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Analysis of Plant Landscape Planning in Macau Universities——Taking Macau University of Science and Technology as an Example

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Abstract: Due to the differences in climate, geography and humanistic customs in different regions, plant landscapes present certain regional characteristics. The public has been aware of the living environment for the past year, and the concept of green ecology has been integrated into every scene of life, especially the continuous improvement of the campus environment. Taking Macau University of Science and Technology as the research object, the plant species, distribution rules and color collocation of the campus plant landscape are studied and summarized, and the existing deficiencies are analyzed and corresponding optimization measures are proposed to improve the campus plant landscape in Macau. The planning has certain significance and provides ideas for the continuous optimization of plant landscape design.

1. Introduction

Campus plant landscape can only use transpiration to increase air humidity, adjust campus microclimate, alleviate heat island effect, and through reasonable configuration, can reduce environmental noise in teaching areas and living areas; the oil and mucus secreted by the leaves of plants can absorb air dust, Purify the air; Plant gathering can provide habitat for insects and animals to maintain biodiversity. And, it plays a decisive role in space separation, sight guidance, shading and summer heat, shaping culture, creating fundamentals, etc.

There are 10 higher education institutions in Macau, among which the University of Macau and Macau University of Science and Technology have internationally recognized university rankings such as QS, Times and Shanghai Branch. They are world-renowned universities and their campus environment has become one of the basis for international rankings. The rationally configured plant landscape does not provide students and teachers with a comfortable learning, living and working environment. At the same time, it serves as an important school image display, attracting students and teachers from all over the world to join the school teachers and students, thereby optimizing

campus plants The landscape and the enhancement of the campus ecological environment have important strategic significance for the long-term development of the campus.

1.1 Climate and Geographical Conditions of Macao

The Macau Special Administrative Region is located on the southeast coast of China, on the west bank of the Pearl River Estuary, with Zhuhai City in the north, about 60 kilometers away from Shenzhen and Hong Kong in the east, and surrounded by the sea on three sides. It has direct sunlight twice a year, strong solar radiation, strong evaporation and heat the climate characteristics of abundant, abundant water vapor, high temperature and rain, belong to the subtropical maritime monsoon climate [1]. As of 2020, Macau has a total land area of 329,000 square kilometers, consisting of the Macau Peninsula, Taipa, Coloane, Cotai Reclamation Area, Xincheng District A and the Hong Kong-Zhuhai-Macao Bridge Zhuhai-Macao Port artificial island Macau Port[2]. The geological structure of Macau is dominated by granite in igneous rocks, and the bedrock is granite in the Yanshan tectonic period. In addition, two-thirds of the land is formed by artificial reclamation [3].

1.2 Introduction to Macau University of Science and Technology

Founded in 2000, Macau University of Science and Technology is the largest comprehensive university in Macau. It is located on Taipa Island, Macau. The campus covers an area of 210,000 square meters. It is adjacent to the Datan Mountain Country Park in the north, the Golden Boulevard in the south, and the Golden Boulevard in the west. Wangde Notre Dame Bay Wetland Park, east of Macau International Airport, beautiful environment and convenient transportation.

2. Plant species

Macau University of Science and Technology has a rich variety of plants. According to the spatial function and height of plants, they can be divided into 5 types: ground cover plants, dwarf shrubs and herbs, shrubs, small trees, and medium-high trees. After investigation, there are 372 species of plants on campus, including 64 ground cover plants, 121 dwarf shrubs and herbs, 112 shrubs, 40 small trees, and 35 medium-high trees. There are many shrubs and herbs. In terms of quantity, Moraceae and Terminalia neotaliala in trees are the most numerous; Ixora chinensis Lam. and Allemanda cathartica Linn. Are the most in shrubs; Wedelia trilobata in ground cover plants are the most. The specific plant names are shown in Table 1. The following plants grow luxuriantly on the campus and show a certain degree of adaptability, which has a certain reference for the selection of plants on the Macau campus. In addition, common plant specimens on campus are shown in Figure 1. There are many flowering plants in four seasons, with rich shapes and colors, which is conducive to enhancing the sense of hierarchy and diversity of the plant landscape.

