Investigation and Ecological Evaluation of Plant Resources on Campus of Jiamusi University

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Abstract. The purpose of the systematic investigation of plant resources in Jiamusi University campus is to understand the composition, community characteristics and ecological distribution of plant resources in Jiamusi University, and to make rational use of them. In the process of investigation, the methods of actual step-by-step search and data search are adopted to carry out ecological evaluation. According to statistics, there are 113 kinds of plants on Jiamusi University campus, of which 93 are woody plants and 18 are herbaceous plants. Its growth environment is suitable for forest margin, undergrowth, hillside, and shrub and so on. Its main uses are greening, shading, dust prevention and noise reduction. It has high value. It is hoped that the research will provide a basis for the future construction of ecological civilization on campus.

1 Introduction

In the context of sustainable development, in order to alleviate urban ecological environment problems, our country strengthens the ecological construction of urban landscape[1]. At present, our country is in the period of vigorous development of university campus construction. Campus construction of domestic universities has entered a new period of rapid progress[2]. Most campuses are in the construction activities of new construction, reconstruction and expansion. Many university campuses in developed cities such as southern China have adapted to the development of the times and built sustainable campus landscape[3-4]. Build ecological campus, low-carbon campus and green campus to realize the sustainable development of campus. Because of its special geographical location[5]. Limited climatic conditions, limited resources and backward economy have led to some limitations and lags in the construction of campus landscape in cold regions universities[6]. Considering the sustainable development of society and the importance of landscape, it provides an opportunity for the construction of plant landscape in University campus[7]. With the state attaching importance to higher education and the continuous expansion of the scale of running a school, more and more research has been done on the construction of University campus[8]. At the same time, the construction of university campus landscape has attracted the attention of the public, and many problems have been found. For example, the location design of the activity venue of cold region university is unreasonable. And blindly imitate the construction of campus landscape in temperate and warm temperate zones. As a result, the location of the university activity venue in the cold area was determined, and the size design was unreasonable. In winter, the site is empty and

bleak, and the utilization rate is low. Large areas of lawns, squares, and activities in the shadows of buildings[9]. Many universities face harsh winter weather conditions, the construction of campus landscape in winter has been neglected[10]. Forming the depression of campus scenery in winter, there is no view to enjoy. It greatly reduces the willingness of teachers and students to do outdoor activities; it embodies the importance of the investigation of plant resources on campus. The remarkable effects of garden plants in water conservation, sterilization and dust reduction, air purification, noise reduction, urban microclimate regulation and urban heat island effect mitigation are also gradually recognized and well known by the people[11]. Therefore, to investigate and understand the plant resources on Jiamusi University campus, to further improve the planning level, it plays an important role in improving the ecological environment construction of Jiamusi City, improving its ecological benefits and maintaining the ecological balance of urban human settlements environment.

2 Research overview

2.1 Overview of research sites

The research site is Jiamusi University Campus. Located in the earliest place in China where the sun rises, Jiamusi City, Heilongjiang Province (Located in the hinterland of the Sanjiang Plain, which is the confluence of Songhua River, Heilongjiang River and Wusuli River in Northeast China). It belongs to the continental monsoon climate of the middle temperate zone. Mean annual temperature of 3 C during the same period of rain and heat. Winter is long and summer is short. Frost-free

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period is about 140 days. The average annual precipitation is 527 mm. Sunshine hours are 2525 hours. The effective accumulated temperature is 2590. Winter is long and summer is short. The frost-free period is about 130 days. It covers an area of 1965 mu (1.31 million square meters). The coordinates of the central point of the campus are E130°21'55.1", N46°47'7.4". At an elevation of 88.8 m, the climate is a continental monsoon climate in the mid-temperate zone, average annual temperature 2.9 °C, maximum temperature 38.1 °C, minimum temperature -41.1 °C. It has good physical and geographical conditions. It is very suitable for the growth of many kinds of plants, especially alpine plants. The area is rich in plant species. The research on this area is representative in Heilongjiang Province. The general situation of plants in this province will be further understood.

2.2 Research

Field investigation May-September 2019 Conduct. First a comprehensive survey of plant resources on Campus of Jiamusi University was conducted. The survey area covers the main areas of school life activities in Colleges A, B, C and D. These were including teaching office area,

student living area, small tour park, sports area, road green space and so on. For the investigation of campus plants, a combination of on-the-spot investigation and data collection is adopted. Samples were collected and photographed on the spot. The growth and planting patterns of plants in Jiamusi University were recorded. Some of these were systematic collation and cataloguing.

