A Pilot Study on Biodiversity Friendly Park in Longhua District: Taking Guanlan Printmaking Base as an Example

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Abstract In order to actively implement the Convention on Biological Diversity and help Shenzhen build a "park city" and a model of beautiful China, the concepts of landscape ecology, landscape urbanism and bio friendly city are introduced to build an evaluation system for biodiversity friendly parks in Longhua District, and explore the relationship between "bio friendly living space" and "city". According to the evaluation system, the Guanlan Printmaking Base scores a total of 273 points, which is rated as a relatively friendly level. In order to coordinate the development between the city and the biosphere and contribute to the goal of building a biodiversity based urban park, the construction of a biodiversity friendly park in Guanlan Printmaking Base is carried out in terms of comprehensive design, plant community construction and biodiversity friendly facilities construction according to the construction principles of biological priority guidance, functional integration and diversification, respect for the park's regionality, and valuing the reachability of natural space.

Key words Biodiversity Friendly Park; Guanlan Printmaking Base

Biodiversity refers to the complexity of all biological species (animals, plants, microorganisms), as well as their genetic variations, and ecosystems within a certain time and region, and it is the foundation of human survival and development. Biodiversity friendly parks are defined as park planning, construction, and management led by biodiversity friendliness, placing the living environment of living beings at the forefront of planning and management. Biodiversity friendly parks use such research theoretical knowledge as landscape ecology[2], landscape urbanism[3] and bio friendly city theory[4] to lay the emphasis on the needs of living creatures in the park in the planning and construction. At the same time, from the perspective of people, they realize the benefits of the natural world for people's physical and mental development, so that organisms and humans can share a healthy and comfortable environment[5].

Strengthening biodiversity conservation is one of the main tasks of ecological protection in Shenzhen at present[6]. In 2014, Longhua District released the *Special Plan for Upgrading the Landscape of Green Space in Longhua New District* (2015 -2020), which is the first district level landscape planning in Shenzhen, and it proposes to "build a green landscape style with green mountains surrounding the city, lucid water flowing through the scenery, green plants shading the paths, blossom flowers blooming the garden, valuable trees greeting guests, cultures booming around"[7]. According to the park planning vision and goals set in the *Special Plan for the Construction and Development of Parks in Shenzhen City* (2021 -2035), Longhua District aims to build an ecological pattern of "green paths around with waters connected", promote the construction of the surrounding park belt and the Guanlan River park belt, supplement the blank area of park coverage with dual measures, and increase the per capita park area[8].

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Park Overview

Located in Dashuitian Community, Guanlan, Longhua District, Shenzhen, Guanlan Printmaking Base began its planning in early 2006 and officially opened for operation in May 2008. With a core area covering 316 000 m^2, it is a comprehensive project integrating printmaking creation, production, exhibition, collection, exchange, research, training, and market development into the Chinese printmaking industry, jointly created by the China Artists Association, Shenzhen Federation of Literary and Art Circles, and the Longhua District Government. Having been the sub venues of the Shenzhen Cultural Expo for 13 consecutive years, it holds the brand projects such as the "China Guanlan International Printmaking Biennale", "China (Guanlan) Original Printmaking Fair", and "Printmaking Academic Forum".

Guanlan Printmaking Base was originally a Hakka Ancient Village in Dashuitian Village, Guanlan, with a history of nearly 300 years. Since the planning and renovation adhered to the principle of "remaining old appearances of old buildings in restoration", the pastoral scenery of the Hakka Ancient Village and the Lingnan Hakka architectural complex were well preserved. There are 90 ancient residences in the east and west areas of Guanlan Printmaking Base, with the house structure, plastic arts and external decoration basically following the style before the Republic of China, and art elements such as murals, clay sculptures and ridge decorations have also been properly protected[10]. The internal sections of Guanlan Printmaking Base are mainly divided into the following areas: Mother Forest, Ecological Wetland, Lotus Field, Green Vegetable and Fruit Planting Area, Peach Blossom Creek, Flower Sea, Printmaking Workshop, Ancient Village, and Office Area.

