Wu, S.T.; Xu, H.B.;Su, W.Q.; Hu, Y.Q.   Improving the sense of citizens' happiness in cold
                                                         regions during the COVID-19 pandemic blockade
                                                         through plant color planning

Research Paper

Improving the sense of citizens' happiness in cold regions during the COVID-19 pandemic blockade through plant color planning
— Taking the Harbin Institute of Technology Community as an example.

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Abstract

Harbin is one of the earliest China's cities that conducted color planning. Due to the influence of the cold geographical environment and the culture of immigrants, the urban color has become a cultural phenomenon deeply rooted in the hearts of the local people. Harbin, as one of the most famous gateway cities in China's "One Belt One Road" project, its position in Asia is becoming more and more important. Compared with international metropolises with excellent color planning such as Turin and Paris, Harbin has the potential to develop into a similar city, thererfore research on color planning in Harbin requires greater attention. In particular, Harbin was the center of the pandemic in the first half of 2020 in China. During the lockdown phase of the COVID-19, Plant color landscape was the most common view outside the community window. People had a deeper understanding of the creation of its color atmosphere. In addition, for most of the communities in cold regions such as the Harbin Institute of Technology (HIT) Community, the optimization of the color landscape is essential to improve the sense of the indoor happiness of the residents in the university (especially during the lockdown period due to the pandemic). Although plants are an important part of the sustainable color creation of the community environment, the current researches mostly start from architectural colors and less on plant colors. This article takes the plant landscape in the entrance area of HIT Community as the research object, draws on the perspective of resources dual-evaluation, and comprehensively evaluates the feasibility and necessity of the Community's plant color planning from the perspective of the supply and demand of Community plant colors. On the plant color supply side: select colorful flora that is well adapted to the climate environment of Harbin, use the AHP method to comprehensively evaluate its aesthetics, ecology, impact on residents' feelings and culture. The color plant clusters with higher scores are selected as the plant resources for color planning. On the demand-side: through the investigation of the plants' color in the entrance area of the college, it is found that the current campus plant color creation still has the following problems: 1.There is no comprehensive consideration mechanism for the color characteristics of campus community plants; 2. The color plant varieties are less used, the color is relatively single, the style is dark, and the color system is not rich enough; 3. The color landscape management is extensive, the overall effect is not satisfactory, 4. The planting of plants has less consideration for

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the health and emotional well-being of residents, and there is an urgent need for plant color planning. In the end, this article combines the campus landscape improvement project of HIT Community. Innovatively, use the subject control method to optimize the plant color landscape, improve the recovery effect of plant color landscape on the well-being of the residents in cold regions. It verified the feasibility of plant color planning in cold region communities, and provide practical reference and theoretical support for subsequent research. At the same time, given the current good results of gate area color planning, we will further expand the scope of the research, in the Campus Botanical Garden of the HIT, a landscape plan for the conservation of Mollisols in Heilongjiang province was carried out. New methods including the use of the subject control method have carried out the creation research of the earth color landscape, as a new form of resilient utilization of the Mollisols resources, it will be the next focus of our research.

1. Introduction

The campus is a place where people could live and learn new knowledge, and its environment is a silent classroom(Li Jing et al., 2007). The campus not only needs to have the function of teaching and educating people, it should also have a beautiful landscape that can cultivates students' sentiment and relaxes their mind. Due to the particularity of the subject (college students) on the university campus, its requirements for aesthetic level and environmental awareness are relatively high, and there are also higher demands for the campus plant landscape. Their requirements for the campus are not only "greening", but also demand for aesthetic appreciation, ecological adaptation, and service functions of the campus plant landscape. This requires us to have outstanding sense of science, aesthetics, and service performance in the campus plant landscape design(Ning Huijuan et al., 2011). Before starting the design, a quantitative evaluation of the beauty of the plant clusters adapted to the local ecological conditions should be carried out to guide the scientificity, accuracy, health and aesthetics of the campus plant landscape cluster layout.

2. Background

2.1. Plant Landscape Evaluation

Plant landscape evaluation originated in the United States in the 1960 s, used to evaluate the visual beauty of the landscape (Wang Jinghong, 2008). At present, the research on plant landscape mainly includes four schools: expert school, psychophysics school, cognitive school, and empirical school. According to different schools, various quantitative methods have been formed (Wu Songtao et al., 2012; Yang Yikun et al., 2007) and the analytic hierarchy process (AHP) is the most widely used method. AHP method can maximize the selection of plant landscape resources suitable for the local climate environment, and is a method to objectively find out the local landscape plant resources.