Table 1 Plant species

species	height (m)	name	spatial effect
Ground cover plants	0.3<	*Paspalum orbiculare* Forst., *Dicliptera chinensis* (Linn.) Juss., *Hydrocotyle sibthorpioides* Lam., *Pilea microphylla* (L.) Liebm., *Mallotus paniculatus* (Lam.) Muell. Arg., *Peperomia pellucida* (Linnv.) Kunth, *Ophia pellucida* (Linnv.) Kunth Argenteo, *Cayratia corniculata* (Benth.) Gagnep., *Oxalis corniculata* L., *Morinda parvifolia* Bartl. et DC., *Terminalia calamansanai* (Blanco) Rolfe., *Red oxalis corniculata* L., *Wedelia trilobata*, *Eleusine indica* (Linn.) Gaertn., *Plantago asiatica* L., *Alternanthera philoxeroides* (Mart.) Griseb., *Zoysia matrella* (Linn.) Merr., *Digitaria sanguinalis* (Linn.) Scop., *Oxalis corymbosa* DC., *Oxalis corniculata* Linn., *Eclipta prostrata* (L.) L , *Acalypha australis* Linn., *Sida acuta* Burm. F., *Sesbania cannabina* (Retz.) Poir., *Pharbitis purpurea* (Linn.) Voigt, *Cyperus rotundus* L., *Solanum lyratum* Thunberg, *Cayratia japparagus* (Thunchinb.) Gagnep. ensis (Lour.) Merr., *Eragrostis tenella* (Linn.) Beauv. ex Roem. et Schult., *Pharbitis nil* (L.) Ching, *Pueraria phaseoloides* (Roxb.) Benth., *Ny mphaea tetragona* Georgi, *Zephyranthes candida* Lindl.Herrb., *Dendrathema indicum* (L.) Des Moul., *Liriope spicata* (Thunb.) Lour., *Hibiscus rosa-sinensis* L., *Euphorbia thymifolia* Linn., *Oxalis corniculata* Linn. ., *Alstonia scholaris* (Linn.) R. Br., *Litsea glutinosa* (Lour.) CB Rob., *Lactuca sativa* Linn., *Cyclosorus parasiticus* (L.) Farwell., *Zanthoxylum avicennae* (Lam.) DC., *Paederia stenophylla* Merr. , *Chlorophytum comosum* (Thunb.) Baker, *Fallopia multiflora* (Thunb.) Harald., *Taraxacum mongolicum* Hand.-Mazz., *Psychotria rubra* (Lour.) Poir., *Schefflera arboricola* Hay., *Mentha haplocalyx* Briq., *Houttuy cordata* Thunb., *Conyza canadensis* (Linn.) Cronq., *Red oxalis corniculata* L., *Paspalum thunbergii* Kunth ex Steud., *Smilax china* Linn., *Rhynchelytrum repens* (Willd.) Hubb., *Cajanus scarabaeoides* (Linn.) Thouars, *Axonopus compressus* (Sw.) Beauv., *Alternanthera sessilis* (Linn.) DC., *Euphorbia thymifolia* Linn., *Philodendron hederaceum* (Jacq.) Schott, *Bothriospermum chinense* Bge., *Eclipta prostata* L.	Plant paving in outdoor spaces.
Dwarf shrub And herbs	0.3-0.9	*Loropetalum chinense* var. rubrum Yieh., *Red hibiscus rosa-sinensis* L., *Schefflera arboricola* Variegata, *Hymenocallis littoralis* (Jacq.) Scalisb., *Morinda parvifolia* Bartl. ex DC., *Catharanthus rose-sinus* (L.) G.Don, *Allamanda catharticus* (L.) G.Don, *Allamanda catharticus* , *Lantana montevidensis* (Spreng.) Briq., *Cyclosorus parasiticus* (L.) Farwell., *Ficus hispida* L. f., *Codiaeum variegatum* Blume, *Bidens pilosa* L., *Bridelia tomentosa* Blume, *Vernonia cinerea* (L.) Less., *Allamanda cathartica* Linn., *Hibiscus rosa-sinensis* L., *Lantana montevidensis* (Spreng.) Briq., *Schefflera minutistellata* Merr. ex Li, *Aglaia odorata* Lour., *Rosa chinensis* Jacq., *Thunbergia erecta* (Benth.) T. Anders,	Define, isolate and connect outdoor spaces.