Research Methods

Indicator system

The evaluation system for the biodiversity friendly park in Longhua District includes three aspects: the current status of the

park's biodiversity, the ability to maintain or enhance biodiversity, and the biodiversity threat status. There are 4 indicators for the current status of biodiversity, 13 indicators for the ability to maintain or enhance biodiversity, and 3 indicators for the threat status of biodiversity.

Table 1 Evaluation index system of biodiversity friendly park in Longhua District

No.	Primary indicators	Secondary indicators	Third level indicators
1	Current status of biodiversity	Animal and plant conditions	Number of vascular plant species
2			Number of terrestrial vertebrate species
3			Proportion of local plants
4			Number of rare and endangered key species
5	Ability to maintain or enhance biodiversity	Vegetation status	Number of food plant species[11]
6			Number of nesting plant species
7			Horizontal structure of communities[12]
8			Vertical structure of communities[12]
9		Habitat status	Functional zoning situation
10			Greening rate
11			Water body condition
12			Water body shoreline condition
13			Habitat connectivity
14			Opening degree of park boundary
15		Management measures	Ecological lighting management
16			Removal of invasive species
17		Biodiversity friendly facilities[13-14]	Construction of biodiversity friendly facilities
18	Biodiversity threat status	Biological invasion status	Types of invasive alien species
19			Extent of invasive alien species
20		Wandering animals	Situation of stray animals

Comprehensive evaluation

Based on the actual situation of the park, the scoring method is used to comprehensively evaluate the biodiversity friendliness of the park. The evaluation parameters are composed of 20 indicators, with a scoring range of 0 – 20 points. Each parameter is classified, scored and recorded according to Table 2, and the final biodiversity friendly evaluation result for each park is the total scor of each indicator. Finally, based on the total score of the park, the park's biodiversity friendliness level is comprehensively determined, namely: 300 < score ≤ 400, friendly; 200 < score ≤ 300, relatively friendly; 100 < score ≤ 200, generally friendly; Score ≤ 100, unfriendly.

Table 2 Evaluation scores of biodiversity friendly park in Longhua District

Evaluating indicator	Friendly	Relatively friendly	Generally friendly	Unfriendly
1 Number of vascular plant species	Number of vascular plant species greater than or equal to 250	Number of vascular plant species ranging from 200 to 249	Number of vascular plant species ranging from 150 to 199	Number of vascular plant species less than 150
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
2 Number of terrestrial vertebrate species	Number of terrestrial vertebrate species greater than or equal to 90	Number of terrestrial vertebrate species ranging from 60 to 89	Number of terrestrial vertebrate species ranging from 30 to 59	Number of terrestrial vertebrate species less than 30
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
3 Proportion of local plants	Local plants accounting for 90% or more	Proportion of local plants greater than or equal to 80%, but less than 90%	Proportion of local plants greater than or equal to 60%, but less than 80%	Local plants accounting for less than 60%
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
4 Number of rare and endangered key species	Number of rare and endangered key species reaching 10 or more	Number of rare and endangered key species greater than or equal to 5, but less than 10	Number of rare and endangered key species greater than or equal to 1, but less than 5	No rare and endangered key species
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
5 Number of food plant species	Number of food plant species greater than 20	Number of feeding plant species ranging from 10 to 20	Number of edible plant species ranging from 0 to 10	No food plant species
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0

(Continued)

(Table 2)