2.2 Two-Way Evaluation

The evaluation method of plant supply and demand mainly draws on the ideas of resource and environment carrying capacity evaluation and suitability evaluation of land space development(Two-Way Evaluation). The method of rationing the supply and demand of natural resources in cities is mainly based on "Regulations on the Use of Natural Ecological Space (Trial)", that is, the amount of local natural resources and the largest scale that it can support human production and living activities (supply-side evaluation), On this basis, carry out the evaluation of the suitability of land and space development. Under the premise of maintaining the good functioning of the ecosystem, comprehensively consider the local resource elements and location elements, and carry out the division of suitable areas for the construction of human activities (Wei Xuhong et al. 2019) (demand-side evaluation)".

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The two-way evaluation considers the natural resources in the site from both sides of supply and demand. On the basis of environmental friendliness, the use of site resources is optimized. This inspired us to learn from and refer to this rationing model when using plant resources on the campus of Harbin Institute of Technology. From both the supply of black soil plant resources and the needs of the campus, we also consider the construction of the local campus plant landscape.

However, in the current evaluation of plant landscape resources, most of them only give suggestions from the supply side. Does this enlighten us on whether we can use the perspective of two-way evaluation to evaluate the plant landscape from the demand side? Which means that under the condition of ensuring that the plant community grows well, what kind of plant landscape do we need, and what kind of plant community is beautiful?

2.3 Color Planning

Italian architects in the 19th century had similar questions. What kind of city made up of architectural "communities" is beautiful? What kind of urban style does the city need? Italian architects used the city color recommendation map of Turin to give us the answer. For cities, we think that the style after color planning is beautiful[2]. Then can we take plant color as the focus of the demand side of the plant landscape? The current research on plant color is mostly biased towards the mechanism of plant color change (Zhu Zhixin et al., 2016)、the effect of plant color changes on the human body (Wu Songtao et al., 2012)、the color design of plant group (Susan Chiworth, 2007), etc，few studies on large-scale and macroscopic plants similar to urban color planning (Yin ming, 2012).

In response to the above-mentioned thinking, based on the evaluation of campus plant resources, this paper draws on the perspective of two-way evaluation and uses plant color as the entry point for the demand side of campus plant landscape. On the basis of ensuring the good growth of plants, we focus on the unified planning of their colors and control the colors of the plant landscape from a macro perspective. And combined with the practical experience accumulated in the HIT school celebration landscape update, summarize the basic process of plant color planning.

2.4 Landscape Planning and Ecological Restoration

Crowe pointed out that "landscape planning" is an extension of the current concept "land planning", encompassing the "organisms" of ecology, sociology and landscape aesthetics. (Crowe S, 1967). prof. Maru believes that "landscape planning" is a science for ordinary people, and encouraging wider public participation is an important part of it. The public and experts will consider the way and significance of landscape planning from their own specific perspectives." (Marusic, 2002). Landscape planning and general landscape design are mainly different from the scale of planning and the ecological considerations it carries. At the beginning of the 21st century, the "Europe I Landscape Convention advocated that "Landscape planning" should have a large amount of ecological advancement, and its planning purpose is to enhance, restore, and create ecological landscapes.

"Landscape planning" includes two important activities, "landscape protection" (protecting the existing landscape based on the current existing landscape value) and "landscape restoration" (ecologically oriented landscape restoration)". Combining the above-mentioned scholars' understanding of "landscape planning and ecological restoration", the definition of "landscape planning and ecological restoration" is summarized as follows: (1) Its research objects are mainly natural resources and human resources on the earth's surface; (2) Its service targets are citizens, and extensive public participation design should be considered; (3) Its research purpose is to repair the damaged natural landscape and coordinate the relationship between human and land; (4) It is an interdisciplinary subject based on ecology and involving many principles of natural science; (5) Its planning content covers a wide range of areas including rational

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use of ecology, land management, ecological restoration, environmental protection, and urban and rural construction (Yue Bangrui, 2019).

3.Evaluation and Investigation of Plant Resources on the Supply Side

3.1 Select plant landscape sample points

According to the different types of plants and configuration methods, 32 typical plant landscape units in the 10*10 square meters plots in HIT and nearby areas were selected for evaluation. Number the selected plant landscape units, record their plant collocation and standardize the plant landscape planting mode through the blurred background of the photo. When selecting plant landscape samples, the main consideration is the type of landscape, ignoring the quality differences caused by planting, to ensure the accuracy and scientificity of the evaluation (Li Shuhua , 2010).

3.2Evaluation system establishment

According to the actual planting and growth situation of the campus plant landscape, with due consideration of its use function, based on the previous research results (Wang Keke, 2017; Lv Wenjun, 2018; Ning Huijuan, et al., 2011; Yang Yikun, et al., 2007), consulted many teachers engaged in the application of plant landscape research in the school, established a campus plant landscape evaluation system (table 1) and scoring standard (attached table 1) to evaluate the plant landscape on the campus of Harbin Institute of Technology. Since the subjective scoring requires a professional background in garden plants, 15 graduate students in garden plants and landscape architecture were invited to score. The scoring is carried out by referring to the fuzzy standardized on-site photos, and the scores are 5, 3, and 1 indicating the best, medium and bad.