		Solanum torvum Swartz, *Adhatoda vasica* Nees, *Conyza canadensis* (L.) Cronq. var. canadensis, *Emilia sonchifolia* (L.) DC, *Cynoglossum zeylanicum* (Vahucal) Brand, Lactucal sativa Linn., *Bidens pilosa* L., *Alysicarpus vaginalis* (L.) DC., *Wedelia triloba* (L.) Hitchc., *Chamaesyce hirta* (L.) Millsp., *Euphorbia atoto* Forst. f. Fl., *Artemisia indica* Willd., *Celtis timorensis* Span., *Carmona retusa* (Vahl) Masam., *Phyllanthus urinaria* L., *Solanum nigrum* L., *Red ixora chinensis* Lam., *Praxelis clematidea* (Griseb.) RM King et H. Rob., *Duranta repens* L., *Red hibiscus rosa-sinensis* L., *Celosia argentea* var. Plumosa, *Dendrathema lavandulifolium* (Fisch. ex Trautv.) Ling et Shih, *Jasminum sambac* (L.)Ait., *Yellow ixora chinensis* Lam., *Punica granatum* Linn., *Litsea glutinosa* (Lour.) CB Rob., *Grewia microcos* L., *Youngia japonica* (Linn.) DC., *Amaranthus lividus* L., *Limonium bicolor* (Bag.) Kuntze, *Pyrostegia venusta* (Ker-Gawl.) Miers., *Iris japonica* Thunb. f. pallescens PLChiu et YTZhao, *Panicum repens* Linn., *Pteris vittata* L., *Eclipta prostrata* (L.) L., *Rhus chinensis* Mill., *Schefflera arboricola* Hay., *Sapium discolor* (Champ. ex Benth.) Muell. Arg ., *Hemerocallis citrina* Eugenio Baroni, *Lantana camara* L., *Gardenia jasminoides* Ellis, *Evodia glabrifolia* (Champ. ex Benth.) Huang, *Mimosa pudica* L., *Mahonia fortunei* (Lindl.) Fedde, *Rosa laeibata* Michx sPolyiricuma Detumlar. Redouté, Fallopia japonica (Houtt.) Ronse Decr., *Agrimonia pilosa* Ledeb., *Perilla frutescens* (L.) Britton var. crispa (Thunb.) Decne., *Sedum aizoon* L., *Andrographis paniculata* (Burm. f.) Nees, *Fuchsia hybrida* Hort. ex Sieb. et Voss., *Rumex acetosa* L., Tradescantia zebrina (Schinz) DR Hunt, *Ampelygonum chinense* (L.) Lindl., *Tetrastigma serrulatum* (Roxb.) Planch., *Scoparia dulcis* Linn., *Lophatherum gracile* Brongn., *Hedyotis corymbosa* (Linn.) Lam., *Centella asiatica* L., *Kyllinga* Rottb., *Psychotria rubra* (Lour.) Poir., *Tridax procumbens* L., *Portulaca oleracea* L., *Bougainvillea spectabilis* Willd., *Ficus carica* Linn. , *Cycas revoluta* Thunb., *Artemisia argyi* H. Lév. & Vaniot, *Alocasia macrorrhizos* (L.) G. Don, *Livistona chinensis* (Jacq.) R.Br. ex Mart., *Millettia pinnata* (L.) Panigrahi, *Nephrolepis exaltata* cv . Bostoniensis, *Cuphea hookeriana* Walp., *Lindernia anagallis* (Burm. F.) Pennell, *Dactyloctenium aegyptium* (Linn.) Beauv., *Fissistigma polyanthum* (Hook. f. et Thoms.) Merr., *Passiflora foetida* Linn., *Aster subulatus* Michx. , *Sageretia thea* (Osbeck) Johnst., *Lantana camara* Linn., *Murdannia triquetra* (Wall. ex CB Clarke) Bruckn., *Lygodium japonicum* (Thunb.) Sw., *Coccinia grandis* (Linn.) Voigt, *Allamanda blanchetii* A.DC., *Toxocarpus wightianus* Hook. et Arn., *Cerasus serrulata* (Lindl.) G. Don ex London, *Canna indica* Linn., *Cordyline fruticosa* (L.) A. Cheval., *Nephrolepis auriculata* (L.) Trimen	

