Study on the Livelihood Capital of Residents in the Entrance Community of the Qinghai Area of Qilian Mountain National Park Considering Ecotourism

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Abstract. In the context of ecological civilization construction and rural revitalization, in-depth research on the impact of ecotourism on the livelihood capital of the entrance communities of national parks has an important role to play in promoting the ecological protection of national parks and the economic development of rural communities. Based on the sustainable livelihood framework, the study constructed a comprehensive evaluation index system for the livelihood capital of rural community residents, used the entropy weight method and the weighted average integrated model to calculate the index weights and the values of the livelihood capital indexes, and analyzed the overall livelihood capital situation in the entrance communities of Qilian Mountain National Park, and the differences in the livelihood capital between the communities with high participation in ecotourism and the communities with low participation in eco-tourism. The conclusions of the study are as follows: (1) the overall livelihood capital of the residents of the entrance community of Qilian Mountain National Park is in the following order: human capital, social capital, physical capital, financial capital, natural capital, and the distribution of various types of livelihood capital is uneven; (2) the overall livelihood capital of the residents of the community with high participation in ecotourism is larger than the overall livelihood capital of the residents of the community with low participation in ecotourism.

Keywords: Ecotourism; national parks; entrance communities; livelihood capital.

1 Introduction

Most of the national parks are located in relatively remote areas, and the livelihoods of the residents are mostly dependent on natural resources [1]. However, the goal of

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"ecological priority" of the national parks has certain impacts on the traditional livelihoods of the residents in the communities, for example, some traditional re-source development activities, such as timber logging and mining, may be restricted or prohibited [2]. In order to mitigate the impact of national park construction on the livelihoods of community residents, it is urgent to explore a harmonious symbiosis path that protects the ecological environment of national parks and enhances the livelihoods of the residents, which is of great significance to the implementation of eco-logical civilization and the development strategy of rural revitalization.

The International Ecotourism Society (IES) defined ecotourism in 1991 as a type of tourism activity carried out in natural areas that protects the natural environment and improves the well-being of local residents [3]. Ecotourism integrates the two themes of ecological conservation and economic development, and as a realistic way to harmonize conservation and development, it has been a hot issue of concern in the academic and nature conservation fields [4]. Different scholars hold different attitudes towards the role of ecotourism in improving community livelihoods. Proponents argue that ecotourism can create many employment opportunities and lucrative tourism income for communities, improve the livelihoods of residents, reduce dependence on natural resources, and promote environmental protection in the process [5]. Kong XZ believes that the rise of ecotourism has prompted the region to pay more attention to ecological conservation, which in turn improves the overall livelihood capital of the community, and is beneficial to the accumulation and enhancement of livelihoods of the farming households [6]. Wang J argues that ecotourism not only creates more sustainable livelihoods for local residents but also helps to protect the natural resources and environment of national parks [7]. Scholars with different attitudes believe that ecotourism can lead to negative impacts such as environmental degradation, destruction of wildlife habitats, and economic losses [8]. It has been shown that there is uncertainty in the impact of ecotourism on community livelihoods, which should be argued and analyzed on a case-by-case basis. Therefore, exploring the impacts of ecotourism on residents' livelihoods and proposing a scientific ecotourism development model is practical guidance for enhancing regional livelihoods.

The entrance community of the national park is the general name of the community located near the entrance of the national park, which is a social group composed of local residents who have lived and produced here for a long time [9]. In the coordinated development of national parks and neighboring regions, entrance communities play a key role, and their geographic location determines that their development affects both the ecological protection of national parks and regional development [10]. It is of great practical significance to improve the livelihood level of the entrance community residents and rationally coordinate the relationship between the national park and the livelihood of the entrance community, so as to achieve the dual purpose of nature protection and economic development.

This study constructs a livelihood capital evaluation index system based on the sustainable livelihood analysis framework, takes residents of the Qilian Mountain National Park entrance community as the research object, and focuses on advancing research in 2 aspects: First, analyzing the overall livelihood capital of the Qilian Mountain National Park entrance community based on empirical research data. The

second is to compare the difference in livelihood capital between residents of communities with high participation in ecotourism and communities with low participation in ecotourism in the entrance communities of the national park.