Evaluating indicator	Friendly	Relatively friendly	Generally friendly	Unfriendly
6 Number of nesting plant species	Number of nesting plant species greater than 20	Number of nesting plant species ranging from 10 to 20	Number of nesting plant species ranging from 0 to 10	No nesting plant species
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
7 Horizontal structure of communities	Pure forest community area in all community areas accounting for less than 10%	Pure forest community area in all community areas accounting for greater than or equal to 10%, but less than 20%	Pure forest community area in all community areas accounting for greater than or equal to 20%, but less than 30%	Pure forest community area in all community areas accounting for greater than or equal to 30%
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
8 Vertical structure of communities	Single-layer community area in all community areas accounting for less than 10%	Single-layer community area in all community areas accounting for greater than or equal to 10%, but less than 20%	Single-layer community area in all community areas accounting for greater than or equal to 20% and less than 30%	Single-layer community area in all community areas accounting for greater than or equal to 30%
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
9 Functional zoning situation	Park containing tourist intensive areas, animal core activity areas, and rare and endangered key species protection areas, with very reasonable zoning design and good implementation of zoning management measures	Park containing tourist intensive areas, animal core activity areas, and rare and endangered key species protection areas, with reasonable zoning design and general implementation of zoning management measures	Park containing tourist intensive areas, animal core activity areas, and rare and endangered key species protection areas, but with unreasonable zoning design and poor implementation of zoning management measures	Park not containing tourist intensive areas, animal core activity areas, and rare and endangered key species protection areas, with very reasonable zoning design and good implementation of zoning management measures
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
10 Greening rate	Greening rate of 80% or above	Greening rate greater than or equal to 60% but less than 80%	Greening rate greater than or equal to 40%, less than 60%	Greening rate less than 40%
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
11 Water body condition	Containing permanent or semi permanent water bodies of moderate area, and relatively even distribution of water bodies with excellent water quality	Containing permanent or semi permanent water bodies of moderate area, and concentrated distribution of water bodies with good water quality	Containing a small number of permanent or semi permanent water bodies with average water quality	No permanent or semi permanent water bodies
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
12 Water body shoreline condition	Achieving a relatively friendly shoreline condition, with no less than 30% of the near natural shoreline only accessible and used by wild animals, avoiding interference from human activities	Mainly composed of gentle slopes or grassy terraces with bank slope dominated with natural materials, high greening rate of the shoreline, and plant isolation strip with a height of no less than 1.5 meters on the nearshore side of the waterfront walkway	Mainly composed of gentle slopes or grassy terraces with bank slope dominated with natural materials, but less vegetation on the shoreline	Most water bodies having rigid vertical shorelines without vegetation
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
13 Habitat connectivity	Few obstruction of recreational facilities, hardened brick pavement inside important habitats of animals and plants such as forests, grasslands, water bodies, and swamps or between habitats, along which measures are taken to help help animals cross more easily, such as using blocks embedded in grass to pave roads	Few obstruction of recreational facilities, hardened brick pavement inside important habitats of animals and plants such as forests, grasslands, water bodies, and swamps or between habitats, which can be crossed over by animals	Some obstruction of recreational facilities, hardened brick pavement inside important habitats of animals and plants such as forests, grasslands, water bodies, and swamps or between habitats, which can be crossed over by animals, although it is difficult.	Serious obstruction of recreational facilities, hardened brick pavement inside important habitats of animals and plants such as forests, grasslands, water bodies, and swamps or between habitats, which cannot be crossed over by animals
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0

(Continued)

(Table 2)