Shrub	1-3	*Ficus elastica* Roxb. ex Hornem., *Pongamia pinnata* (Linn.) Pierre, *Codiaeum variegatum* (L.) A. Juss., *Phoenix hanceana* Naud., *Alocasia macrorrhiza* (Linn.) Schott, *Aglaia odorata* Lour., *Meconopsis concinna* Prain, *Epipremnum aureum* (Linden et Andre) Bunting, *Duranta repens* Linn., *Excoecaria cochinchinensis* Lour., *Clerodendrum thomsonae* Balf., *Ixora chinensis* Lam., *Podocarpus macrophyllus* (Thunb.) Sweet, *Bougainvillea spectabilis* Willd. jorides Elenilis var.)Hara, *Celtis sinensis* Pers., *Duranta repens* Linn., *Lantana camara* Linn., *Bougainvillea glabra* Choisy, *Hibiscus syriacus* Linn., *Podocarpus nagi* (Thunb.) Zoll. et Mor. ex Zoll., *Syzygium jambos* (Linn.) Alston, *Camellia hongkongensis* Seem., *Osmanthus fragrans* (Thunb.) Loureiro, *Boehmeria nivea* (L.) Gaudich., *Physalis angulata* Linn., *Eriobotrya japonica* (Thunb.) Lindl., *Bridelia tomentosa* Bl., *Saccharum a Lrundinaceum* Retza., *Murphy* Mant., *Allemanda cathartica* Linn., *Melia azedarace* L., *Excoecaria cochinchinensis* Lour., *Codiaeum vari egatum* (L.) A. Juss., *Trema cannabina* Lour. var. dielsiana (Hand.-Mazz.) CJChen, *Amygdalus persica* Linn., *Sabina chinensis* (Linn.) Ant., *Bougainvillea spectabilis* Willd., *Clerodendrum thomsonae* Balf. , *Loropetalum chinense* (R. Br.) Oliver var. rubrum Yieh, *Ixora chinensis* Lam., *Rhododendron simsii* Planch., *Podocarpus macrophyllus* (Thunb.) Sweet, *Camellia japonica* Linn., *Acer palmatum* Thunb., *Machelia figo* (Lour.) S ., *Gentiana rubicunda* Franch., *Peperomia pellucida* (Linn.) Kunth, *Dracaena terniflora* Roxb., *Typhonium divaricatum* (Linn.) Decne., *Hibiscus rosa-sinensis* L., *Osmanthus fragrans* (Thunb.) Lour., *Elaebra* Tagnus., *Melastoma candidum* D. Don, *Callistemon rigidus* R. Br., *Ephedra equisetina* Bunge, *Macaranga tanarius* (L.) Muell. Arg., *Anredera cordifolia* (Tenore) Steenis, *Quisqualis indica* Linn., *Canavalia maritima* (Aubl.) Thou., *Bride tomentosa* Bl., *Alocasia cucullata* (Lour.) Schott, *Pericampylus glaucus* (Lam.) Merr., *Epipremnum aureum* (Linden et Andre) Bunting, *Cassia tora* Linn., *Leucaena leucoce phala* (Lam.) de Wit, *Coix lacryma-jobi* Linn., *Bryophyllum pinnatum* (Linn. f.) Oken, *Jasminum sambac* (Linn.) Aiton, *Ricinus communis* Linn., *Opilia amentacea* Roxb., *Dioscorea opposita* Thunb., *Momordica cochinensis* (Lour.) Spreng., *Plumbago zeylanica* Linn., *Erythrorchis altissima* (Bl.) Bl., *Ficus superba* Miq. var. japonica Miq., *Colocasia tonoimo* Nakai., *Pharbitis nil* (Linn.) Choisy, *Amygdalus persica* Linn., *Erythrorchis japonica* (Thunb.) Lindl., *Cycas revoluta* Thunb., *Carmona microphylla* (lam.) G. Don, *Rhododendron championae* Hook., *Breynia fruticosa* (Linn.) Hook. f., *Sabina chinensis* (Linn.) Ant. var. chinensis cv. Kaizuca Hort., *Paederia scandens* (Lour.) Merr., *Citrus reticulata* Blanco, *Allemanda neriifolia* Hook., *Citrus limon* (L.) Burm. F.,	It can be used to decorate the facade of the space, and has an enclosing effect on the space.

