Potential assessment of urban roof greening resources and analysis of Greening Strategies

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Abstract: Roof greening is an important strategic choice for modern cities to improve the ecological environment and alleviate the negative impact of human activities in high-density built-up areas. Reducing the energy consumption of urban buildings has become an effective way to improve the green coverage. Building age, load-bearing structure, roof property and roof microclimate are the main suitable elements for urban roof greening. Eight influencing factors, including building age, building structure, roof structure, roof function, roof slope, equipment area, building height and shade condition, are the key indicators to determine the potential of urban roof greening resources. Utilize 8 key influencing factors to evaluate its greening resource potential, so as to evaluate the resource potential of roof greening. The development and utilization of a large number of roof green spaces in the city to expand the urban green area, increase the amount of green, improve the urban heat island and dry island effect, reduce building energy consumption, and alleviate the contradiction between construction land and green land. The focus of urban greening.

1. Introduction

Roof greening is an important technical option for modern cities to improve the ecological environment and alleviate the negative impact of human activities in high-density built-up areas. Germany, Japan and other developed countries have a deep accumulation in the basic research and application practice in this field, while China started relatively late in this field [1]. At present, researches on roof greening at home and abroad mainly focus on the selection of plant materials for roof greening, allocation of planting matrix, eco-environmental effect, comprehensive benefit evaluation, formulation of policies and regulations, resource potential evaluation, etc. [2]. In view of the combination of the structural characteristics, functions and microenvironmental conditions of the roof space has an important influence on the applicability of roof greening technology and the design of specific technical schemes, therefore, the assessment of the spatial resource potential of roof greening has become a hot topic of common concern among scholars. With the acceleration of the urbanization process, the urban population has soared and the high-rise buildings have brought modern urban prosperity. At the same time, a series of environmental problems such as intensified smog, heat island effect and urban waterlogging have seriously affected the urban environmental quality and residents. Health [3]. Therefore, reducing industrial emissions and strengthening pollution control while vigorously developing greening, increasing green coverage, improving urban environmental quality, and building a green ecological city are the inevitable trends of urban construction and sustainable development [4]. Roof greening can not only increase urban green quantity and green area, alleviate urban "heat island effect" and improve air quality, but also protect building materials, reduce noise and energy consumption. Its contribution to urban ecological environment has been recognized by all parties and will become a new direction of urban greening in China [5]. Roof is called the "fifth face" of urban architecture, and its area is about 20~25% of the area of a city. It can be seen that in the limited urban space, roof greening is the most effective way to improve the green coverage rate [6]. Roof greening can not only increase the amount of urban greenery and green area, but also beautify the urban landscape. It has played an important

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role in further improving the ecological environment. It is beneficial to alleviate the "heat island effect" of the city and improve air quality, and is beneficial to rainwater management, protection of biodiversity, and improvement of urban comfort, etc., thereby effectively improving the human living environment. Quality [7].

2. Roof greening

Roof greening is a kind of greening mode which uses plants to build vegetation on the roof in various forms. There are many classification methods of roof greening in China. There are different classification methods according to the layout form, height, space position, use function and roof bearing capacity of roof greening. For example, according to the form of green layout, it can be divided into carpet type, pot flower type, scaffolding type and garden type. But generally speaking, it can be divided into two categories, namely simple roof greening and garden roof greening, namely roof garden. According to its purpose and characteristics, foreign roof greening can be divided into extensive roof greening and intensive roof greening, and it can also be divided into semi-intensive roof greening between the two. The extensive green roof refers to planting plants on a thin substrate, usually sedum or lawn, with a very light structure. Intensive green roof refers to a deeper substrate layer that allows plants with deeper structures, such as shrubs and trees, to be planted.

Roof greening is one of the most potential greening methods in urban construction. It is very important to increase the area of urban green space and improve the deteriorating human living environment. Change the status quo of high-rise buildings and cement pavement everywhere in the city. Reduce the harm of urban heat island effect, sandstorm, etc. caused by excessive deforestation of natural forests and a large amount of waste gas emission. It is of great significance to broaden human green space, build garden cities, beautify urban environment and improve people's quality of life.

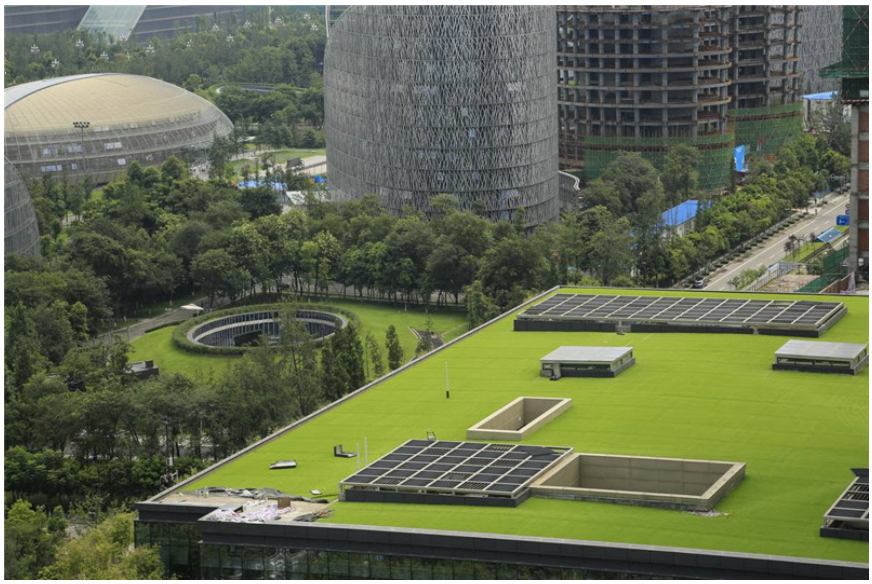

Figure 1 Green roof

Roof greening has a better thermal insulation effect than roof insulation. Not only the indoor thermal environment has been significantly improved, but the roof temperature is also significantly reduced. Experimental tests have proved that: compared with roofs without green roofs, green roofs have a significant cooling effect in the hot summer. When the temperature reaches 30 ℃ ° The ground without greening has reached an unbearable 40-50 °, The temperature of the green roof base is 20 cm higher than that of the green roof base °, It has the effect of roof heat insulation. In winter, the green roof always protects the building like a warm cover.