Evaluating indicator	Friendly	Relatively friendly	Generally friendly	Unfriendly
14 Opening degree of park boundary	Open park with no surrounding walls	Semi-enclosed park with 20% – 50% of the boundaries still in closed state, which are covered by changes in the terrain and vegetation morphology of the park's internal habitats, and the existing park boundaries are covered	Closed park, only retaining tourist entrances and exits, but using fence style walls, which make it possible for small animals to enter and exit the park	Closed park with only tourist entrances and exits reserved, and no animal entry or exit
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
15 Ecological lighting management	More than 5 measures related to ecological lighting being taken	3 – 5 measures related to ecological lighting being taken	1 – 2 measures related to ecological lighting being taken	No ecological lighting management measures being taken
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
16 Removal of invasive species	More than 5 measures being taken to remove invasive organisms or excellent removal effect of invasive organisms	3 – 5 measures being taken to remove invasive organisms or good removal effect of invasive organisms	1 – 2 measures being taken to remove invasive organisms or average removal effect of invasive organisms	No measures being taken to remove invasive organisms
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
17 Construction of biodiversity friendly facilities	Equipped with more than 5 biodiversity friendly facilities, or more than 10 biodiversity friendly facilities	Equipped with 3 – 5 biodiversity friendly facilities, or the number of biodiversity friendly facilities ranging from 5 to 10	Equipped with 1 – 2 biodiversity friendly facilities, or the number of biodiversity friendly facilities less than 5	Equipped with no biodiversity friendly facilities
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
18 Types of invasive alien species	No alien invasive species	Invasive alien species of less than 2	Invasive alien species of 3 – 5	Invasive alien species of more than 5
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
19 Extent of invasive alien species	No foreign invasive species, no invaded habitats found in the park	Number of invasive alien species ranging from 1 to 5, and the invaded habitat area accounting for less than 0.5% of the park area	Number of invasive alien species ranging from 5 to 10, and the invaded habitat area accounting for 0.5% – 1.0% of the park area	Number of invasive alien species greater than 19, and the invaded habitat area accounting for over 1% of the park area
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0
20 Situation of stray animals	No stray animals	Stray animals with varieties less than 2 and number less than 5	Stray animals with varieties ranging from 2 to 5 and number ranging from 5 to 10	Stray animals with varieties grater than 5 and number greater than 10
	Score: 20 19 18 17 16	Score: 15 14 13 12 11	Score: 10 9 8 7 6	Score: 5 4 3 2 1 0

Results and Analysis

Evaluation of biodiversity status indicators

(1) Number of vascular plant species. According to field investigations, a total of 204 species of vascular plants are found, such as *Schefflera actinophylla*, *Lagerstroemia speciosa* (L.) Pers., *Cyperus involucratus* Rottboll, *Excoecaria cochinchinensis* Lour., *Paederia scandens* (Lour.) Merr, *Ruellia simplex*, *Mangifera indica* L., *Stromanthe sanguinea* Sond, *Pentas lanceolata* (*Forssk.*) *K.* Schum., *Leucaena leucocephala* (Lam.) de Wit. Each species shows a good survival status, with a score of 20 points.

(2) Number of terrestrial vertebrate species. A total of 36 terrestrial vertebrates are found, including 6 amphibians, 4 reptiles, 24 birds and 2 mammals, such as *Polypedates megacephalus*, *Hylarana guentheri*, *Bufo melanostictus* Schneider, *Ptyas korro*, *Hemidactylus bowringii*, *Sphenomorphus indicus*, *Copsychus saularis*, *Motacilla alba*, *Pycnonotus jocosus*, *Zosterops japonicus*, *Prionailurus bengalensis*, *Canis lupus familiaris* Linnaeus, scoring 10 points.

(3) Proportion of local plants. There are 60 local plant species, such as *Sida rhombifolia* L., *Rhynchospora rubra* (Lour.) Makino, *Kyllinga brevifolia* Rottb., *Broussonetia papyrifera*, *Paederia scandens* (Lour.) Merr, accounting for 29.4% of all vascular plant species, scoring 5 points.

(4) Number of rare and endangered key species. There are 5 species found in the park listed in the *List of National Key Protected Wild Animals*, *the List of National Key Protected Wild Plants*, *the International Union for Conservation of Nature Red List of Threatened Species* (*IUCN*), *the Red List of Chinese Species*, *the appendix to the Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES) or the key protected animals in Guangdong Province, namely, *Ptyas korro*, *Ardeola bacchus*, *Garrulax canorus*, *Centropus sinensis*, *P. bengalensis*,

scoring 15 points.