		Pittosporum tobira (Thunb.) Ait., *Bougainvillea spectabilis* Willd., *Cordyline fruticosa* (Linn) A. Chevalier, *Lagerstroemia speciosa* (Linn.) Pers., *Catharanthus roseus* (Linn.) G. Don, *Melastoma candidum* D. Don, *Solanum photeinocarpum* Nakamura	
Small tree	3.1-6	*Bauhinia purpurea* Linn., *Sterculia pexa* Pierre, *Cladrastis wilsonii* Takeda, *Ficus microcarpa* Linn. f., *Michelia alba* DC. Syst., *Chrysalidocarpus lutescens* H. Wendl., *Bauhinia variegata* Linn., *Sterculia solata* Caviana., *Thevet* K. Schum., *Bauhinia glauca* (Wall. ex Benth.) Benth., *Bischofia javanica* Bl., *Hydrangea macrophylla* (Thunb.) Ser., *Dracontomelon duperreanum* Pierre, *Trifolium pratense* Linn., *Bambusa multiplex* Lour., *Calliandra haematocela* Hassk., *Plumeria rubra* Linn. cv. Acutifolia, *Manilkara zapota* (Linn.) van Royen, *Crescentia cujete* Linn., *Lonicera japonica* Thunb., *Clausena lansium* (Lour.) Skeels, *Lagerstroemia indica* Linn., *Celtis sinensis* Pers., *Robinia pseudocia* Linn., *Bambusa ventricosa* McClure, *Artocarpus nitidus* Trec. subsp. lingnanensis (Merr.) Jarr., *Fortunella margarita* (Lour.) Swingle, *Nandina domestica* Thunb., *Ligustrum lucidum* Ait., *Carica papaya* Linn., *Phoenix hanceana* Narima., *Jatropha integer* Jacpha., *Duranta repens* Linn., *Cassia surattensis* Burm. F., *Tabebuia chrysantha* (Jacq.) Nichols., *Bauhinia purpurea* Linn., *Ocimum basilicum* Linn	Strengthen the sense of hierarchy and distance of the space.
Medium and high trees	>6	*Delonix regia* (Boj. ex Hook.) Raf., *Melaleuca leucadendra* Linn., *Koelreuteria bipinnata* Laxm., *Casuarina equisetifolia* L., *Araucaria cunninghamii* Mudie, *Roystonea regia* (Kunth) of Cook, *Artocarpus nitidus* Tréculs subsp. ios, *Laxm* Pers., *Terminalia neotaliala* Exell, *Morus alba* L., *Koelreuteria bipinnata* Laxm., *Ficus elastica* Roxb., *Ficus rumphii* Bl., *Schefflera actinophylla* (Endl.) Harms, *Antidesma bunius* (L.) Spreng., *Ravenala madagascariensis* Sonn., *Scariensis* Sonn. Morus alba L., *Melaleuca leucadendron* L., *Heteropanax fragrans* (Roxb.) Seem, *Cinnamomum camphora* (L.) Presl, *Cinnamomum burmanni* (Nees et T. Nees) Blume, *Bombax ceiba* L., *Erythrina variegata* Lgia (Roystone), *Artocarpus heterophyllus* Lam., *Mangifera indica* L., *Ficus microcarpa* Lf, *Hibiscus tiliaceus* L., *Bauhinia blakeana* Dunn, *Fagraea ceilanica* ThunCasb., *Casularina equisetifolia* L., *Strelitzia reginae* Banks	The basic framework of the plant landscape.

