Green Building--Design of Kunming Forestry Museum

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ABSTRACT: On the basis of surveying the status quo of the terrain, water and soil as well as the vegetation at Haikou Forestry Farm in Kunming City, Kunming Forestry Museum is designed as a comprehensive urban forestry museum and an ecological culture education base which serve as a forestry park for tourism, rest and leisure, as well as a museum featuring exhibition and education. It consists of ten functional areas—the forestry and vegetation system demonstration area, the forestry history demonstration area, the forestry product exhibition area, the digital forestry experience hall, as well as the subtropical highland arboretum, the area for research on germplasm of forestry (including cultivation of rare animals and plants), camp site, waterfront landscape and tourism area and the grape production and picking area.

KEYWORDS: Forest museum; Exhibition; Landscape; Kunming.

The construction of Kunming Forestry Museum can not only serve as a good facility for learning about forestry and satisfy the demand for developing the city into a livable place, but also facilitate Kunming to move onto the civilized development path which features production and development, easy life and excellent ecological environment.

1 DESIGN OBJECTIVE OF KUNMING FORESTRY MUSEUM

Through “The flow of Entropy-Reflection on and Prospect of the Construction of Kunming Forestry Museum”, we put forward the design objective of the museum as follows:

a) Through the reformation and enhancement of the forestry quality, raise and cultivate the rare animals and plants suitable to live in the Kunming area and construct a forestry system characterized with the rich germplasm resources and the good vegetation growth;

b) Design nine professional botanic gardens and one subtropical highland arboretum to fully showcase the features of forestry scenery;

c) construct a forestry museum which integrates ecological tourism, ecological service, ecological education and ecological culture;

d) Construct a forestry museum consisting of the exhibition hall of forestry history, the forestry product exhibition hall and the digital forestry experience hall featuring the combination of indoor space and outdoor space;

e) Research on planting of olives as well as the education of the history of olives and science popularization;

f) Boost local grape cultivation and brewing of grape wines, as well as orchards and wine culture;

g) Arrange the scientific investigation and experience center, the landscape center, the tourist reception and service center as well as hygiene and environmental sanitation facilities in the usable land which accounts for 3% to 8% of the park.

2 ANALYSIS OF THE CURRENT SITUATION OF THE SITE FOR CONSTRUCTION OF KUNMING FORESTRY MUSEUM

2.1 Physiographic condition

Kunming is located at the southwest China and the middle of Yunnan Province, as well as at the east...
longitudes of 102°10’ to 103°40’ and the north latitudes of 24°23’ to 26°33’, at the altitude of 1,891m, with the soil types of mountain red soil and purple soil. It belongs to the subtropical climate region, in the majority of which there is no intense heat in summer and sever cold in winter, instead, it is pleasant, thus acclaimed by ancient people as “The climate is like in February and March, with flowers blooming in four seasons incessantly” and thus becoming popular at home and abroad for its title of “Spring City.”

Located at Haikou Forestry Farm in Xishan District, Kunming in the planning, Kunming Forestry Museum is 40 km from the city. Haikou Forestry Farm covers an area of 7,563hm², with the land for forestry of 6,683.8hm², including the state-owned non-commercial forest of 1,196.5hm² and the local non-commercial forest of 3,239.6hm², accounting for 66.37% of the land area of Haikou Forestry Farm (Figure 1).

![Figure 1. The overall design.](image)

The planned area of Haikou Forestry Farm includes part of the non-commercial forest of Haikou Forestry Farm and the work management area, totaling 331.07hm², including the construction region of 3,194 mu. The forest at the periphery of the construction region is taken as the natural shield for the forest park. In the design, we only adopt the safety design for the transportation system for the convenience of fire prevention for forestry, without design for other functions, thus maintaining the ecological balance between the growth situation of the natural forest belts and the phytoecommunity.

2.2 Current situation of forest resources

The total area of the forestry farm is 7,563hm², accounting for 88.37% of total land area (6683.8hm²) of Haikou Forestry Farm. The land for non-forestry is 879.2 hm², accounting for 11.63% of the total land area of Haikou Forestry Farm, with the total storage of standing trees of 235,500m³. The forest coverage rate is 80.54%, among which the coverage rate of forest land is 80.46%. The rate of woody plant cover is 82.70%, including the coverage rate of forest land of 80.46% and the coverage rate of shrub wood of 1.58%. The forest category is mainly the protection forest, and the tree types mainly include Yunnan pines and Huashan pines.