2 Materials and Methods

2.1 Description of the Study Area

The Qilian Mountains Qinghai Province area is 1.58×10km^2, accounting for 31.5% of the total area. It covers Menyuan and Qilian counties in Haibei Tibetan Autonomous Prefecture, Tianjun county in Haixi Prefecture, and Delingha city, with a total of 41,000 people in 60 villages in 17 townships. Local farmers are mainly engaged in traditional pastoralism, planting, individual business, tourism, and other livelihood activities, the region's production methods are backward, single economic structure. The entrance community of the national park is a necessary place to enter the national park, and residents can fully utilize the advantages of its geographical location to improve their livelihood capital. However, the Qilian Mountains National Park implements strict protection of the ecosystem, which imposes certain restrictions on residents' livelihood activities. In order to improve the level of sustainable livelihoods of the residents in the entrance communities of Qilian Mountain National Park, and to promote the synergistic linkage between ecological protection and livelihood improvement, a new pattern of harmonious development between human beings and nature has been formed. In this study, six entrance communities with different levels of ecotourism development in the Qinghai Area of Qilian Mountain National Park were selected as study cases (figure 1) to analyze the overall livelihoods of residents in the entrance communities of the national park and the differences in the livelihood capital of entrance communities with different levels of ecotourism participation.

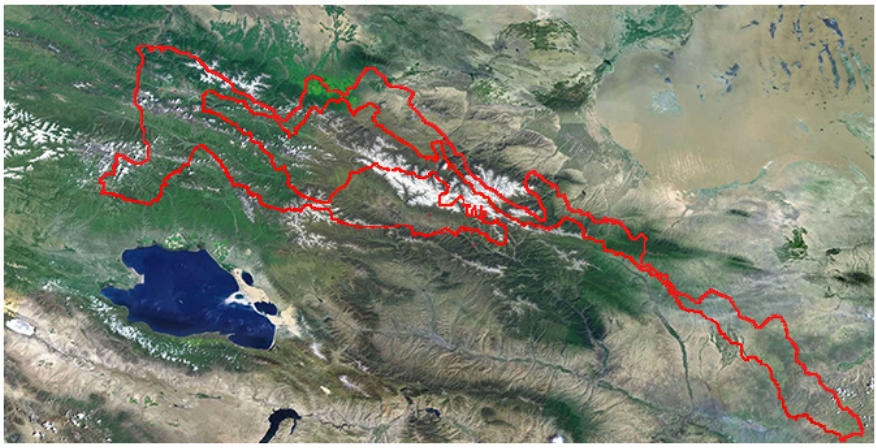

Fig. 1. Overview of the study area (caption centered).

2.2 Data Sources and Collection

In July 2022, under the recommendation of the Qinghai Provincial Administration of Qilian Mountain National Park, and following the principles of representativeness and accessibility, the research team determined the research area and used semistructured interviews to carry out field research in six entrance communities, namely Ebao Village, Guomi Village, Pigeon Hole Village, Taola Village, Dazhuang Village, and Laolongwan Village. Firstly, a seminar was held with the secretaries, directors, chairpersons of the Women's Federation and party representatives of the six rural communities, with each seminar lasting about 2-3 hours, secondly, in-depth interviews were conducted with 88 households based on the recommendations of the village committees, with each household being interviewed for about 30 minutes. The questionnaire is designed for the livelihood capital status of the residents of the entrance community of the national park in five aspects: human capital, natural capital, social capital, physical capital and financial capital. The interviews mainly included: (1) basic information about residents' families, including gender, age, education level, health level, etc.; (2) various types of residents' assets as well as social relations, such as arable land per capita, pasture per capita, production and living equipment, and neighborly relations, etc.; (3) financial capital of the residents, including household income, and the opportunity of loans from financial institutions.

2.3 Research Methodology

Entropy method: a mathematical method used to determine the degree of dispersion of a metric. In information theory, entropy is a measure of uncertainty. The larger the amount of information, the smaller the uncertainty and the smaller the entropy; the smaller the amount of information, the larger the uncertainty and the larger the entropy. According to the characteristics of entropy, using the entropy value to judge the degree of dispersion of a certain indicator, the greater the degree of dispersion, the greater the impact of the indicator on the comprehensive evaluation. Therefore, the entropy value method can be utilized to measure the amount of information contained in each indicator in the evaluation index system and determine the weight of each indicator. It is generally believed that the entropy value method can calculate the weights of each indicator more objectively, and the weight values of the indicators given by it have higher credibility than those of the Delphi method and hierarchical analysis method [11]. The steps for determining the weights of indicators using the entropy value method are as follows:

In order to eliminate the differences in the magnitude of each indicator, the base matrix is normalized to the extremes, which results in a normalized matrix x_{ij}:

$$X_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \tag{1}$$

The weight of the *ith* indicator value under the *jth* indicator is calculated:

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}} \tag{2}$$

The entropy value of the *jth* indicator e_j is calculated:

$$e_j = -\frac{1}{\ln m}\sum_{i=1}^{m} P_{ij} \ln P_{ij}, e_j \in [0,1] \quad (3)$$

The coefficient of variation for indicator *j*, g_j, is calculated:

$$g_i = 1 - e_j \quad (4)$$

The weight of the *j*th indicator w_j is calculated:

$$W_j = \frac{g_i}{\sum_{j=1}^{n} g_j} \quad (5)$$

The weighted average composite model was applied to calculate the composite score for each evaluation subject:

$$F_i = \sum_{j=1}^{n} W_j X_{ij} \quad (6)$$

2.4 Construction of the Indicator System

In the sustainable livelihood framework developed by the UK Department for International Development (DFID), livelihood capital includes five types: natural capital, physical capital, human capital, financial capital and social capital. With reference to the results of quantitative research on livelihood capital carried out by scholars [12,13], and taking into account the actual situation of the residents of national parks, a livelihood capital evaluation index system applicable to the residents of the entrance communities of national parks was designed (table 1).

Cultivated land and grassland are important natural resources on which the residents of the national park depend, and the area of cultivated land per capita and the area of grassland per capita are used as measures of natural capital. Qinghai area of Qilian Mountains National Park belongs to a typical minority farming and herding area, whether residents know Mandarin or not will affect their communication with others and access to labor opportunities; the education level and health level of the residents can better measure the human capital. Houses and living equipment are important physical capital for residents, and most of the farming households in the Qinghai Area of the Qilian Mountains use agriculture and pastoralism as their main livelihood, so production equipment is selected as one of the indicators for measuring physical capital. In the context of financial support, loans play an important role in solving the shortage of residents' development funds, promoting industrial development, and increasing residents' income and wealth, and the opportunity for loans from financial institutions is taken as one of the measurement indicators of financial capital. The entrance community of Qilian Mountain National Park receives high attention from the government and society, and the degree of social support, etc. is taken as a measurement indicator of social capital.

Through semi-structured interviews, relevant information on the livelihoods of people living in the entrance communities of Qilian Mountain National Park was obtained, and the data standardized values of each indicator were calculated using

formula (1), and the weights of each indicator were calculated using formulas (2)-(5) (table 1).

Table 1. Indicator system for evaluating the livelihood capital of farming households in the entrance communities of National Parks.

Livelihood capital	Secondary indicators	Indicator explanation/Calculation formula	Weighted results
Natural capital (0.0979)	Cultivated land area per capita	Total area of cultivated land/total village population (acres)	0.0349
	Grassland area per capita	Total pasture area/total village population (acres)	0.0630
Human capital (0.2933)	Labor force share	Number of village labor force/total population	0.0649
	Educational level of labor force	Middle school and above labor force/total labor force population	0.0981
	Healthiness of labor force	Very unhealthy(0.2); Relatively unhealthy(0.4); Fair(0.6); Healthier(0.8); Very healthy(1.0)	0.0588
	Putonghua penetration level	Determined by the proportion of residents speaking Putonghua	0.0715
Physical capital (0.1642)	Condition of housing	Houses are evaluated according to quality, size, condition and facilities	0.0639
	Production facilities	Evaluated according to the popularity of large-scale production equipment in the village	0.0667
	Living facilities	Evaluated according to the popularity of large home appliances in the village	0.0336
Financial capital (0.2241)	Annual household income	Annual household income in 2021 (million yuan)	0.1493
	Loan opportunities from financial institutions	Assessment based on the village's opportunities for loans from banks, rural credit cooperatives, and insurance financial institutions	0.0748
Social capital (0.2206)	Degree of social support	Including human, technical, policy and financial support (no support: 0; receiving one kind of support: 0.25; two kinds of support: 0.5; three kinds of support: 0.75; four or more kinds of support: 1)	0.0668
	Number of cooperatives	No cooperative (1); one cooperative (0.3); two cooperatives (0.6); three and more (1)	0.0447
	Neighborhood	Very poor (0.2); poor (0.4); fair (0.6); good (0.8); very good (1.0)	0.1091