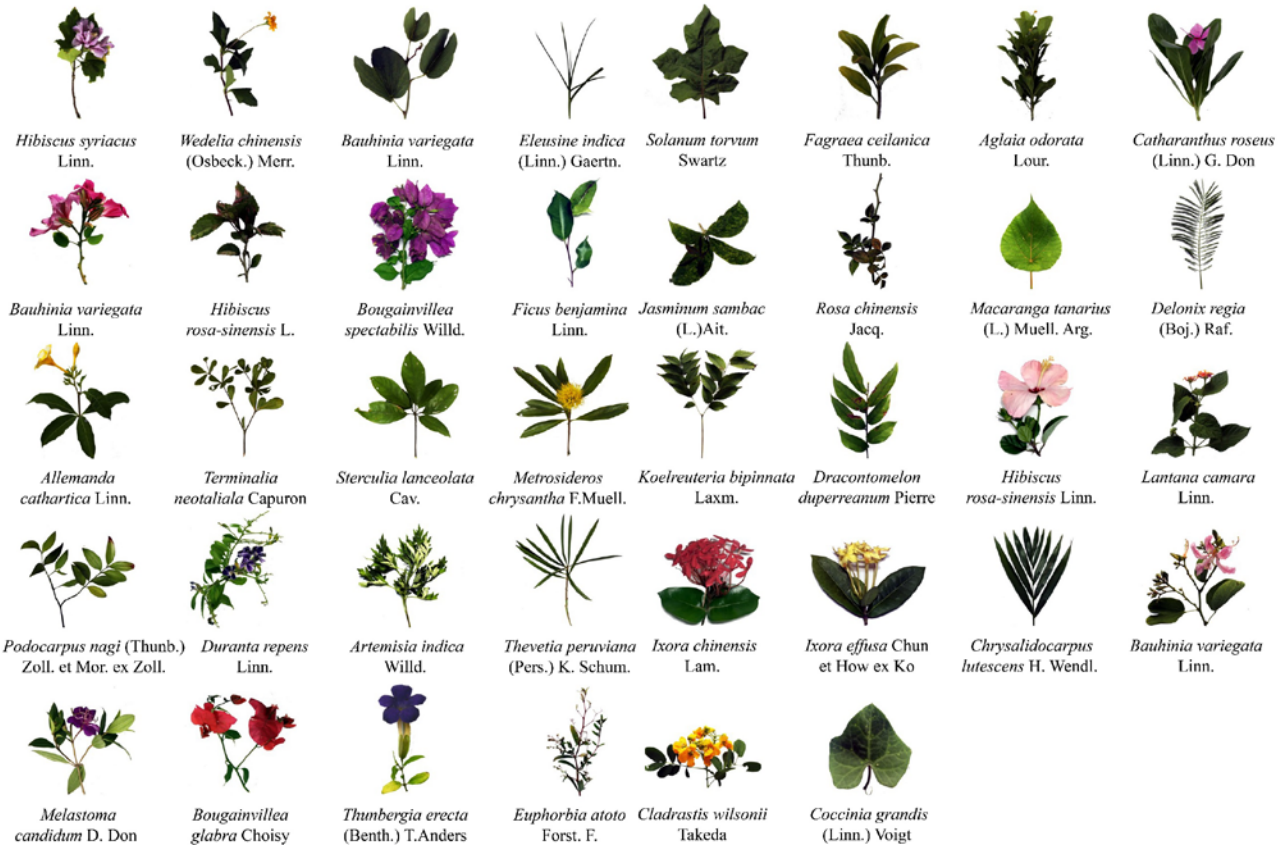

Figure. 1 Common plant specimens on campus

3. Configuration Mode

3.1 Space law

The spatial law of plant planting is based on different space requirements and types. The spatial law of campus plants includes open space, semi-open space, vertical space, and covered space. Different spatial laws can produce different spatial aesthetics, satisfying the functional needs of space, such as vision, privacy, sports, and shading. After investigation, the spatial laws can be divided into the following types, as shown in Figure 2.

