

# A Study on Green Infrastructure Development in the Development of Outdoor Sports Resources in Zhaoqing City

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## ABSTRACT

This study analyses the development of green infrastructure in the outdoor sports resource development of Zhaoqing City, focusing on its reliance on natural landscape resources and diverse outdoor sports activities. It examines the current issues, including the lack of systematic planning and design, limited funding channels, inadequate interdepartmental coordination mechanisms, and ecological impacts. The study proposes optimisation strategies, including strengthening planning coordination, expanding diversified financing channels, establishing cross-departmental coordination mechanisms, and enhancing ecological protection measures. These strategies aim to provide theoretical references for the sustainable development of Zhaoqing City's outdoor sports industry and offer insights for resource development and ecological protection in similar regions.

## KEYWORDS

Outdoor Sports Resources; Green Infrastructure; Sustainable Development

## 1 Introduction

In the context of rapid globalisation and urbanisation, outdoor sports, as an activity that combines health, leisure, and ecological value, are gradually becoming an important part of people's lifestyles. Zhaoqing City, with its unique natural landscape and rich ecological resources, has made significant progress in the development of outdoor sports resources in recent years<sup>[1]</sup>. However, with the booming development of the outdoor sports industry, how to achieve a balance between ecological conservation and economic development during the development process has become a critical issue that needs to be addressed urgently. Green infrastructure construction, as an important link connecting nature and human activities, offers a potential solution to this challenge. Green infrastructure not only provides necessary services and support for outdoor sports participants but also minimises negative impacts on the ecological environment, thereby promoting the sustainability of ecosystems. However, there is currently limited research on green infrastructure construction in the development of outdoor sports resources in Zhaoqing City, particularly regarding how to construct and optimise green infrastructure to achieve ecological and economic benefits. This study aims to address this research gap by conducting an in-depth analysis of the current status of outdoor sports resource development in Zhaoqing City, exploring the role and challenges of green infrastructure construction in this context, and proposing corresponding optimisation strategies. This not only contributes to the sustainable development of the outdoor sports industry in Zhaoqing City but also provides valuable references for resource development and ecological protection in other regions facing similar circumstances<sup>[2]</sup>.

## 2 Current Status of Outdoor Sports Resource Development in Zhaoqing City

### 2.1 Natural Resource Foundation

Zhaoqing City's natural geographical conditions provide a rich foundation for the development of outdoor sports resources. The mountain ranges in the northern part of the city offer ideal venues for outdoor activities such as mountaineering, hiking, and mountain biking, while the mountain streams and waterfall landscapes add unique charm to outdoor sports. Additionally, the city's numerous rivers and lakes provide ample space for water sports like kayaking, sailing, and paddleboarding<sup>[3]</sup>. Abundant forest resources offer an excellent ecological environment for activities such as forest exploration and camping. This diversity of natural resources enables Zhaoqing City to meet the needs of various types of outdoor sports, attracting a large number of outdoor enthusiasts to experience them.

### 2.2 Current Status of Outdoor Sports Projects

Zhaoqing City offers a wide variety of outdoor sports activities, including hiking, cycling, water sports, rock climbing, and camping. In recent years, Zhaoqing City has hosted several influential outdoor sports events, such as the Zhaoqing International Half Marathon and the Zhaoqing Mountain Bike Race<sup>[4]</sup>. These events have not only enhanced Zhaoqing

City's reputation but also promoted the development of the outdoor sports industry. Additionally, Zhaoqing has developed a series of outdoor sports tourism routes, such as the Dinghu Mountain Hiking Route and the Xinghu Cycling Route, attracting a large number of tourists to participate. However, despite the diversity of outdoor sports activities, there are still shortcomings in the depth and breadth of project development. Some outdoor sports projects remain in the initial development stage, lacking systematic planning and management, with relatively lagging infrastructure development, which affects the quality of the tourist experience.

### 2.3 Current State of the Tourist Market

The outdoor sports tourist market in Zhaoqing City exhibits diverse characteristics. In terms of tourist origins, local tourists account for a significant proportion, but as the development of Zhaoqing's outdoor sports resources continues to advance, the proportion of tourists from surrounding cities and even other provinces is gradually increasing. The age structure of tourists is primarily composed of young and middle-aged individuals, who possess relatively high consumption capacity and a strong interest in outdoor sports. In terms of consumption characteristics, visitors spending on outdoor sports primarily includes admission tickets, equipment rental, catering, and accommodation. However, the current supply of outdoor sports products and services in Zhaoqing City cannot fully meet visitors needs, with issues such as product monotony and inconsistent service quality. Additionally, visitors have high requirements for the safety and professionalism of outdoor sports, which also imposes higher demands on the development of Zhaoqing City's outdoor sports resources<sup>[5]</sup>.