3 Results and Analysis

3.1 Analysis of Overall Livelihood Capital Results for Entry Communities

By quantifying the livelihood capital of residents in the entrance community of Qilian Mountain National Park, and accumulating the values of each secondary indicator to arrive at the value of the total livelihood indicator of residents (table 2), the overall situation of the current status of the livelihood capital of residents in the study area can be more intuitively seen, and thus the level of development and potential of the community can be assessed. This assessment will help to formulate community development strategies, improve the quality of life of residents, and lay the foundation for subsequent research on the impact of ecotourism on the livelihoods of residents in different types of communities.

The overall stock of livelihood capital of the residents of the entrance community of Qilian Mountain National Park was ranked from high to low as follows: human capital (0.1189), social capital (0.0880), physical capital (0.0818), financial capital (0.0620), and natural capital (0.0452), with a total value of livelihood capital of 0.3959. The residents of the study area had the highest human capital, accounting for 30.03%. Among them, the value of the indicator of the labor force's education level is 0.0345, and the value of the indicator of the labor force's health level is 0.0392, which scores higher compared with the values of other human capital indicators, indicating that residents have higher literacy and health levels, and residents with higher literacy usually have higher levels of knowledge and cognitive ability, which to some extent can promote the innovation of the residents' livelihood strategies. However, the value of the indicator of the labor force is low, which restricts the development and livelihood capacity of households. Social capital is the next highest, accounting for 22.23% of the total value of livelihood capital, of which the value of the neighborhood relationship indicator is 0.0364, with a score at a high level, indicating that residents in the study area have better neighborhood relationships and that residents care for, help and support each other, which, to a certain extent, contributes to the stability and harmonious development of the community. The capital values of the degree of social support and the number of cooperatives are 0.0278 and 0.0238, with low scores, indicating that residents need more social support and that the development of the community can be promoted through the provision of more employment and training opportunities, and an increase in the number of cooperatives. The physical capital of households is average, accounting for 20.66% of the total value of livelihood capital, and the capital value of house situation is 0.0373, with better indicators of the quality of houses and living area of the residents. Financial capital is low, accounting for 15.66% of the total value of livelihood capital, and the value of the annual household income indicator is 0.0330, indicating that the overall income level of residents is average. This is due to the fact that the local population is dominated by traditional farming and animal husbandry, with a single pattern of industry, economic income, and fewer households engaged in multiple livelihood activities. The value of the indicator of access to loans from financial institutions is 0.0291, with low access to loans and lack of access to borrowing. The level of natural capital is the lowest, accounting for 11.42% of the total

value of livelihood capital, indicating that the total amount of natural resources per capita occupied by residents of the entrance communities of Qilian Mountain National Park is relatively small. This is mainly due to the fact that Qilian Mountain National Park has a large undulating terrain and poor climatic conditions, so the area available for arable land is relatively small. At the same time, the implementation of the policy of returning pasture to grass is also an important reason for the reduction of pasture areas for herders [14].

Table 2. Quantitative standard values of overall livelihood capital for people living in communities at the entrance to the Qilian Mountain National Park.

Livelihood capital	Secondary indicators	Indicator value	Livelihood capital indicator value	Rank
Natural capital	Cultivated land area per capita	0.0195	0.0452	5
	Grassland area per capita	0.0257		
Human capital	Labor force share	0.0234	0.1189	1
	Educational level of labor force	0.0345		
	Healthiness of labor force	0.0392		
	Putonghua penetration level	0.0218		
Physical capital	Condition of housing	0.0373	0.0818	3
	Production facilities	0.0278		
	Living facilities	0.0168		
Financial capital	Annual household income	0.0330	0.0620	4
	Loan opportunities from financial institutions	0.0291		
Social capital	Degree of social support	0.0278	0.0880	2
	Number of cooperatives	0.0238		
	Neighborhood	0.0364		

3.2 Analysis of Differences in Community Livelihood Capital across Ecotourism Participation Levels

Through an in-depth study of the current situation of the communities at the entrance of Qilian Mountain National Park, it was found that there are obvious differences in the degree of ecotourism participation in the study case sites, and in order to further study the impact of ecotourism on livelihood capital, the case sites are now divided into two groups of ecotourism-high-participation communities, low-participation communities, and other groups for a comparative study. In this study, communities with 50% and more residents participating in ecotourism are defined as communities with high participation in ecotourism, mainly including Ebao Village, Guomi Village, and Laolongwan Village. Communities with 20%-50% of residents participating in ecotourism were defined as communities with low participation in ecotourism, including Qila Village, Dazhuang Village, and Pigeonhole Village.