Figure. 2 The spatial law of plant planning

3.1.1 Open space

Through flexible potted planting methods, ground cover plants, dwarf shrubs and herb plants are used to embellish and beautify the space, and plants are used to soften the coldness of the hard ground walls, and the height will not obscure the pedestrian's view, maintaining the openness of the space. When specific activities require, move the potted plants to increase the movable space or separate space.

3.1.2 Semi-open space

Using the dense arrangement of plants to cover the building facade can not only beautify the building facade, but also protect the privacy of the residents inside the building. The monotonous arrangement of green plants has a certain orientation, accelerates the walking speed of pedestrians, prevents detention, protects residents' indoor activities from outdoor pedestrians, and creates a sense of space.

3.1.3 Vertical space

In this space, one side is the road for cars and the other side is the facade of the building. The two sides of the road are covered by shrubs, which has a spatial effect of sandwiching the scenery, which enhances the depth of the space and protects the privacy of the residents in the building. At the same time, it is full of control over the space, inducing, organizing and gathering pedestrian paths and sight lines, creating an interesting space.

3.1.4 Coverage space

On the basis of the vertical space, the canopy and climbing plants are used to cover the space comprehensively, which has stronger privacy for pedestrian activities. Macau has long summers and short winters. The summers are hot and humid. The full coverage of plants is used to block solar heat radiation, adjust the microclimate of the space, and make the passages cool and comfortable. In addition, the covered space allows people to have a certain degree of spatial autonomy in the space, prevents pedestrians from running and driving bicycles, and improves the safety of walking.

3.2 Color matching

The color collocation of plants has a certain impact on human perception, which can be divided into lightness and weight, cold and warm, dynamic and static. Reasonable spatial plant color helps to enhance the visual beauty of the space, regulate the emotions and activities of pedestrians, and separate the domain and scope of the space.

3.2.1 Sense of weight

The combination of shades and colors of plants creates a sense of weight in the space. The color combination of bottom-heavy and top-heavy plants constitutes a stable space experience. Pedestrians will be relatively quiet and soothing in the space; the color combination of lower-light and upper-heavy plants constitutes an active space experience. Because the lower part is relatively light and wide, pedestrians are in the space. It has a relatively large space for activities, which guides pedestrians' lively behavior, as shown in Figure 3.

Figure. 3 Plant color sense

3.2.2 Cold and warm feeling

In addition to direct physiological factors, people’s perception of temperature also has indirect psychological factors. In color psychology, warm colors make people feel warm, and cool colors make people feel cold. Use this phenomenon to plant cool-colored plants in summer, such as Brazilian wild peony and false forsythia; in winter, plant warm-colored plants, such as bougainvillea and periwinkle. Reasonable plant color matching is conducive to creating a cool summer and warm winter atmosphere, making the plant landscape a more comfortable sensory experience for people.

3.2.3 Dynamic and static

Plants with higher brightness have lively emotions, enthusiasm and clarity, and thus behave more vigorously in behavior, such as Allemanda cathartica Linn. And Wedelia chinensis (Osbeck.) Merr. Wait. Plants with low lightness are emotionally stable, calm and conservative, and thus behave quietly in behavior, such as Hibiscus rosa-sinensis Linn. And Bush Thunbergia etc. In specific places, the color and brightness of plants can increase the scale of the space. For example, schools and hospitals are suitable for planting low-brightness plants to make people's mood more stable; outdoor sports spaces are suitable for planting high-brightness plants to cause people's sports mood.

4. Optimization suggestions

4.1 Invasive plants

Invasive plants are plants that have strong growth ability and can occupy entire green spaces in a short period of time, crowding out and suppressing native species. Because it invades the growth space of other plants and even causes its death, it will cause ecological imbalance in the long term, form a single dominant population, and destroy ecological diversity. Therefore, it needs to be maintained and cleaned up in time to avoid greater ecological losses. Common invasive plants on the campus of Macau University of Science and Technology include Mikania, Wedelia, Lantana, etc. As shown in Figure 4, the Wedelia are entwined on the juniper, causing the juniper to not grow normally and need to be cleaned up in time.