Figure 2 Schematic diagram of a garden-style rooftop garden

Roof greening reduces the heat reflection and radiation of outdoor surroundings, effectively improves the environment around buildings, and plays a significant role in reducing the heat island effect. Roof greening not only significantly increases the green area of the city, but also provides a good ecological environment for urban birds and other organisms. It also plays a significant role in urban ecological optimization and urban biodiversity.

3. Potential assessment of urban roof greening resources

At present, there is no unified index and method to evaluate the potential of roof greening resources at home and abroad. There are some differences in the research results using different indexes and methods. It is urgent to establish a perfect evaluation system of roof greening resources potential, so as to reasonably allocate resources and provide reference for formulating reasonable roof greening related policies and measures in the future Compared with the ground greening, the roof belongs to a specific habitat type, and the appropriate construction elements are the necessary conditions for the implementation of roof greening. On the basic premise that urban climate conditions are suitable for the growth of roof greening plants, the suitable elements of roof greening can be used as the basis for judging whether the roof is suitable for greening. Usually, this consideration includes several aspects: building age, load-bearing structure, roof properties and roof microclimate. In view of the fact that the influence mechanism of green roofs in urban built-up areas is independent of each other, and the different factors have no significant relationship with each other, in the regional green roof resource potential assessment, the building monomer will be used as the basic evaluation unit, all impact The factors are considered as the key influencing factors of whether the roof greening measures can be implemented and equal weights are considered at the same time. In view of the complex differentiation of building structure, function and environmental characteristics of urban roof, the evaluation results of roof resources greening are divided into three kinds according to the degree differences of eight impact factors. The specific methods are shown in Table 1.

Table 1 Evaluation method of roof greening resource potential

Evaluation result	Construction age	Building structure	Shade conditions	Roof structure	Roof function	Roof slope	Equipment area	Building height
Suitable for construction	A_1	A_2	A_8	A_3	A_4	A_5	A_6	A_7
Partially suitable for construction	A_1	A_2	A_8		At least one item is C_n and none is B_n			
Not suitable for construction				At least one item is B_n				

Generally speaking, compared with the ground, the roof of a building has higher wind speed, larger temperature difference between day and night, and lower air relative humidity. In summer, the light intensity is higher, the sunshine time is longer, and the water evaporation is larger. Compared with the surrounding roofs with the same conditions, the above-mentioned indexes have significant changes: the wind speed decreases, the temperature difference between day and night decreases, and the relative humidity of air increases. Taking temperature as an example, according to our multi-point comparative measurement, under the condition of completely eliminating human effects, the summer green roof is compared with the insulation board roof, the average roof surface temperature is 6.3℃ lower, and the temperature is lower at a height of one meter from the roof. 1.8℃, the indoor temperature of the lower layer of the roof is 2.6℃ lower. In winter, the above indexes are higher than 3.2 ℃, 0.44 ℃ and 0.84 ℃ respectively. This is one of the direct reasons for the extension of the service life of the roof after the implementation of roof greening.

The survival and growth of plants depend on the substrate conditions for their growth. Due to the limitation of roof natural conditions, the plant materials used for roof planting are stricter than those used on the ground. Generally speaking, small shallow-rooted trees, shrubs, flowers, grasses and vines with strong adaptability and long sunshine should be selected. Plant materials with deep roots and strong penetrating properties should not be used, and trees that grow fast and grow tall should be used with caution. Generally speaking, native plant materials are more suitable, and other plant materials can also be used when economic permits.

4. Conclusions

According to the five point system evaluation on the growth of some plants from two aspects of plant growth and adaptability, and according to the results, on the basis of the existing roof greening, 15 kinds of trees, 36 kinds of shrubs, 7 kinds of vines and 31 kinds of herbs with excellent performance were selected. When greening roofs, these adaptable greening plants can be applied to green roofs as soon as possible and alleviate urban ecological problems. Only these 89 kinds of plants are used for roof greening, and the roof area of the building is far from enough. Building age, load-bearing structure, roof attributes, and roof microclimate are the main suitable elements for urban roof greening in four aspects. The building age, building structure, roof structure, roof function, roof slope, equipment area, building height, and shelter are covered. Eight influencing factors such as shade conditions are key indicators that determine the potential of urban rooftop greening resources. The comprehensive evaluation method based on these eight indicators can effectively evaluate the potential of roof greening resources in urban built-up areas, and provide scientific basis for relevant planning work. There are many advantages of roof greening, but it has not been fully promoted in the actual process, mainly due to the constraints of technical level and process localization. Compared with foreign cities, China's urban greening work shows obvious gap in both basic research and planning practice. It is an important task to bring urban roof greening into the overall consideration of urban ecological structure and function construction, and actively carry out resource evaluation, planning research and supporting management policy construction.

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