## 3 Issues in the Development of Green Infrastructure for Outdoor Sports in Zhaoqing City

### 3.1 Planning and Design Issues

The planning and design of green infrastructure form the foundation of its construction. However, Zhaoqing City currently faces significant shortcomings in this area. Planning lacks system and overall coherence, failing to effectively integrate with urban planning, tourism planning, and ecological protection planning, resulting in unreasonable facility layout and inability to fully utilise their functions. For example, the starting and ending points of some ecological trails are not scientifically determined, and connections to public transportation stations and tourist gathering centres are not smooth, increasing transportation costs and time for tourists. Design standards are low, failing to adequately consider the diversity and complexity of outdoor sports<sup>[6]</sup>. Some facilities only meet basic functional requirements, with insufficient in-depth analysis of the needs of different user groups. For example, the sanitation facilities and wastewater treatment facilities at camping sites are designed simply and cannot meet the needs of peak-period visitors, leading to frequent environmental hygiene issues. Additionally, the integration of green infrastructure with the surrounding natural environment and cultural landscapes is insufficient, and the construction of some facilities has even damaged natural landscapes, significantly impacting visitor experience quality. For example, the construction of some viewing platforms has destroyed existing vegetation and terrain, affecting the integrity of natural landscapes.

Funding is a critical guarantee for green infrastructure construction, but Zhaoqing City currently faces significant financial pressures. Insufficient construction funds primarily rely on government fiscal allocations, resulting in a single funding source that cannot meet the demands of large-scale construction. For example, the construction of ecological trails in mountainous areas has progressed slowly due to funding shortages, with some sections unable to be completed on schedule. Additionally, maintenance funds lack adequate 保障, leading to some facilities failing to receive timely and effective maintenance after completion. For example, some wooden trails have deteriorated due to lack of maintenance, posing safety risks and affecting visitor experience. Furthermore, funding allocation is unreasonable, with excessive funds concentrated in certain areas, leaving emerging outdoor recreation zones without adequate support for infrastructure development. For instance, some new water sports areas lack funding to build proper waterfront facilities and safety infrastructure, hindering the development of related activities<sup>[7]</sup>.

### 3.2 Management and Coordination Issues

Green infrastructure construction involves multiple departments such as natural resources, environmental protection, tourism, and transportation, but the current management and coordination mechanisms between these departments are insufficiently developed. Responsibilities are unclear, and the roles of each department in green infrastructure construction have not been clearly defined, leading to finger-pointing and delays in project construction and operation. For example, in the construction of ecological parking lots, the natural resources department and the transportation department have disagreements over land use and planning, causing project delays. Additionally, the lack of a unified coordination mechanism results in poor communication and insufficient information sharing among departments,

severely impacting the overall efficiency of project implementation. For example, in the development of outdoor sports projects in some mountainous areas, the environmental protection department and the tourism department have inconsistent requirements for green infrastructure construction, making it difficult to implement the projects smoothly. Furthermore, public participation is low, and the public's understanding and support for green infrastructure construction are insufficient. For example, some community residents lack awareness of the importance of green infrastructure construction and have low participation rates, making it difficult for projects to gain community support.

### **3.3 Environmental Impact Issues**

The original intention of green infrastructure construction is to promote the development of outdoor sports resources while protecting the ecological environment. However, during the actual construction process, some facilities have caused certain negative impacts on the ecological environment. Land occupation is a prominent issue, with some large-scale green infrastructure projects requiring the occupation of a significant amount of land resources, thereby disrupting the original ecological system. For example, the construction of some campsites has occupied a certain area of forest land, leading to vegetation damage and soil erosion<sup>[8]</sup>. Ecological damage during construction is severe, with some construction activities causing damage to the surrounding ecological environment. For example, the use of construction machinery has led to soil compaction, affecting plant growth; untreated construction wastewater has been directly discharged, polluting surrounding water bodies. Additionally, the operation of some facilities has also had a certain impact on the ecological environment. For instance, the construction and operation of some water sports piers have caused disturbances to aquatic ecosystems, affecting the survival and reproduction of aquatic organisms.