3 Result analyses

3.1 Analysis of Plant Composition

A, B, C and D institutes in the study area were selected for field investigation and research through comprehensive investigation. The results show that: there are about 113 species of plants on the campus of Jiamusi University. There are 93 ornamental woody plants. It belongs to 22 families and 54 genera, 18 species of herbaceous plants. The species of deciduous trees are obviously more than that of evergreen trees. The species of deciduous shrubs were also more than that of evergreen shrubs. The species of vines are seldom used. There is only 1 kind. One species of aquatic and marsh plants (Fig 1).

Fig 1. Statistical Table of Plant Species on Campus of Jiamusi University

3.2 Characteristics of hierarchical plant communities

The plant landscape of Jiamusi University campus is the characteristics of plant communities at different levels. First, in student dormitories, canteens and other living areas, sports venues, road green space. Double-layer plant community structure is commonly used. Evergreen trees or deciduous trees + ground cover or herbs, flowers or lawns, the form of evergreen shrubs or deciduous shrubs + ground cover or herbs, flowers or lawns; Secondly, the three-storey structure is often used at the landscape nodes. That is evergreen trees or deciduous trees + evergreen shrubs or deciduous shrubs + ground cover or grass, flowers or lawns; thirdly, on the whole, array and determinant are mostly used. Form or solemn order, or open atmosphere, or simple and lively plant landscape style. The multi-layer plant community structure is commonly used in teaching office area, small tour area and leisure area. Based on the formation of

three to five levels of design that is evergreen trees or deciduous trees + sub-trees + evergreen shrubs or deciduous shrubs + small shrubs + ground cover or grass flowers or lawns. It is often combined with the structure of double-decked communities. Spatial sequence of sparse and dense plant landscape was formed. To meet the multiple needs of landscape and function. The selected plants are mainly native plants and zonal plants. Among them, lilac, elm, spruce, willow, poplar and *Pinus sylvestris* var. *mongolica* are scattered, isolated or gathered to form the landscape characteristics of plants on Jiamusi University campus.

3.3 Diversity and ecological distribution of families, genera and species of woody plants

A, B, C and D institutes in the study area were selected for field investigation and research through comprehensive investigation. The results show that: most woody plants are angiosperms. There are great

differences in genera content among different families of plants. For example, there are 32 genera of cypress family, and only one genera of Rutaceae, Tamarix and other families. The growth environment is suitable for

hillside, shrub, pine, forest margin and other places, suitable for hierarchical community planting. Selection of double or three-layer planting is beneficial to plant growth and beautiful layers.

Table 1. Composition and Ecological Distribution of Woody Plantson Campus of Jiamusi University

№	Plant gate	Family name	Genus number	Species number	Growth environment	purpose	Representative plants
1	Gymnosperm	Pinaceae	3	7	hillside	green	Pinus sylvestris var. mongolica
2	Gymnosperm	Cypress	32	4	hillside	green	Sabina chinensis
3	Angiosperm	Rosaceae	12	29	hillside Understory、shrub	Medical green	Sorbus
4	Angiosperm	Osmanthus	4	8	hillside	Medical\green	A Manchurian Ash
5	Angiosperm	Birch family	3	3	hillside	edible Medicalgreen	、Corylus heterophylla
6	Angiosperm	Leguminous	3	5	hillside	edible、 Medical\green	Desert false indigo
7	Angiosperm	Lonicera	3	6	Forest margin shrub	、green	Northeast, elder
8	Angiosperm	Yang Liu Ke	2	5	hillside	green	Populus poplar
9	Angiosperm	Aaron	2	2	Understory、shrub	green	philadelphus schrenkii
10	Angiosperm	Euonymus	2	2	Understory、hillside	Medical、greenl	Euonymus japonicus
11	Angiosperm	Vitis	2	2	hillside、shrub	Edible、greenl	Vitis amurensis
12	Angiosperm	Acer	2	5	hillside	green	Vitis amurensis
13	Angiosperm	Ulmus	2	5	hillside	green	Ulmus pumila
14	Angiosperm	Berberis	1	2	hillside、shrub	green	Berberis
15	Angiosperm	Ruta	1	1	hillside	edible、 Medical	orange
16	Angiosperm	Walnut family	1	1	hillside	Medical、greenl	Juglans mandshurica
17	Angiosperm	Self induction	1	1	hillside	green	Koelreuteria Paniculata
18	Angiosperm	Tamarix	1	1	hillside	Medical green	Tamarix chinensis
19	Angiosperm	Cornus	1	1	hillside	Medical、greenl	Cornus officinalis
20	Angiosperm	Rhododendron	1	1	Understory	Medica green	Rhododendron dauricum
21	Angiosperm	Bignoniaceae	1	1	hillside	green	Lagerstroemia indica
22	Angiosperm	Family family	1	1	hillside	Medical green	Mongolia oak

3.4 There are many kinds of common herbs

Campus green planting, woody plants are mostly one-time investments. Daily watering care is enough. Herbs play an important role in campus beautification. It has the characteristics of transformation, flexibility and

low cost. There are many families and genera of herbaceous plants on the campus of Jiamusi University. Choose one more year. It can change the shape of planting every year. It adds vitality and vitality to the future of the campus.