3.3Factor layer weight establishment

The campus plant group has both aesthetic, ecological, service, and cultural values. According to the campus's requirements for plant landscape, through consultation with 9 experts (4 of landscape design, 3 of garden plants, and 2 of gardening department responsible for garden construction guarantee), construct A-B, B1-(C1-C5), B2-(C6-C8), B3-(C9-C11), B4(C12-C13) judgment matrices, and make importance judgments, Yaahp software is used to obtain the weight value of the factor layer and check the consistency (Table 2).

Table 1：Campus Plant Landscape Evaluation System

Target layer	Criterion layer	Factor layer	Factor layer description
Application Evaluation of Campus Plant Group A	Aesthetic index B1	Ornamental of plant groups C1	The aesthetic degree of ornamental parts such as flowers, leaves, fruits and branches.
		Level richness of plant landscape C2	The Collocation of Plant Landscape Trees, Shrubs and Grasses, the Mismatch of Plant Groups.
		Plant color change and seasonal change C3	The richness of plant landscape with seasonal variation and the color intensity.
		Spatial Enclosure of Plant Landscape C4	The enclosure and definition effect of plant groups on space.

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	Tree Canopy Density C5	Tree shading degree in the region.
Ecological Indexes B2	Species Diversity C6	The richness of plant species
	plant Ecological Adaptability C7	Plant health, growth potential, cold resistance, drought resistance, pest resistance and other traits.
	Stability of Plant Landscape C8	Symbiosis and Coexistence of Plants in Groups to Maintain a Sustainable Landscape.
Service Index B3	Plant Landscape Accessibility C9	Accessibility of plant itself, accessibility of plant community space.
	The symbol of plant landscape C10	A strong sense of plant image, plants have a symbolic role.
	Plant landscape interactivity C11	Attract visitors to interact with multiple senses such as touching and sniffing.
cultural indicator B4	Imagination Meaning of Plant Landscape C12	The cultural significance of the plant landscape itself, such as pine, bamboo, and plum, is known as the "Three Friends of the Years and Colds" in Chinese tradition.
	Local Culture of Plant Landscape C13	Plants that show the characteristics of mollisols plants and have significant regional characteristics.

Table 2: The weight of each index of campus plant application evaluation

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
Weight	0.0211	0.0391	0.0609	0.0107	0.0134	0.0651	0.1707	0.2982	0.0364	0.1456	0.0364	0.0341	0.0682
Consistency Check	CR=0.0304＜0.1												

3.4 Landscape Effect Evaluation of Campus Plant Group

Take the selected 32 groups of plants that can grow and reproduce normally on campus as the research object. According to the evaluation criteria, 15 graduate students were invited to score. The results of their scoring are shown in Table 3. According to the score, the plant clusters are divided into three levels. 5≥Class, I plant group ≥4, 4＞Class II plant group ≥3.2, 3.2＞Class III plant group ≥0. There are 24 groups of plants groups in the I and II levels, representing the plant groups with relatively outstanding effects on the landscape, ecology, campus services, and cultural inheritance on the campus of the HIT and nearby areas. They can be used as excellent planting resources for campus plants to supply and reserve, and they can be promoted and planted on campus according to the requirements of the campus demand side.

Table 3: 6 groups of plant landscape groups with the highest scores

Number	The Species composition of group plants	Conflation	Grading

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31	*Xanthoceras sorbifolia + Betula platyphylla Suk. + Sedum spectabile + Swida alba + Euonymus phellomanus+Quercus mongolica. + Plantago asiatica*	4.3129	I
10	*spruce + pine + cypress + rosewood + Syringa oblata + northeast forsythia + yuyemei + leafy Syringa oblata + white Syringa oblata r*	4.2698	I
30	*Xanthoceras sorbifolia + Euonymus variabilis + Pinus sylvestris var. mongolica + Redwood + Gleditsia sinensis + Acer truncatum + Wax + Poa pratensis*	4.2185	I
20	*Jingtao + Pinus sylvestris + Wax + Platycladus orientalis + Euphorbia quinquefolius + Ulmus pumila + Trifolium repens*	4.2038	I
13	*Betula platyphylla Suk. + Platycladus orientalis + Picea asperata + Acer truncatum + Redwood + Rosa davurica + Syringa oblata + Wax + Trifolium repens*	4.1136	I
6	*Salix matsudana + cypress + Ulmus pumila + wax + Syringa oblata + Syringa microphyla + Rosa xanthina + Kentucky bluegrass*	4.0640	I

