passage to form an enclosed forest belt. The selection of plants should fully learn from the experience and methods of traditional urban landscaping tree species to meet the needs of urban green space construction. The screening system of edible plants in urban green space of Yunnan province is shown in Figure 1.

Selection factors of edible plants in disaster-avoiding green space: flowers, leaves, roots, stems, fruits, seeds and other parts of plants can serve as temporary food for direct or processed consumption. In this study, edible plants in the green space for disaster avoidance were selected as follows: photinia, ginkgo, photinia rubra, loquat, plum, pomegranate, yew, peach tree, bayberry, walnut, phoenix tree, *Euonymus angustifolia*, fig, *Broussonetia papyrifera*, mango, apricot, anemone, dragon's blood tree, pear tree, grape, etc. Among them, 16 families, including Rosaceae, Palmae, Rutaceae, Moraceae, Pinaceae, Anacardiaceae, Gramineae, Passiflora, Sapindaceae, *Garcinia*, Myrtaceae, Solanaceae, Oleaceae, *Elaeagnus*, Euphorbiaceae, and Musaceae, are used in many species. Among them, there are 14 species of Rosaceae, 5 species of Palmae, Rutaceae and Moraceae, 4 species of Pinaceae, Anacardiaceae and Gramineae, and 3 species of 9 families including Passiflora, Sapindaceae, *Garcinia*, Myrtaceae, Solanaceae, Oleaceae, *Elaeagnus*, Euphorbiaceae and Musaceae.

