Evaluation of Management Effectiveness Based on RAPPAM of Danxia Mountain Global Geopark in Guangdong Province

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Abstract. The Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) is widely used for geopark management effectiveness evaluation. This paper takes Danxia Mountain Global Geopark of Guangdong Province as the research object and adopts the RAPPAM method to evaluate specifically seven aspects, including landscape protection, stakeholders, biodiversity, cultural heritage protection, tourists management and information, interpretation and popularization and human resources. The results showed that: 1) the Danxia Mountain Geopark was good overall, especially in the three aspects of infrastructure, transportation and publicity, and the less desirable aspects were human resources and landscape protection, with a score of less than 3 points; 2) The items with the highest scores were tourists management and information, explanation and science popularization, indicating that Danxia Mountain is the strength of Danxia Mountain Geopark in terms of tourists management, transportation, infrastructure, publicity and science popularization; 3) The human resources component scored low, between 2–3 points, indicating the need for greater investment in this area. From the actual situation, tour guides need more training to enhance their operational capabilities, and in terms of salary, they also need to improve their remuneration according to the needs of the market. The study can accurately and effectively make management suggestions to the managers of Danxia Mountain Global Geopark, so as to help the managers improve their management measures.

Keywords: geopark · RAPPAM · Danxia Mountain · management effectiveness evaluation

1 Introduction

Geoparks are geological sites of great scientific value that can show the public the evolutionary history, geological events or significant geological processes of the earth [1–5]. By 2022, there will be a total of 177 Global Geoparks in 46 countries, of which China has 41 Global Geoparks. The protection of geoparks is part of environmental protection, and the principle of "active protection and rational development" should

be implemented and followed. Although the numbers and areas of geoparks in China have developed rapidly, the actual management level is relatively lagging behind, which restricts the further development of geoparks. Therefore, it is necessary to evaluate the management effectiveness of geoparks to understand the threats and pressures faced by them, determining the priority of protected area management policies and improving the level of protected area management.

This study uses the "Rapid Assessment and Prioritization of Protected Area Management" provided by the World Wide Fund for Nature (WWF) to investigate and evaluate the management effectiveness of Guangdong Danxia Mountain Global Geopark in order to identify the main problems in the management of the geopark. Assessing the conservation value and goal achievement of protected area management is an effective way to ensure the quality of nature reserve management and achieve the management goals of protected areas, as well as to make suggestions for the rational allocation of management, investment and resources of geoparks in the future.

2   Data and Method

China's Danxia landforms are mainly distributed in the southeast region, the Sichuan basin and the Qilian-Liupan region. Guangdong Danxia Mountain Global Geopark is located in the southeast region of China, in the north of Guangdong Province, specifically in Renhua County, Shaoguan City, Guangdong Province, with a total area of about 290 km^2.

2.1   Research Method

Based on the field research of Danxia Mountain Global Geopark, this paper optimizes the RAPPAM evaluation index system, which covers 17 evaluation aspects and a total of 96 evaluation sub-items (Table 1) [6, 7].

2.2   Field Research and Questionnaire Recovery

This study is mainly used questionnaire survey and on-site interview, and the selected respondents are all familiar with the current situations of Danxia Mountain Global Geopark, including local community residents and catering staff. The survey period was from August 24, 2022 to September 15, 2022, and 55 valid questionnaires were returned.

2.3   Data Processing

Since the number of items corresponding to the evaluation details of each evaluation index in the planning, management input, management process and management results of Danxia Mountain Global Geopark is different. In order to compare the differences in evaluation indicators horizontally, the weighted average of each evaluation line item can be carried out to understand the advantages and disadvantages of the management of the geopark.