4.Demand Side Plant Color Planning

The main campus buildings were built in the 1960s and 1970s, At the beginning of the establishment of the school, the campus architecture focused on functionality and is poor in integrity (Wang Ziying, 2007). After the unified planning of urban architectural color in Harbin in 2002 (Susan Chiworth, 2007), with the renovation of the campus building in 2009, the materials and colors of the building have been enhanced in terms of integrity(Zhang Shuang et al., 2010), the color of the main campus has become more unified and the integrity has been optimized. Meanwhile, in the HIT Botanical Garden, on account of the demand for local Mollisols conservation and plant color landscape of the campus, there is a need for color landscape planning.

4.1 Selection of research area

The main campus of Harbin Institute of Technology, which has a certain architectural color foundation (Harbin Urban Planning Bureau, 2015) and an urgent need for landscape renewal (Li Bing, 2015) is selected as the experimental site. At the same time, in order to better cooperate with the HIT 100th Anniversary Landscape Renewal Project, this study selected the experimental area at the entrance of the main campus, and selected sites with obvious and representative landscape features: including the main building, administrative building, library, and ZhengXin Building, Court Street, Commander Street, FuHua Street and its surrounding areas (Figure 3). The test site is located in the center of Harbin city, with a temperate continental monsoon climate. The average temperature in winter is -19 ℃ , the average temperature in summer is 23℃, and the annual average rainfall is about 570mm.

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4.2 Analysis of color planning problem of HIT main entrance area
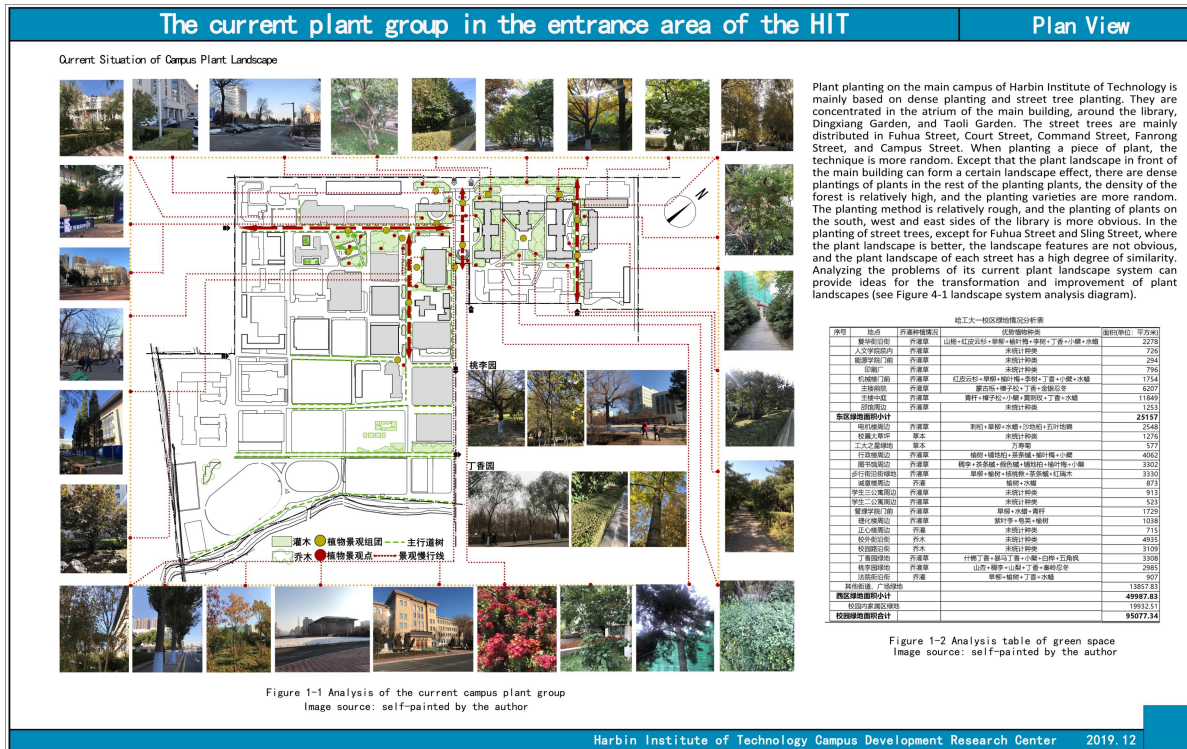
Figure 1. Color quantitative analysis of the entrance area of HIT. Source: Author drawing.