Assessment of the ability to maintain or enhance biodiversity

(1) Number of food plant species. There are 83 species of food plants found in the Guanlan Printmaking Base, among which there are 42 species for animals to consume nectar (like *Eriobotrya japonica* (Thunb.) Lindl., *Musa nana* Lour., *S. actinophylla*, *Agave americana* var. *marginata* (Trel.), 60 species for animals to consume fruit seeds (like *Prunus persica* (L.) Batsch, *Cinnamomum camphora* (L.) Presl, *Dimocarpus longan* Lour., *Ficus hispida* (L. f.), and 6 species for animals to consume stems and leaves (like *Brassica rapa* var. *glabra* Regel, *Brassica rapa* var. *chinensis* (Linnaeus) Kitamura, *Morus alba* L., *Amaranthus mangostanus* L., *Saccharum officinarum* L.), scoring 20 points.

(2) Number of nesting plant species. There are 32 plant species suitable for nesting in the Guanlan Printmaking Base, including *C. camphora*, *Schima superba* Gardner & Champ., *Swietenia mahagoni* (L.) Jacq., *F. hispida*, scoring 20 points.

(3) Horizontal structure of community. Most of the plant communities in Guanlan printmaking base are non pure forest communities, and the common community configurations included Ficus concinna (Miq.) Miq. -*Fagraea ceilanica* Thunb. -*Ixora chinensis* Lam. community, C. camphora + *Cinnamomum burmanni* (Nees & T. Nees) Blume -*Alocasia odora* (Roxburgh) K. Koch community. Pure forest communities are mainly found in the flower sea and green fruit and vegetable planting areas, mainly including *Cosmos bipinnatus* Cav. community and *Fragaria* × *ananassa* Duch. community. Overall, non pure forest communities account for 68% of all community areas, while pure forest communities account for 32% of all community areas, scoring 5 points.

(4) Vertical structure of community. The complex structure of "trees, shrubs, and grasses" is more common in Guanlan Printmaking Bases, such as the surrounding garden vegetation of printmaking workshops. There is no typical area in the double layered structure of "tree shrub", "tree grass", and "shrub grass". Monolayer structures such as "tree", "shrub", "grass" could also be found, such as *C. bipinnatus* in the flower sea, *Cyperus involucratus* Rottboll and *Thalia dealbata* Fraser in ecological wetlands. Therefore, non monolayer communities account for 64% of all community areas, while monolayer communities account for 36% of all community areas, scoring 5 points.

(5) Functional zoning situation. The internal sections of Guanlan Printmaking Base are mainly divided into areas such as Mother Forest, Ecological Wetland, Lotus Fields, Green Vegetable and Fruit Planting Area, Peach Blossom (Taohua) Creek, Flower Sea, Printmaking Workshop, Ancient Village, Office Area, *etc.* Among them, Mother Forest, Ecological Wetland, and Peach Blossom (Taohua) Creek are made into good habitats for animals, with little human interference; Lotus Fields, Green Vegetable and Fruit Planting Area, and Flower Sea are places for tourists to pick and watch, as well as for animals to forage and play, with moderate human activity interference; Printmaking Workshop, Ancient Village, and Office Area are daily places for visitors to play and staff to work, with slightly stronger interference from human activities. The park is divided into tourist intensive areas, animal activity areas, and key species protection areas, and the zoning design is very reasonable with good implementation of zoning management measures, scoring 20 points.

(6) Greening rate. According to remote sensing images and field investigations, the green space area in the Guanlan Printmaking Base is mainly concentrated in the Mother Forest, Ecological Wetland, Lotus Field, Green Vegetable and Fruit Planting Area, Flower Sea, and the surrounding garden vegetation of Printmaking Workshop, and the green space area accounts for 65% of the total area, scoring 15 points.