## **4 Optimisation Strategies for Green Infrastructure Construction in the Development of Outdoor Sports Resources in Zhaoqing City**

### **4.1 Improving Planning and Design**

The planning and design of green infrastructure are the foundation of its construction and must emphasise system-wide and holistic approaches. To this end, coordination with urban planning, tourism planning, and ecological protection planning should be strengthened to ensure rational facility layout and comprehensive functionality. During the design phase, design standards should be elevated to fully consider the diversity and complexity of outdoor sports and meet the needs of different user groups. For example, for outdoor sports enthusiasts of different age groups and skill levels, diverse trail systems and activity areas should be designed. Additionally, facilities should be integrated with the surrounding natural environment and cultural landscapes to minimize damage to natural landscapes and enhance visitor experience quality. Specific measures include using eco-friendly materials, optimizing trail and camping site designs to harmonize with the natural environment, and protecting the integrity of ecosystems.

### **4.2 Expanding Funding Channels**

Insufficient funding is a key constraint on green infrastructure development. To address this issue, funding sources should be diversified. In addition to government fiscal allocations, social capital should be actively attracted, and enterprises encouraged to participate in the construction and operation of green infrastructure. By establishing diversified financing channels, such as setting up special funds, issuing green bonds, and implementing PPP projects, adequate financial support for green infrastructure development can be ensured. At the same time, funds should be allocated reasonably to ensure that they cover emerging outdoor recreation development areas and promote the balanced development of green infrastructure. Specifically, a special green infrastructure construction fund can be established to attract social capital investment; green bonds can be issued to raise funds for large-scale infrastructure projects; and PPP projects can be launched to attract enterprises to participate in the construction and operation of facilities, thereby achieving complementary advantages between the government and enterprises.

### **4.3 Strengthen Management and Coordination**

Establishing a coordination mechanism for the construction and management of green infrastructure is crucial to ensuring the smooth progress of projects. To this end, it is necessary to clarify the responsibilities of each department and strengthen communication and collaboration between departments. A dedicated coordination body or platform should be established to oversee the overall planning and coordination of green infrastructure construction, addressing issues such as unclear responsibilities and poor coordination between departments. Additionally, public participation should be enhanced through publicity campaigns, public engagement mechanisms, and other means to increase public

understanding and support for green infrastructure construction, fostering a positive interaction between green infrastructure development and community development. Specific measures include conducting community publicity and education activities to raise residents' awareness of green infrastructure construction; establishing public participation platforms to collect opinions and suggestions from residents and tourists to optimise facility layout and design; and encouraging community residents to participate in facility maintenance and management to foster a good atmosphere of joint construction and shared benefits.

#### 4.4 Strengthening Ecological Protection Measures

Strengthening ecological protection measures during green infrastructure construction is crucial for achieving sustainable development. To this end, land use should be strictly controlled, facility layout should be optimised, and damage to natural ecosystems should be minimised. Environmental management during construction should be strengthened, and effective measures should be taken to reduce the damage caused by construction to soil, vegetation, and water bodies. For example, eco-friendly construction techniques should be adopted to reduce soil compaction caused by construction machinery; construction wastewater should be treated to avoid pollution of surrounding water bodies. Additionally, an environmental monitoring mechanism should be established to dynamically monitor the ecological and environmental impacts of green infrastructure construction and operation, promptly identify issues, and take corresponding remedial measures.

### 5 Conclusion

The development of outdoor sports resources in Zhaoqing City requires balancing ecological protection and industrial upgrading through green infrastructure construction. Current challenges in green infrastructure include fragmented planning, fiscal dependency for funding, inadequate interdepartmental coordination, and ecological disturbances. The study demonstrates that improvements can be achieved by: enhancing the coordination of planning with urban and ecological protection frameworks and adopting eco-design concepts; expanding diversified financing channels that integrate government funds with social capital and ensuring balanced fund allocation; clarifying departmental responsibilities, establishing cross-departmental coordination platforms, and increasing public participation; and implementing full-process ecological control from site selection and construction to operation, including low-disturbance technologies, monitoring systems, and visitor environmental education. This research provides a practical pathway for the green transformation of Zhaoqing's outdoor sports industry, offering universal reference for ecologically sensitive areas. Future studies may deepen the quantitative assessment of ecological benefits and regional collaborative development models.

#### Funding

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#### About the Author

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