At present, the campus area building color planning has a certain foundation, forming a style dominated by beige and off-white, but the color planning of plants is slightly blank. After a comprehensive inspection of the entrance area, we believe that:

1. HIT has not yet formed a consideration mechanism for the overall characteristics of campus plant color, The plant landscape colors in some areas are too gorgeous and unique, and lack of necessary connection with the overall style. As far as the local plant landscape is concerned, the color scheme is pragmatic and the color matching is bright, but these areas that pursue gorgeous and unique undermine the overall color style of the campus.

2. Affected by the idea of University Flower promotion, the existing plant group varieties use single and rigid color matching techniques. In some areas, the proportion of plants of the same species is too high, resulting in the convergence of plant landscapes on campus. Although *Syringa* (HIT school emblem) is a good color plant that adapts to the climate characteristics of Harbin, attention should be paid to the issue of landscape homogeneity in its application.
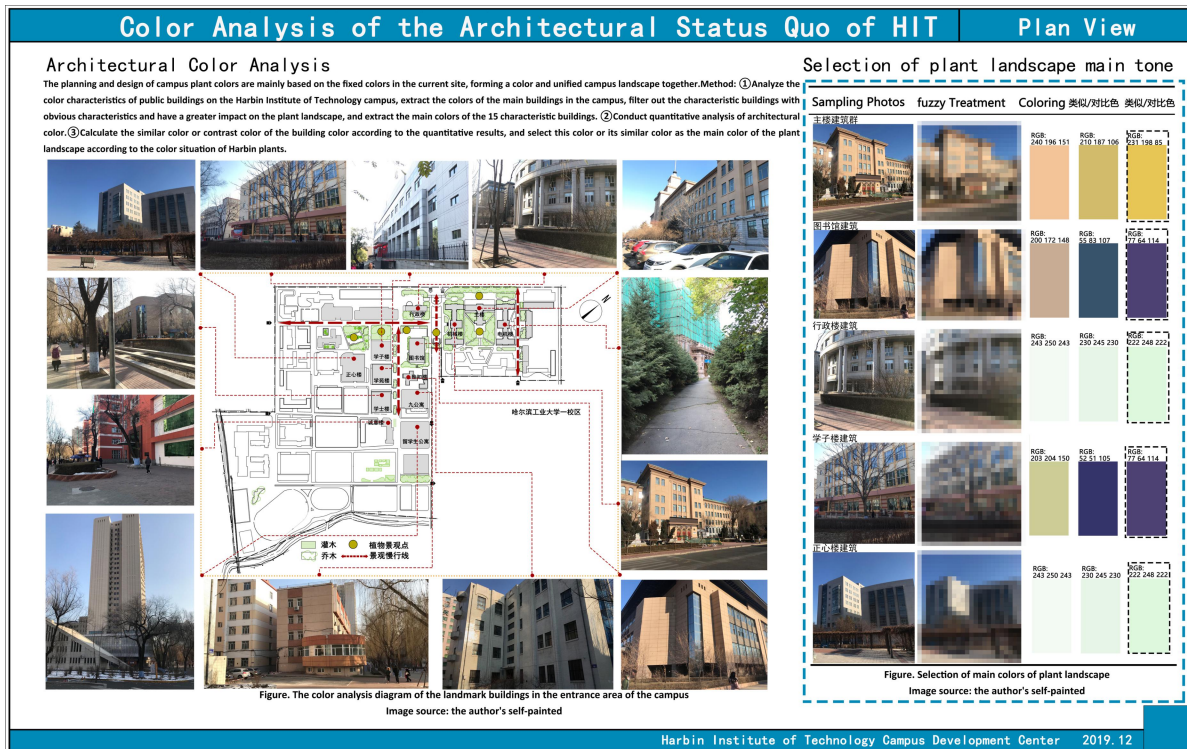
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Figure 2.Quantitative analysis of typical plant color in the entrance area of HIT. Source: Author drawing.

3. Affected by funds and manpower, the color matching of plant landscapes in some areas is superficial, lacking refined management. Since the plants on the campus are state-owned assets, workers often use transplanting methods for landscape renovation, especially when it comes to plants. However, the transplanted plants are often planted at will, most of them planted hedges in the periphery.

4. The Mollisols resources in the botanical garden are mainly used for consumption, and the fertility of the soil resources in the botanical garden has declined severely. At present, soil fertility in the campus is maintained through soil replacement. The soil to be replaced comes from the forest outside the city, the color of the soil after utilization becomes lighter, and the fertility declines seriously, it is difficult to effectively support the growth of plants.