Table 3. Comparison of livelihood capital between high and low participation groups in ecotourism in communities at the entrance of national parks.

Livelihood capital	High participation group	Low participation group	Indicator parameters	High participation group	Low participation group
Natural capital	0.0328	0.0575	Cultivated land area per capita	0.0182	0.0207
			Grassland area per capita	0.0146	0.0368
Human capital	0.1634	0.0744	Labor force share	0.0361	0.0108
			Educational level of labor force	0.0581	0.0109
			Healthiness of labor force	0.0392	0.0392
			Putonghua penetration level	0.0301	0.0135
Physical capital	0.0598	0.1038	Condition of housing	0.0320	0.0426
			Production facilities	0.0111	0.0445
			Living facilities	0.0168	0.0168
Financial capital	0.1033	0.0208	Annual household income	0.0535	0.0124
			Loan opportunities from financial institutions	0.0499	0.0083
Social capital	0.1185	0.0576	Degree of social support	0.0445	0.0111
			Number of cooperatives	0.0194	0.0283
			Neighborhood	0.0546	0.0182
Sum	0.4778	0.3141	-	-	-

Through group comparison analysis (table 3), it was found that the stock of livelihood capital of residents in communities with high participation in ecotourism was greater than that of residents in communities with low participation in ecotourism, and the values of the livelihood capital measure were 0.4778 and 0.3141, respectively. The results indicated that the stock of livelihood capital of residents in communities with high participation in ecotourism was higher and that the tourism livelihood strategy had a positive impact on the enhancement of the residents' livelihoods.

Natural capital. Natural capital is a very important livelihood capital for residents of nature reserve entrance communities, who mostly choose to rely on natural resources for related livelihood activities. The key indicators of natural capital chosen for this study are per capita cultivated area and per capita pasture area. As can be seen from

table 3, the natural capital stock of the high ecotourism participation group is 0.0328, the natural capital stock of the low ecotourism participation group is 0.0575, and the per capita cultivated land area and per capita pasture area of the residents of the low ecotourism participation community are larger than that of the residents of the high participation community. This result shows that the area of pasture and the area of cultivated land owned by the residents of a region has a significant impact on whether they choose to participate in ecotourism and the energy they invest in it.

Human Capital. Communities with high ecotourism participation have higher levels of human capital compared to communities with low ecotourism participation, with human capital stocks of 0.1634 and 0.0744. In terms of labor force share, labor force education level, and Putonghua penetration, residents of communities with high ecotourism participation also have significantly higher capital values than residents of communities with low ecotourism participation, and higher than the entrance communities residents' overall livelihood capital (figure 2). This suggests that residents with higher levels of education are better able to identify opportunities presented by ecotourism participation and participate more actively in them, as well as being more fluent in Mandarin during their interactions with tourists. The health of the labor force was similar in both groups, so the health of the labor force had little effect on the ecotourism participation of community residents. In addition, the labor force share of communities with high ecotourism participation is significantly higher than that of communities with low ecotourism participation, because residents of national park entrance communities usually own cultivated land and pasture, and households with a larger labor force have more opportunities to choose their livelihood strategies and engage in planting and farming, while the remaining labor force can choose to participate in ecotourism. In contrast, households with smaller workforces are reluctant to give up their existing cultivated land and pasture and have less energy to devote to ecotourism.

Physical capital. Physical capital is generally assessed by looking at aspects such as the condition of the residents' houses, production equipment and living equipment. The study found that high-participation communities in ecotourism had relatively low values of physical capital, while low participation communities in ecotourism had high values of physical capital. The high participation communities had lower scores in terms of housing conditions, including quality and quantity of housing, while the low participation communities had higher scores. In terms of living equipment, the two groups of communities are at a comparable level. Despite the relatively higher household incomes in the high participation community, the investment in areas such as housing and living equipment is lower because ecotourism is still in an upward stage of development in the high participation community and requires more financial investment, which shows that there is still a lot of room for ecotourism development in the high participation community. The high value of the production equipment indicator in the low ecotourism community is mainly due to the fact that most of the residents in this community rely on cultivation and farming for their livelihoods, thus acquiring more production equipment for their daily needs.