(7) Water body condition. Most of waters are permanent water bodies, with a total area of 12 946.1 m^2. The best water quality is found in the streams near the Flower Sea and Ancient Village, followed by the Lotus Field and Peach Blossom Creek. The average water quality is found in the Half Moon (Banyue) Pond, Lotus Field, and Reflection Pond. The water area with strong reachability of animals is the stream beside the Flower Sea, followed by the Lotus Pond, the Peach Blossom Creek and the stream beside the Ancient Village, and the Half Moon Pond, Lotus Field and Reflection Pond are less accessible to animals, thus scoring 18 points.

(8) Water body shoreline condition. Overall, the riverbank slopes of the small streams, Half Moon Pond, Lotus Pond by the Flower Sea are relatively gentle, with a high degree of natural shoreline; the slope materials used are more natural and ecological, and the green plants are diverse and well arranged. So the comprehensive rating is friendly. Peach Blossom Creek is relatively long, and the source area has a steep slope of cement dams. The slope of the middle and lower reaches of the Peach Blossom Creek is gentle, with a high degree of natural shoreline and a variety of green plants. Overall, it is rated as relatively friendly. The artificial traces of Lotus Field, small streams near Ancient Village, and Reflection Pond are relatively obvious. The seasonal rotation of Lotus Field leads to varying levels of greenery. Although the water quality of small streams near Ancient Village is good, a large part of the slope banks are vertical shorelines made of hard cement, and half of the slope banks of Reflection Pond are vertical shorelines made of hard cement. Overall, the comprehensive rating is generally friendly. In summary, 15 points will be given for the condition of the water body shoreline.

(9) Habitat connectivity. Most areas in the park are connected and animals can cross over, scoring 15 points.

(10) Opening degree of the park boundary. The boundary opening degree of the Guanlan Printmaking Base is not high, and most of the boundaries are blocked, mainly consisting of cement dams, brick walls, houses, and wire fences. Among them, wire fences account for about 60%, and only small animals can enter and exit the park. A small portion of the area does not have a fence, and the Mother Forest area, which accounts for about 15% of the park boundary, has a high degree of openness and can be crossed by animals. So 10 points will be given.

(11) Ecological lighting management. The main ecological lighting management measures include: ① The area is divided into lighting areas, controlled lighting areas, and prohibited lighting areas based on the distribution of ecological resources and visual needs. ② Lighting time is adjusted to strengthen night protection. ③ The light source wavelength is adjusted to reduce the impact on

animals and plants. ④ Ground projection lighting is preferred to reduce the proportion of buried face up lights and projection lights. Thus, 3 – 5 measures related to ecological lighting are taken, scoring 15 points.

(12) Removal of invasive species. The invasive species in the Guanlan Printmaking Base are mainly *Mikania micrantha* Kunth, *Ipomoea cairica* (L.) Sweet, *Sphagneticola trilobata* (L.) Pruski, *Bidens pilosa* L., *Pomacea canaliculata*, and *Lissachatina fulica*. The main removal measures taken include manual control, mechanical or physical control, and biological control, with a score of 15 points.

(13) Construction of biodiversity friendly facilities. There are 2 duck feeding racks found in Half Moon Pond, 1 bird resting board found in Reflection Pond, and a micro habitat stepping stone corridor in Peach Blossom Creek, which provide convenience for birds to disembark and rest, belonging to biodiversity friendly facility, with a score of 15 points.

Assessment of Biodiversity Threat Status

(1) Types of invasive alien species. The main invasive alein species in the Guanlan Printmaking Base are *M. micrantha*, *I. cairica*, *S. trilobata*, *B. pilosa* L., *P. canaliculata*, and *L. fulica*, scoring 5 points.

(2) Extent of invasion of alien species. *M. micrantha* is found in about 6 places, suggesting a moderate degree of invasion. *I. cairica*, *S. trilobata* are found in one place, indicating a mild degree of invasion. The eggs of *P. canaliculata* have been found in Lotus Field and small streams near Ancient Village, with about 10 clusters, so it has a mild degree of invasion. About 5 *L. fulica* are found in Mother Forest and Ecological Wetland, with a mild degree of invasion. The number of invasive alien species ranges from 5 to 10, and the percentage of the invaded habitat area in the park area ranges from 0.5% to 1%, resulting in a score of 10 points.