4.3 Quantitative color analysis of typical buildings and plant groups in main entrance area

Quantification of the color of typical buildings in the entrance area (Figure 1): 1. Historical characteristic buildings: Select and quantify the buildings that are close to the plant cluster, unique in style, heavy in history, and representative. The main building complex, the color scheme is distributed in R186 G153 B122-R240 G196 B151 (beige series), with high saturation and high brightness style characteristics. 2. Modern characteristic buildings: select neoclassical buildings with obvious style characteristics, large flow of people, and great influence on the formation of plants. Mainly for the library and administration building. The color scheme of the library continues the color style of the main building complex. In order to highlight the black soil characteristics, the color selection reduces the color saturation and brightness. It is distributed in R200 G172 B148-R233 G190 B149 (dark yellow series), and the material is paint. The color scheme of the administrative building is distributed in R232 G231 B2253─R243 G250 B243 (off-white color) in the high brightness and low saturation area, and the material is stone. The two buildings have obvious characteristics and represent the modern architectural style of the campus.3. Public buildings: select buildings that have a large flow of people and are closely related to the formation of planets, mainly the ZhengXin Building. The color matching of ZhengXin Building continues the

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administrative building, with R232 G220 B119──R243 G250 B243 (off-white series) in high brightness and low saturation areas, and the material is stone.

Typical plant color quantification (Figure 2): Since HIT uses *Syringa oblata* as the University Flower, *Syringa oblata* has become the most widely distributed and most typical color plant on campus. The *Syringa oblata* garden in the entrance area and the front of the main building are mainly colored plants of the *genus Syringa*, and the colors are mainly distributed in areas with low lightness saturation in R93G82B125-R116G87B141 (purple series). *Populus sibiricum* is another typical color plant, mainly distributed on both sides of Fuhua Street. The planting scale is large and the style is outstanding. The color is distributed in the areas with low saturation and lightness in R222G197B64-R232G203B101 (yellow series).

4.4 Overall Orientation of Campus Plant Color

After a century of development, Harbin Institute of Technology has obvious color characteristics in campus architecture, forming a style dominated by beige and off-white, and the architectural style and color characteristics tend to be harmonious. In terms of plant color style, we should also adhere to the principle of harmony and unity, and take "*Syringa oblata* , elegant, warm, and harmonious" as the overall positioning of the plant color plan: based on the purple of *Syringa oblata* , and pay attention to the color matching of the campus building. , Forming a campus plant color landscape with uniform color, rich hues and overall harmony [8].

At the same time, we tried to create corresponding color styles in the botanical garden, using large areas of colorful plants to cover the soil, by increasing the input of organic matter to the soil ecosystem, try to restore the fertility of Mollisols in a near-natural way.

4.5.Color Control of the Campus Plant Communities

When planning the color of plants, you can appropriately refer to the color styles of the buildings that have been formed for matching. Select the complementary color/similar color of the theme color of typical buildings as the main color of the adjacent plant group to carry out color matching (main control method)[8], and control the color of the plant in blocks. On the basis of combining the existing typical color plants, create a harmonious and unified campus color impression (This method is also suitable for the protection of large areas of Mollisols in the botanical garden).

The campus((Including botanical garden) color area exists in the form of points (nodes), lines (streets), and planes (blocks), and multiple areas are connected to form a network, thus forming the overall impression of campus colors [8]. Among them, the area occupied by the nodes is very limited, but the number is large, which is not easy to control and can be appropriately integrated into blocks for control. The campus color construction is controlled by block method, This paper divides the color control area of the entrance area into the active pedestrian area, the historical style control area, the axis green space control area, and the open green space control area according to the different functional blocks of the green space distribution on the campus. These four-color control areas are used for the overall control of plant color. (Figure 3)
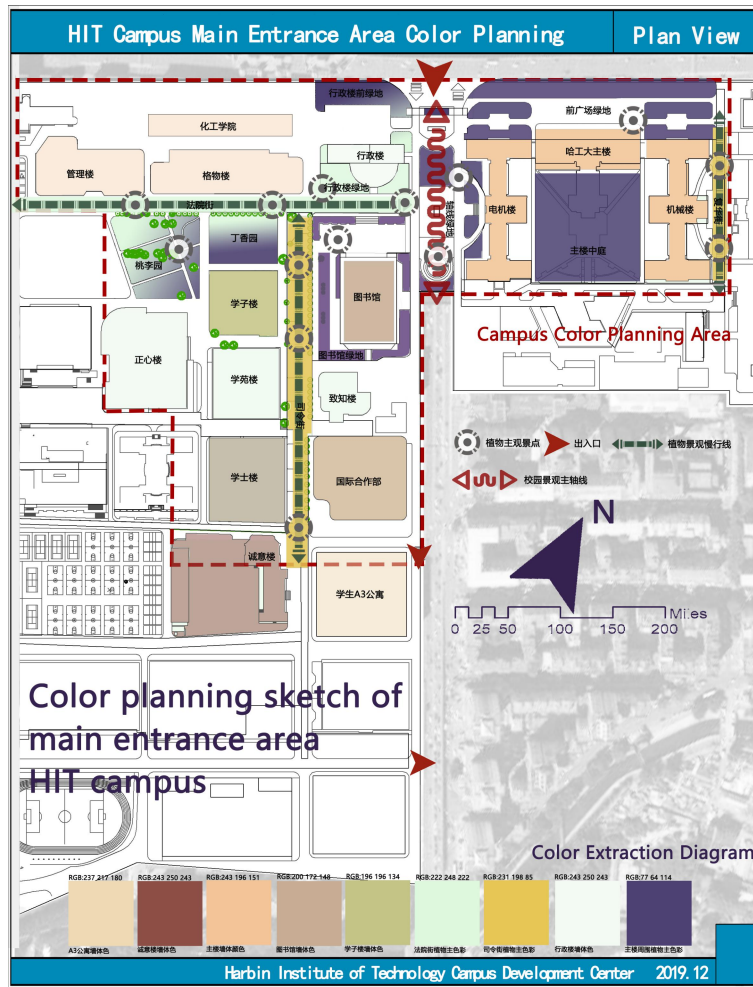
Figure 3. Color planning of HIT University campus entrance area. Source: Author drawing.