2.3 Existing buildings and natural landscape

The existing buildings are mainly the buildings for residential and office purposes which are located at the concentrated area at the south of the park, while there is a lack of integrated planning for the buildings inside the park, hence, they cannot form a system, their colors are not harmonious, thus cannot blend with the overall natural environment. In addition, the existing forestry exhibition hall is too small and its exhibits are not rich.

On the one hand, the showcasing form of the original exhibition hall is monotonous and lacks new conception, thus failing to attract tourists, nor can it perform well its function of education.

On the other hand, the design of the road system inside the park is unreasonable and disorderly, hence cannot form a system. It was paved in a disorderly manner and too outdated to attract tourists. The paths to the arboretum cannot form a ring, the trees in the neighborhood are monotonously arranged, the greenbelt coverage rate is too low, it has lack of entirety and consistency, and the overly deserted lands cannot be effectively used.

2.4 Humanistic environment

The residents in Haikou Town would enter the forest to pick waxberries and wild mushrooms in the season when they are mature. Such unregulated conducts would cause some difficulties to the normal management and safety work of the farm. Moreover, the residents in the downtown of Kunming and its neighboring areas would enter the forest for picnic or angling, among others.

3 DESIGN OF THE SHOWROOMS OF THE MUSEUM

3.1 Exhibition hall of forest products-innovation of exhibition dimension

The exhibition hall for forest products at Kunming Forestry Museum will be located at the site of the forestry exhibition hall at the existing Haihou Forest Farm, and expanded into a semi-open two-storied building in the arrangement of a rectangle outside with an inner garden, with a total area of 1,440m². Architectural design: the first floor is all used as the main indoor exhibition area, without a lecture hall, with an area of 705m²; the second floor is used as the office area for managing forest products, store for featured forest products, reception room, washing room, storage area of specimens of animals and plants and the reparation and processing area; and 228m² of the 507m² indoor space will be used as
a sidewalk café, serving tourists with tea, rest and viewing. The center of the building is set with a round courtyard, which can provide natural lights to the exhibition hall to the favor of plant growth inside the courtyard.

3.2 Forest history pavilion-embodiment from time dimension

The Forest History Pavilion of Kunming Forest Museum has three parts: “Forest History Corridor”, forest historical events exhibition room and forest historical figures exhibition room (Figure 2).

![Figure 2. Forest history pavilion.](image)

The “Forest History Corridor”, connecting the Forest Products Exhibition Pavilion, is a closed space with display boards and mural level ground floor with electronic luminescence to show the history of forest. Through pictures, sound and light effect, it makes people feel like walking in the forest. Following the river of time, people will go back again to the events which decide the development of history and also are easy to be neglect, recall the workers and heroes who sacrifice themselves for the development of forest and the safety of forest, even the safety of people and their fortunes.

3.3 Digital forest experience museum-new spatial dimension

The Digital Forest Experience Pavilion of Kunming Forest Museum pursues ecology and evolving ecological style in the aspect of architectural design. It consists of three connected branches—digital operation, simulated digital forest and mini space experience. The architectural appearance will be sphere which shares the same structure principle of ovenbird and Bert wasp. (Figure 3)

![Figure 3. Digital forest experience museum.](image)

The architecture will have the biggest structural strength (Steven Tufts, 2002) volume, airflow velocity and stability, but the material and labor cost is the lowest. The sphere provides the smallest surface and biggest volume and structural strength. It is proved that the sphere can keep the indoor space cool when the outdoor temperature exceeds 42°C while no thermal insulation material is used. (Eugene Tsui, 2002) Such design complies with the concept we proposed in the planning, the Forest Museum should reflect the life processes of trees growing from seeds germinations to big trees. The museum is a mature seed with all the strength of a new life and three beautiful pearls embedded in the green blanket, emanating glamour of science.