(3) Situation of stray animals. No stray animals are found during the investigation, scoring 20 points.

Overall evaluation

The Guanlan Printmaking Base scores a total of 273 points in three aspects: the current status of biodiversity, the ability to maintain or enhance biodiversity, and the threat status of biodiversity. Among them, the current status of biodiversity scores 50 points, the ability to maintain or improve biodiversity scores 188 points, and the threat status of biodiversity scores 35 points. Therefore, with the total score between 200 and ⩽ 300, the biodiversity friendly park of Guanlan Printmaking Base is evaluated as a relatively friendly level.

Countermeasures and Suggestions for Improvement

According to the construction principles such as biological priority guidance, functional integration and diversification, respect for the regionality of the park, and valuing the reachability of natural space[15], the construction of the biodiversity friendly park of Guanlan Printmaking Base is carried out with the construction steps of habitat refinement of cluster unit sites, construction of fiber green paths, and improvement of connectivity and closure[5].

Comprehensive design. The construction of park green space, which is an important carrier for protecting nature, should pay attention to providing an ecological environment for animals and plants to inhabit, reproduce, and shelter while meeting people's needs[16]. According to the different landscape elements within the park, there are 3 different types of biological habitats and human leisure spaces with different themes. Firstly, the backbone tree species that are evergreen all year round form the green tone of the park space, serving as the skeleton of the ecological community within the park, such as Mother Forest; secondly, a forest space with certain ornamental value is formed with the aim of enriching the park's landscape by coordinating with the tone space, such as Flower Sea; thirdly, with grassland as the background, other landscape elements are integrated into the park to ensure the integrity of the landscape system, such as Ancient Village. The reasonable arrangement and layout of these 3 types of vegetation spaces make full and rational use of the overall space, providing both quiet habitats and interactive experience places, thus creating a harmonious and biologically rich ecological environment in the park.

Plant community construction. Plants provide food and habitat for living creatures through photosynthesis, and with environmental specificity, plant can evolve into different forms and communities to adapt to different climates, rainfall, humidity, soil topography[17]. Therefore, more varieties of local trees and plants can be introduced in Mother Forest to maintain community stability, such as *Lindera communis Hemsl*, *Litsea glutinosa*, *Heptapleurum heptaphyllum*, *Sterculia lanceolata*, *Elaeocarpus sylvestris*, and *Glochidion lanceolarium*; local flowering plants for viewing can be introduced to the Flower Sea area, such as *Gardenia jasminoides*, *Clerodendrum fortunatum*, *Clerodendrum canescens*, *Callicarpa kochiana*, and *Pavetta hongkongensis*; Local vine plants can also be introduced in Office Area, Ancient Village, and Printmaking Workshop to increase vertical greening, such as *Byttneria grandifolia*, *Rourea microphylla*, *Taxillus sutchuenensis*, *Ficus pumila*, *Mucuna birdwoodiana*, and *Caesalpinia crista.*

Construction of biodiversity friendly facilities. Adhering to the principle of environmental protection, animal friendly facilities should be of wood, stone, and metal materials. In order to take care of birds living in the park, bird feeders, bird bathing facilities, and bird nests can be installed at small green nodes in the park to provide food and rest space for birds. Space can be reserved in the green spaces of the park to set up reptile activity corridors, and small openings can be set up in the courtyard fences, necessary walls or fences of Ancient Village to connect animal roads, facilitate animal access, and provide corresponding habitats in open green spaces. For example, quiet and hidden rest spaces can be prepared in Ancient Village for small and medium-sized mammals, and simple feeding stations can also be offered in suitable seasons to help animals survive in the park.

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