Quantification of main hues of plant groups: On the basis of determining the typical buildings in each region, the color of typical buildings are quantified to determine the RGB value of theme color. According to the Mensell system, two colors on the hue ring that are 120 to 180 degrees apart are called contrast colors (Se Yan, 2011)，The range accounts for about one-sixth of the total color wheel. In RGB mode, assignment calculation, formula 1 is(Xue Xiangyang et al., 1999)：

$$r3 = (r1 - r2) / 256$$
$$g3 = (g1 - g2) / 256$$
$$b3 = (b1 - b2) / 256$$
$$diff = sqrt(r3^2 + g3^2 + b3^2)$$

Set two colors in A (r1g1b1) B (r2g2b2): diff is the ratio of two colors. If AB is a contrast color, diff should satisfy $5/6 \leq diff \leq 1$. If AB color is similar, diff should satisfy $0 \leq diff \leq 1/6$. The comparative/similar colors of typical architectural colors can be obtained, taking it as the main tone of plant groups for resource selection.

4.5.1 historic townscape control area
Scope: Green space in front of the three buildings and green space in the atrium. Control principle: emphasize the original historic site, plant landscape color should play a prominent role in the original historic site. The third building is a typical historical building in this region, with the main tone of

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R186G153B122 - R240G196B151 (beige) medium-high brightness and high saturation. Considering that the representative plant of the campus is Syringa oblata , in order to highlight the historicity of the main building, strengthen the color comparison, and give people a full, vivid, and strong visual impact, the comparative color system of the theme color of the main building is selected as the main tone of the plant group in the region. Substituting formula 1, R77G64B114 (blue-violet) with low brightness and low saturation in the colorimetric system was selected as the main hue of plant group in this region. According to the excellent campus plant group resources screened above, the 10th group of *spruce + pine + cypress + rosewood + Syringa oblata + northeast forsythia + elm leaf + leaf Syringa oblata + white Syringa oblata s* and the 1st group of *syringa + leaf Syringa oblata + Salix matsudana + Lonicera japonica Thunb. + climbing tiger + Poa pratensis* were selected as the plant groups suitable for planting in this area.

4.5.2 Axis green space control area

Scope: The planting area in front of the school, the green space on the west side of the main building, and the sculpture background green space. Control principle: highlight the main axis of the *Syringa oblata* campus, and the application ratio of purple and related color plants is over 60%. The three green spaces are all located on the campus entrance axis, which is highly symbolic. The theme color should be the school color R156G87B141 (blue-purple series), based on the plant group resources selected in the previous article, Selected 29 groups: *purple leaf plum + purple leaf plum + Syringa oblata + yuyemei + ground cypress + water wax + bluegrass* for planting. It should be noted that the green area on the west side of the main building is mainly herbaceous, and cold-resistant herbs such as *Viola Serrata* and *Viola sage* can be replanted appropriately.

4.5.3 Vitality walking area

Scope: The planting area of FuHua Street, Command Street, and Court Street. Control principle: Coordinate the building, control the color of the plants by the street as a unit, and build the characteristic streetscape of the campus. Typical buildings in the planting area: main building, library, administration building, The main colors of the building are R186G153B122-R240G196B151 (beige series), R200G172B148-R233G190B149 (dark yellow series), and R232G231B2253-R243G250B243 (off-white series).