Figure. 4 Invasive plants

4.2 Optimize flowerpot shape

The flowerpots on the campus of Macau University of Science and Technology should have the school's text logo, which enriches the surrounding elements of the campus and unifies the visual image of the school. However, the shape of the flowerpot is rigid, straight and dull, creating a certain contrast with the naturally stretched shape of the plant. The strip-shaped facade reminds people of the corrugated boards commonly used in factory buildings, creating a certain sense of cheapness. And the white color will reflect the light relatively more strongly, making people feel glare. In addition, white occupies most of the area of the flowerpot, robbing people of the center of attention, and anti-personality, weakening the landscape visual effect of the plant. Therefore, it is

necessary to redesign the flowerpot elements to return to the role of setting off plants.

Figure. 5 Facade of campus flowerpot

4.3 Increase plant functionality

Most of the plants in the campus are ornamental plants, and the interaction between people and the plant landscape is only for viewing, lacking the relevance at the level of material circulation. Yu Kongjian put forward the concept of "Bigfoot Revolution" and called for fruit trees to take to the streets and replace ornamental plants with productive landscapes [4]. This concept can be introduced into the campus plant landscape. Planting crop landscapes can not only increase the interaction between people and plants, but also increase the attractiveness of campus plant landscapes, such as planting mango trees, jackfruit, and papaya trees.

4.4 Increase listing to improve recognition

Currently, the plants on campus are not listed with names (Figure 6). It is difficult for non-plant-related professionals to know the names of plants, which leads to "aphasia" of plants. Increasing the listing of plants and establishing names for plants can not only enhance the emotional relationship between people and plants, but also enhance the scientific significance of campus plant landscapes.

Figure. 6 The lack of listed plants

4.5 Reasonable road planning

During the survey, it was found that many flower beds were trampled on for a long time because of people walking through them, resulting in no grass growing, as shown in Figure 7. Since pedestrians have the need to walk through the flower beds, it has revealed that the existing road planning has certain problems and cannot meet the walking habits and needs of pedestrians. Rather than exhaustively blocking such "man-made" trails, which makes pedestrians more inconvenient to pass, it is better to put people first and open up new roads in such places to separate them from the landscape. Not only can the plants be better protected from damage, but the pedestrian road network is improved to make traffic more convenient.

Figure. 7 The destroyed flowerbed

4.6 Focus on plant lighting

Plant landscape planning needs to consider the impact of the surrounding environment on plants. As shown in Figure 8, *Sabina chinensis* (Linn.) Ant. cannot receive necessary light due to being blocked by buildings, resulting in poor growth of plants and almost withering. It is recommended to replace sun-loving plants with shade-loving plants in areas lacking light, such as *Chrysalidocarpus lutescens* H. Wendl., etc., which can effectively prevent plants from being inconsistent with water and soil due to light, making the environment more suitable for plant growth.

Figure. 8 Withered plant

5. Conclusions

This paper conducts a general survey and analysis of the plant landscape on the campus of Macau University of Science and Technology, and classifies them according to the height and function of plants. A total of 372 plant names are counted, which changes the plant landscape planning and summarizes the principles of space and color matching. Analyzing the problems observed in the process and making suggestions will help the continuous improvement and optimization of the campus plant landscape. At the same time, it has certain reference value for the regional plant landscape design of the Macau campus.

References

[1] Bureau of Geophysics and Meteorology of Macao Special Administrative Region. (2020) Introduction to Macao's Climate [WB/OL]. Link: https://www.smg.gov.mo/zh/subpage/124/page/28

[2] Macao Special Administrative Region Government Tourism Office. (2020) Geographical location and time [WB/OL]. Link: https://www.macaotourism.gov.mo/zh-hant/travelessential/about-macao/location-and-time

[3] Geophysical and Meteorological Bureau of Macao Special Administrative Region. (2020) Geological structure [WB/OL]. Link: https://www.smg.gov.mo/zh/subpage/219/page/266

[4] Yu Kongjian, Wang Xin, Lin Shuangying (2016) urban design needs a "bigfoot revolution"-Sanya's urban "double repair" practice [J]. Urban and rural construction. 2016 (09).