Table 1. Danxia Mountain Geopark Management Evaluation Index System

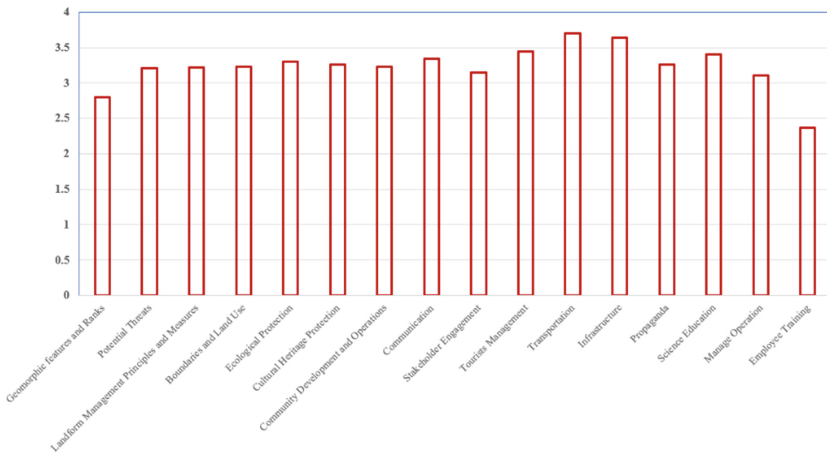| Evaluation Aspect	Evaluation Index	Evaluation Item
Landscape Protect	Geomorphic features and Ranks Potential Threats Landform Management Principles and Measures Boundaries and Land Use	25
Stakeholder	Community Development and Operations Communication Stakeholder Engagement	12
Biodiversity	Status Quo of Ecological Protection and Management Measure	4
Cultural Heritage Protection	Status Quo and Management Measures of Cultural Heritage Protection	4
Tourists Management and Information	Tourists Management Transportation Infrastructure Propaganda	32
Science Education	Science Education	8
Human Resources	Manage Operation Employee Training	11

Fig. 1. Evaluation indexes of Danxia Mountain Geopark

3   Results and Discussion

From the survey results (Fig. 1), the basic infrastructure, traffic and publicity scores of Danxiashan Global Geopark ranked in the top three, with 3.7, 3.64 and 3.44 respectively, indicating that Danxiashan Geopark has done the jobs perfectly in the three aspects and has won the approval of the public. However, the geomorphological features and human resources training are lower than 3 points, standing at 2.8 and 2.37 respectively, which means Danxia Mountain has insufficient human resources, lack of training and loss and other adverse conditions, leading to greatly reduce the sense of tourists' experience.

3.1   Landscape Protection

The average score for landscape protection is about 3.12 (Fig. 1). This indicator mainly focuses on geomorphological features, threats to landforms caused by human and natural causes, the management agency's understanding and concept of geopark management, management objectives, regulations, geomorphological management measures and whether there are clear boundaries, whether boundary planning and land usage are reasonable. The figure of landform features and ratings were the lowest (2.8), while that of the other three were above 3.0. For potential threats, 47.6% of respondents believe that natural factors destroy the geological landform of Danxia Mountain, while the remaining 52.4% of respondents reckon that it is caused by human factors.

In terms of landscape management, 83.4% of the people agreed or strongly agreed that Danxia Mountain Global Geopark has long-term protected landform management and measures, corresponding methods to solve the threats faced and protected by laws and regulations. When it comes to boundaries and land use, 81.8% of people agreed or strongly agreed that there are not any industrial facilities, no cultivated land occupied and the land that have already covered are all with scientific and tourism value. Danxia Mountain Geopark has a very typical Danxia landform landscape, and its surrounding natural landscapes include Jinjiang Gallery, Bazhai Scenic Area, and cultural landscapes such as Liuzu Nanhua Temple.

3.2   Stakeholder

The stakeholder mainly evaluates the communication of Danxia Mountain Geopark, the participation of stakeholders, and the development and operation of the community, with a overall average score of 3.24. In terms of communication, the figure was 3.15, and 79.5% of the people agreed and strongly agreed that the geopark management units actively participated in the Asia-Pacific/Global Geoparks Network meeting, the meeting of the Tourism Geoscience and Geopark Research Branch of the Chinese Geological Society, related academic seminars and participated in other exchange activities. In 2009 and 2011, the Danxia Landform International Symposium was held in Danxia Mountain.

The score of participation of stakeholders was 3.34. 85% of the respondents agreed or strongly agreed that the Geopark management department had established a sound communication channel for stakeholders and could effectively deal with conflicts of interest of different stakeholders. Additionally, it had long-term and stable cooperative

relations with stakeholders and local residents and organizations actively participated in ecological monitoring.

The community development and operation score is 3.23 and 80% of the people agree or strongly agree with the local residents to support the development of the geopark, which is also conducive to increasing the employment opportunities of local residents, and the local people will have special goods related to the geopark. In short, the operation of the Danxia Mountain Geopark contributes to the local economic development. Local residents can increase their income by opening restaurants, offering accommodation [8, 9].

3.3 Biodiversity

Biodiversity concentrates on the ecological protection status and management measures of Danxia Mountain, including assessing whether the ecological quality of the Geopark has decreased, whether a complete ecological resource survey has been conducted, whether there is an adequate ecological management plan and whether there is a long-term management plan for ecological management. Its score is 3.3, and 82.2% of the people agree or strongly agree that the above actions are being implemented in the Geopark.