In order to create a strong sense of immersion and campus coordination in the street scene, the same color system of the main color of the building is selected as the theme color of the plant group in the area. After substituting formula 1 into the calculation, select the high-brightness and low-saturation regions in the same color system R231G198B85 (brown-yellow), R222G248B222 (white-green), and R222G248B222 (white-green) as the theme color of the plant group in this area. According to the plant group resources selected in the previous article, select the fourth group: *Populus Albus + small leaf syringa + water wax + yellow thorn rose + bluegrass (yellow series)*, and the 12th group: *Acer truncatum + Pentagonal maple + water wax + plug wings Euonymus + bermudagrass (yellow-red)*, group 31: *Aronia Vulgaris + white birch + acacia Saponaria + red dogwood + Pteropus euonymus + hemerocallis + mongolica + plantain (white red)* and group 5: *Dry willow + fir + plum tree + spruce + water wax + golden flame spiraea + Syringa oblata + white Syringa oblatar (white purple)* for planting, appropriate replanting of plants with prominent colors such as mountain apricots, peaches, and pear trees can be used as supplements for promotion.

4.5.4 Open Green Space Control Area

Scope: Syringa oblata Garden, Peach Tree, and Plum Tree Garden, green space in front of the library building, and green space in front of the administrative building. Control principle: control the color tone and build an open color landscape. Typical buildings around the green space are Zhengxin Building, Library, and Administration Building. The main colors of the building are R232G220B119 ─ R243G250B243 (off-white color), R200G172B148 ─ R233G190B149 (dark yellow), R232G220B119 ─ R243G250B243 (off-white color). Since the four green spaces are close to the building, the contrasting colors of the main building can be used to highlight the architectural style in terms of color matching. In

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the pedestrian zone, the theme color (white) of the pedestrian zone is used for gradual color matching. After substituting formula 1 into the calculation, choose R77G64B114 (blue-purple series), R156G87B141 (red-purple series), and R77G64B114 (blue-purple series) in the contrast color system as the theme colors of the plant group in this area. According to the previous text, the plant group resources were selected, and the 21st group: *pear tree + water wax + northeastern apricot + peach + mongolica + larch (white)*, the 3rd group: *mongolica + spruce + Syringa oblatas + gold and silver Honeysuckle + Ume + Bluegrass (blue-purple)*, group 19th : *paving cypress + apricot tree + spruce + peach + mountain peach thick plum + water wax (white)* and group 20th: *peach + camphor Pine + water wax + paving cypress + five-leaf brocade + flowering plum (purple)* are promoted as a plant group suitable for planting in this area.

5. discussion AND Conclusions

This article draws on the perspective of two-way evaluation,(1) From the supply side, the HIT plant resources were considered, and the AHP method was used to analyze and evaluate the 32 groups of plant units that are currently distributed in the school and can be used as plant transformation resources. 24 groups of groups with good comprehensive benefits were selected as reserve resources for plant color planning.(2) At the same time, starting from the demand side of campus plant landscape, considering the demand and feasibility of plant color planning in the entrance area of the campus, it is found that the current campus building color planning is relatively complete, and the plant color is still relatively weak. It is necessary and feasible to conduct plant color planning. Finally, according to the current situation of the campus entrance area, the main control method is adopted to plan the colors of the plants in the garden, and the results have certain practical guiding significance.

The campus botanical garden of HIT is the key area for our future color planning. Due to the excessive planting of fast-growing plants, the over-cleaning of plant litter in the site, and the major pedestrian movement, it seriously affects the habitat of birds and other creatures. As a result, the input of organic matter to the ecosystem in the entire region is too little, and Mollisols degradation is serious. At present, it relies on successive years of Mollisols replacement to maintain the artificial vegetation on the site. For this reason, we adopt the method of landscape color planning to cover the entire area with colored soil remediation plants, and use flexibly control method to adjust the flow of people to reduce human interference during the animal breeding and migration seasons, while reducing the cleaning of litter and introduces animal food plants to attract more animals to join the ecosystem in this area. In addition, in autumn, the increase in the water level of the Majiagou River flowing through the Botanical Garden is used to guide the river water to cover the litter and restore the Mollisols fertility of the entire area in a natural way. The resilient use of the Mollisols resources in the campus botanical garden and the protection of the local ecosystem are the next important directions for our color planning.

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Figure 4. Landscape Intention Map of HIT's Botanical Garden. Source: Purple Valley Eden.

This study also has certain limitations. The selection of plant resources on the supply side is limited to the first and second campuses of Harbin Institute of Technology, and the number of samples is not large enough. In addition to the lack of color planning mentioned above, the current plant landscape in Harbin Institute of Technology also has problems such as high canopy closure of plant clusters and unclear division of plant functional areas. Therefore, in future research, we can continue to learn from the dual evaluation idea, extensively count the plant landscape resources in Harbin, and further refine the functional division of plants under the campus plant color plan. The construction of the campus plant landscape according to color, function, and density is the main work that our team will carry out in the next step.

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