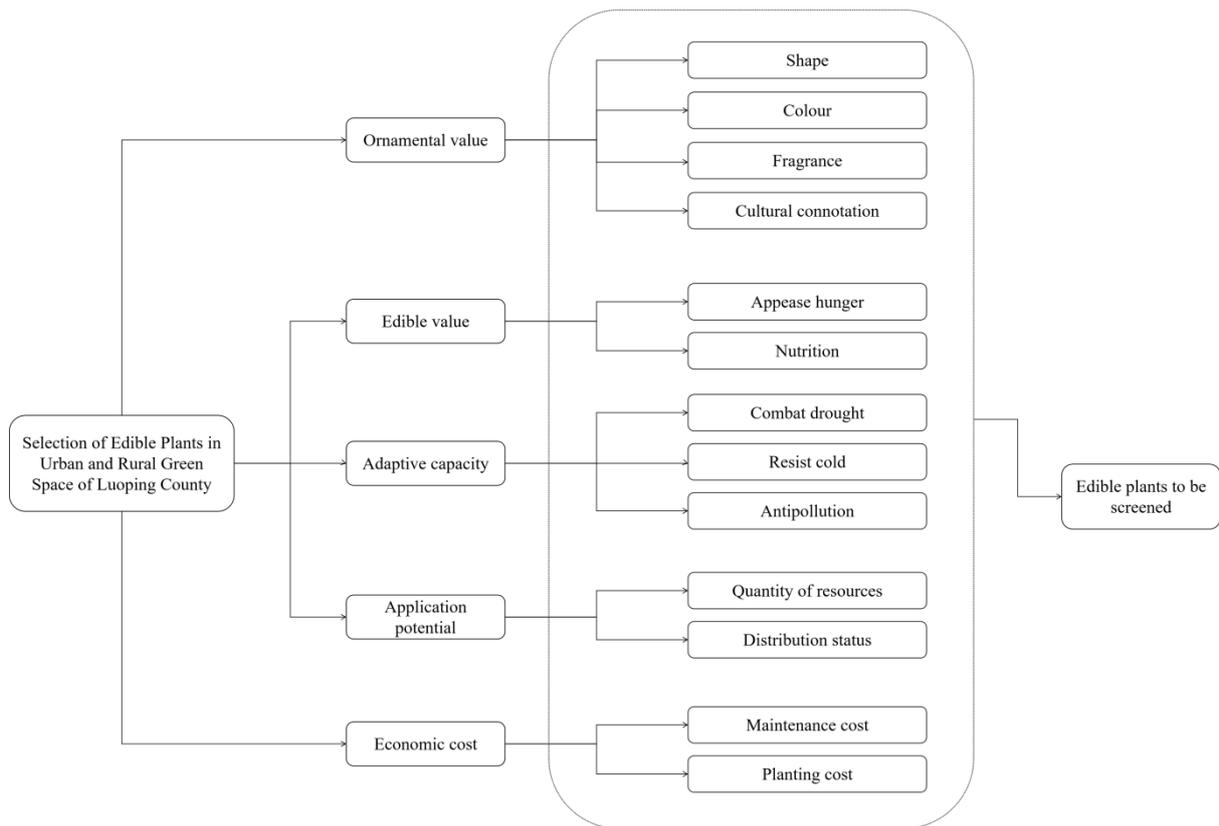


Figure 1 Screening system diagram of edible plants in urban green space of Luoping County

4. Comments and suggestions

The most important principle of planting trees is to adapt to the land and trees. Only when the local natural conditions are suitable can trees have room for growth and development. Therefore, the tree species selected in residential areas should not only have the function of disaster prevention and hedge, but also be easy to survive and resistant to pruning. Therefore, the local native tree species should be selected first, and the effectiveness of disaster prevention and hedge can be exerted under the condition of ensuring the survival rate. Edible plants are one of the most important kinds of plants in disaster-avoidance green space. Besides being used as emergency vegetables, some of them also have medicinal functions of dispelling diseases. The selection factors of edible model plant selection scheme are: the flowers, leaves, roots, stems, fruits, seeds and other parts of plants can serve as temporary food for direct or processed consumption. Generally, tree species with large leaf volume and area often have the function of preventing wind and dust, and *Ligustrum lucidum* can play a role in preventing wind. For flood control and debris flow prevention, broad canopy, thick root system and dense branches and leaves should be selected. Trees such as willow, maple, walnut, maple, *Metasequoia*, spruce, fir and cypress, and shrubs such as hazel, oleander, *Lespedeza* and *Amorpha fruticosa* can be selected. When planning the green space for disaster prevention and avoidance, it is necessary to consider setting up a fire isolation belt to ensure the fire or secondary fire caused by natural disasters such as earthquakes and tsunamis, so as to ensure the personal and property safety of urban residents. The function of disaster-avoidance greenbelt is mostly ornamental park greenbelt. Arbor is the main plant configuration, and the combination of arbor, shrub, herb, vine and ground cover forms a rich ecological community structure. For example, arranging flower-eating plants at landscape nodes such as the entrance of disaster-avoiding green space and squares adds colorful colors to disaster-avoiding sites; Planting vines such as grapes, passion fruit and eggshells on pavilions, corridors, pavilions and other gardens or rockeries can not only prevent objects from falling when buildings collapse, but also create rich light and shadow effects.

5. Conclusions

As an important part of urban environment, urban green space has important social value. With the development of the times, the landscape demand of modern urban green space is no longer at the level of appreciation, and it is necessary to combine economic benefits, ecological benefits and social benefits. The application of edible landscape can break through the limitations of traditional landscape, and through reasonable design methods and layout forms, changeable characteristic landscapes can be formed. Disaster-avoiding edible plant landscape is a new design approach based on this. Based on this, this paper takes Luoping County as an example, and makes a field survey of 6 townships in 4 towns and 3 streets in Luoping County, and discusses the application of edible plants in urban and rural green space planning. This paper introduces the general situation of Luoping County and the research method of this paper, and analyzes the application of families, genera and species in disaster-avoiding green space in Luoping County, and the application of edible plants, genera and species in disaster-avoiding green space. Based on the research results, some opinions and suggestions are put forward. Reasonable plant allocation of disaster-avoidance green space is one of the important ways to realize the function of disaster prevention and mitigation of urban disaster-avoidance green space. On the basis of following the basic principles of urban green space plant planning, plant allocation for disaster avoidance emphasizes the disaster reduction function of plants in all kinds of disasters and their secondary disasters. Relevant personnel should pay attention to the excavation and promotion of edible garden plant resources in disaster-avoidance green space, and pay attention to the combination of disaster-avoidance green space plant application, so as to maximize the comprehensive function and landscape of disaster-avoidance green space plants.

Acknowledgements

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