3.4 Cultural Heritage Protection

Cultural heritage protection is mainly to evaluate the current situation of cultural heritage protection and management measures in Danxia Mountain, including whether the quality of cultural heritage has decreased, whether a complete cultural heritage resource survey has been conducted, whether a complete cultural heritage management plan has been carried out and whether there is a long-term cultural heritage management plan, with a score of 3.26, and 82.3% of the people agree or strongly agree that the above actions are being implemented in the Geopark.

3.5 Tourists Management and Information

Tourists Management and Information focuses on tourists management, transportation, infrastructure and publicity in Danxia Mountain, with a score of 3.51. It is obvious that the figure of tourists management is 3.26, ranking the lowest in the overall tourists management and information. 86.9% of the people agreed or strongly agreed that the Geopark has a reasonable division of activities for tourists, a reasonable tourists management system is set up, and the Geopark can effectively deal with the incidents of tourists violating the law. The Geopark enhances the tourists experience by delimiting the scope of tourists' activities, setting up rest places and observation decks. In terms of transportation, the score is 3.64, ranking second in the tourists management and information indicators, and the main content is to assess whether the external traffic and passenger traffic of Danxia Mountain Geopark are convenient, whether there are roads and trails maintenance, whether there are enough roads and walking paths for tourists and whether the number of touring cars is sufficient. The roads and walking paths in the Danxia Mountain Geopark are well planned to meet the needs of tourists.

In terms of infrastructure, its value is 3.7, 93.9% of the respondents agreed or strongly agreed that the Geopark's interpretive signs, observation decks and map boards were well maintained and placed in the appropriate location. The areas of parking lots, tourists centers and dining areas were adequate for tourists and were repaired timely. Furthermore, the publicity score was 3.44 and 90.2% of the people agreed or strongly agreed that the Geopark has a exclusive website and actively participated in various tourism promotion activities to promote the Geopark, and that tourists can easily obtain promotional materials and tourist information of the Geopark in the nearby attractions, cities and tours, and that the Geopark is well-known. Hotels and travel agency near Danxia Mountain Geopark can easily obtain tourist information and scenic maps.

3.6   Explanation and Popular Science

Explanation and popular science mainly evaluate the science popularization education of Danxia Mountain, including whether Danxia Mountain Geopark has specialized interpretation teaching materials, whether the content of the explanation board is reasonable, scientific and sufficient, whether it has its own APP and whether there is enough space to carry out regular geological science popularization activities and education courses. The score of this category was 3.4. The trees and characteristic attractions in the Geopark are equipped with sufficient interpretation boards. The Danxia Mountain Museum, the land and resources science popularization base, the youth science popularization education base and the college teaching practice base have been built successively. Meanwhile, a number of geological and biodiversity investigation routes have been opened, and popular science books such as "Danxia Mountain Landform" and "China Hongshi Park" have been published.

3.7   Human Resources

This part is human resources which mainly focuses on human resources training, human resources and management ability of Danxia Mountain Geopark, with a score of 2.84. It shows that the average score of human resources training is the lowest among human resources, at 2.37. 78.6% of the participants agreed or strongly agreed that the staff, tour guides and patrol staff in the Geopark had received adequate training. However, after field research, the number of tour guides and employees in the park is insufficient, and most tour guides do not equip with the expertise of the origin and geomorphological characteristics of the Danxia landform. Moreover, the average score of human resources was 3.03, and 78.6% of the people agreed or strongly agreed that the Geopark had selected a certain proportion of local personnel as employees and the total number of employees was sufficient, and there were some assessments provided for the employees to evaluate their performance, progress of work and their income. The management agency's management capacity is 3.11, the highest average score in the human resources category, and 83% of people agreed or strongly agreed that the Geopark's management agency staff and team have rich experience in landscape protection, tourists management, and community development and are reasonable, well-organized, and clearly divided rights and responsibilities.

4   Conclusions and Recommendations

Based on the results and discussions presented above, the conclusions are obtained as below:

1) In this study, the management effectiveness of Danxia Mountain Global Geopark in Guangdong Province was evaluated by the RAPPAM method. From the results of this survey, the Danxia Mountain Geopark was better overall, especially in the three aspects of infrastructure, transportation and publicity, and the less desirable aspects were human resources and landscape protection, with a score of less than 3 points.

2) The categories with the highest scores were tourists management and information, science popularization education, indicating that the strengths of Danxia Mountain Geopark are tourists management, transportation, infrastructure, publicity and science popularization education.

3) The human resources component scored low, between 2–3 points, pointing out the need for greater investment in this area. From the actual situation, tour guides need more training to enhance their operational capabilities, and in terms of salary, they also need to improve their remuneration according to the needs of the market.

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