4 OUTDOOR PLANTS PLANNING

4.1 Gymnosperm garden

Select 27 kinds of gymnospermous plants which are grow well in Kunming and plant them at the left side of the Arboretum entrance, including Cedrus deodara, Pseudolarix Kaempferi, Tsuga chinensis, Sequoia semperviren, Keteleeria evelyniana and Ginkgo biloba, etc. It is the starting point of plants derivation tour.

4.2 Fagaceae and hamamelidaceae garden

11 kinds of fagaceae plants and 10 kinds of hamamelidaceae plants and to form the “Autumn Corridor” in landscape, including fagaceae plants like Castanea seguinii, Fagus longipetiolata, Quercus variabilis and Quercus acutissima etc and hamamelidaceae plants like Corylopsis yunnanensis, Loropetalumchinense var.rubrum, Liquidambar formosana and Hamamelis mollis etc are selected.

4.3 Lauraceae garden

Select 26 kinds of lauraceae plants including Cinnamomum glanduliferum, Cinnamomum burmannii f. Heyneanum, Cinnamomum cassia, Actinodaphne forrestii, Actinodaphne henryi, Beilschmiedia yunnanensis etc.
4.4 Magnoliaceae garden

Select 22 kinds of magnoliaceae plants, including Magnolia delavayi, Magnolia grandiflora, Magnolia liliflora, Magnolia soulangeana Soul, Magnolia campbellii, Manglietia fordiana and Liriodendron tulipifera etc.

4.5 Theaceae garden

15 kinds of theaceae plants to form the wonderful scenery of four seasons blossom, including Ternstroemia gymnanthera, Camellia sasanqua, Camellia taliensis, Camellia oleifera, Camellia pitardii, Camellia reticulata and Schima superba Gardn et Champ etc. are selected.

5 WATER SUPPLY AND DRAINAGE DESIGN

The water supply project of the Forest Museum includes the supply and drainage of water for the plants growth, the domestic water used in the display areas and water for production and fire protection. The drainage project must satisfy the drainage needs of sanitary sewage, production wastewater and rain. A reasonable project designing plan should be applied according to the site situations and area conditions during the planning period.

Take the first reservoir of Haikou forest farm as the water point and lead the water to the gardens and exhibition pavilions. The area of newly planted plants will be the important area. Regarding to drainage, the focus is to consider the drainage of main road. Excavate open drains at the west sides of 6m’ and 4m’ road to meet the drainage needs of the roads. Other tourist roads shall be drained naturally in combination of the landform.

6 TRAFFIC SYSTEM DESIGN

The main road is a 7m asphalt road. Because of the function areas along the sides of the road, it is considerable for a single-side parking.

The secondary roads all connect to the main road and form the ring roads with the tourist walks.

The tourist walks should reasonable set in combination with the current environment and landform features. In some places where special scenery requirement is needed, like in the arboretum and “Huama Xigu”, wooden plank bridge which is 50 centimeters higher than the ground should be used; the width of the bridge should be controlled within 2m, the wooden plank of 10cm wide should be used and the space between two planks should be 1 centimeter. Such wooden plank bridge provides a comfortable walking and a near distance to plants; both appreciation and admiration of plants are very convenient.

7 CONCLUSION AND PROSPECT

In the current era, the science and culture develops rapidly. Re-understanding the function of the Forest Museum, using the advanced display methods and concepts from foreign modernized museum for reference, centering on cultural leisure and put people at an active and dominate position rather than passive receivers of preaches and bookish knowledge will be the direction for the design and planning of forest museum (Jiang Ling, 2009). During the research process, several problems needing to be solved and improved are found.

On one hand, the income resource of the forest museum mainly depends upon the money from gate receipts in addition to the financial allocation from government. The general low economic efficiency is closely connected to its operating system. Thus, mature operating experience from foreign museums can be absorbed to improve the economic efficiency of the museum and perfect the museum with the profits. On the other hand, innovation and practice in consideration of energy saving and low cost operation should be taken into account in the design of architectural space. Finally, how to put the scientific planning and research theories into all the designs and make them successfully referenced laws and regulations or basis to decision makers and how to put all the ecological planning into reality are the questions need to be thought deeply in the future practice.

REFERENCES