Table 2. List of Common Herbs on Campus of Jiamusi University

№	Plant name	Scientific name	Generic name	purpose	Growth characteristics	Growth habit
1	A bunch of red	labiatae	sage	ornamental greening	annual	sunny Sandy soil /
2	Persian chrysanthemum	Compositae	Autumn British	ornamental greening	Annual/ perennial	sunny Avoid heat /
3	Scutellaria barbata	Ligulariaceae	Scutellaria	ornamental greening	perennial	Humid and humid
4	Impatiens	Impatiens	Chrysanthemum supergenus	ornamental greening	annual	Happy water
5	Campanulaceae	Campanulaceae,	Campanulaceae	ornamental greening	Biennial	Cold tolerance drought lérance

6	Violet	Cruciferae	Violet	ornamental greening	Biennial perennial	Cool off
7	Dianthus	Pink	Dianthus	ornamental greening	perennial	Cold tolerance drought toleranc
8	Chinese herbaceous peony	Ranunculus	Paeonia	ornamental greening	annual	Sandy soil
9	Jasmine	Osmanthus	Jasmine	ornamental greening	annual	Light and cold tolerance
10	Lilac	Osmanthus	syringa	ornamental greening	perennial	Drought tolerance
11	Clivia	Lycoris	Clivia	ornamental greening	perennial	Light and cold tolerance
12	Celosia	Amaranthus	Genus clove	ornamental greening	annual	Light and cold tolerance
13	Tulips	Liliaceae	Tulip	ornamental greening	perennial	Avoid alkali soil
14	Lavender	labiatae	Lavender	ornamental greening	perennial	Cold tolerance

4 Conclusion

The distribution of plants is mainly influenced by natural geographical factors and human economic activities. Especially the difference of latitude location, land-sea distribution and altitude. Jiamusi University is located in the North Temperature Zone and has a big temperature difference in four seasons. The soil is mainly meadow soil and black soil, with rich vegetation types and high green coverage.

According to the survey and statistics, as a whole, the plant resources on the campus of Jiamusi University have been rationally planted. It has created a more beautiful campus environment. In addition to satisfying the senses of sight, smell and touch. It also pays more attention to ecology, the improvement of green scenery, the humanized design of teachers and students use needs and the presentation of campus characteristics. But the Campus of Jiamusi University is located in high latitude. It belongs to the alpine region. The plants are mainly cold-tolerant plants. Limited in planting. In particular, plants lack aquatic plants for landscaping. The species of trees and shrubs are single and need to be renewed and maintained without considering the scientific-city of planting. It is suggested that the overall situation, artistry and noise reduction functions should be considered in future development planning. To maximize the role of campus plant resources and create a more beautiful environment for good teachers and students.

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Reference

- Grimm N B, Faeth S H, Golubiewski N E, et al. (2008) Global change and the ecology of cities. *J. Sci. Science*, 319: 756-760.
- Zhao G, Jiang Z. (2010) From e-campus to e-learning: An overview of ICT applications in Chinese higher education. *J. Sci. British Journal of Educational Technology*, 41: 574-581.
- Li J, Shui B. (2015) A comprehensive analysis of building energy efficiency policies in China: status quo and development perspective. *J. Sci. Journal of Cleaner Production*, 90: 326-344.
- Kibert C J. (2016) Sustainable construction: green building design and delivery. John Wiley & Sons, the US.
- Geng Y, Liu K, Xue B, et al. (2013) Creating a "green university" in China: a case of Shenyang University. *J. Sci. Journal of Cleaner Production*, 61: 13-19.
- Saljoughinejad S, Sharifabad S R. (2015) Classification of climatic strategies, used in Iranian vernacular residences based on spatial constituent elements. *J. Sci. Building and Environment*, 92: 475-493.
- Lovell S T, Johnston D M. (2009) Johnston D M. Creating multifunctional landscapes: how can the field of ecology inform the design of the landscape. *J. Sci. Frontiers in Ecology and the Environment*, 7: 212-220.
- Tierney W G. (1988) Organizational culture in higher education: Defining the essentials. *J. Sci. The Journal of Higher Education*, 59: 2-21.
- Xi T, Li Q, Mochida A, et al. (2012) Study on the outdoor thermal environment and thermal comfort around campus clusters in subtropical urban areas. *J. Sci. Building and Environment*, 52: 162-170.
- Dober R P. (2000) Campus landscape: functions, forms, features. John Wiley & Sons, the US.
- Solecki W D, Rosenzweig C, Parshall L, et al. (2005) Mitigation of the heat island effect in urban New Jersey. *J. Sci. Global Environmental Change Part B: Environmental Hazards*, 6: 39-49.