Financial capital. It is clearly observed from table 3 that the annual household income and financial institution loan opportunities of communities with high eco-

tourism participation are much more than those of communities with low eco-tourism participation. The capital values for annual household income are 0.0535 and 0.0124, and the capital values for financial institution lending opportunities are 0.0499 and 0.0083. Participation in ecotourism requires a higher level of financial investment, and households with more lending opportunities are more likely to be actively involved in ecotourism while at the same time feeding back into the household income. In contrast, communities with low levels of ecotourism development suffer from a lack of understanding of the lending system, reluctance to borrow, or fear of borrowing. Access to financial capital is limited, thereby limiting the opportunities for community residents to participate in ecotourism.

Social capital. In this study, in order to adequately measure the social relationships available to residents, three indicators were chosen to measure social capital: the level of social support, the number of cooperatives, and neighborhood relations. Through the analysis of the data results in table 3, it was found that the level of social support and neighborhood relations in the ecotourism high participation community is higher than the ecotourism low participation community, while the number of cooperatives in the ecotourism low participation community is more than the ecotourism high participation community. Typically, low ecotourism communities have cooperatives in the form of agricultural cooperatives and pastoral cooperatives for the sale of planted and raised products. High-participation ecotourism communities. On the other hand, rely more on governmental and social support, as well as their own interpersonal resources, and therefore have fewer cooperatives.

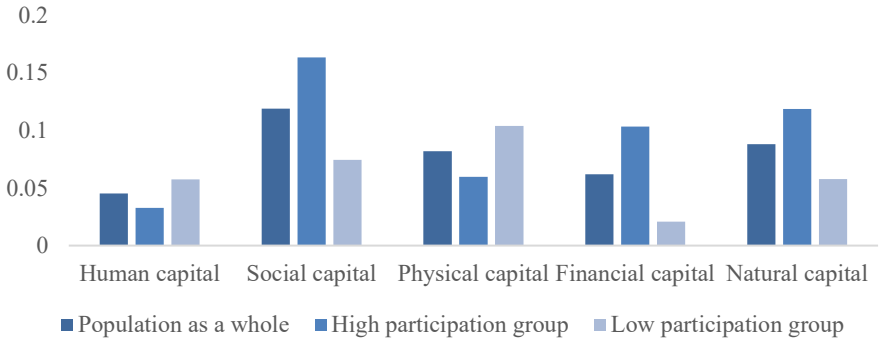

Fig. 2. Comparison of livelihood capital results for entrance communities to Qilian Mountains National Park.

4 Conclusion and Discussion

Based on the field research data of six entrance communities in the Qinghai Area of Qilian Mountain National Park, this study analyzes the current situation of the overall livelihood capital of residents in the entrance communities of Qilian Mountain National Park, and the differences in the livelihood capital of residents in communities with high and low ecotourism participation, by constructing the evaluation index system of the

residents' livelihood capital, and by applying entropy weighting method and the weighted average synthesis model. The following conclusions were drawn from the study:(1)The overall stock of livelihood capital of the community residents at the entrance of Qilian Mountain National Park is ranked from high to low as follows: human capital, social capital, physical capital, financial capital, natural capital, and the distribution of various types of livelihood capital is uneven. (2)The overall livelihood capital stock of community residents with high ecotourism participation is significantly larger than that of community residents with low ecotourism participation, and the livelihood capital stock of the high participation group is about 52% higher. Among them, natural and physical capital values were lower in the high participation group than in the low participation group, and the difference was small. While human capital, financial capital, and social capital were larger in the high participation group than in the low participation group. Human and physical capital in the high-participation group is about twice as high as in the low-participation group, while financial capital is about five times as high as in the low-participation group.

National Park entrance communities coexist with national parks, and the interaction between the two not only affects the ecological environment and livelihoods of the residents but is also closely related to the current ecological civilization development pattern and rural revitalization development strategy [15]. Clarifying the different livelihoods and natural resources of each rural community can help promote ecological protection and economic development of rural communities, which is an urgent research issue.

In order to accurately grasp the livelihood capital of the entrance communities of the national park and put forward suggestions to reduce the contradiction between ecological protection and community development, this study comprehensively reveals the characteristics of community livelihood capital through field research in six entrance communities of the Qilian Mountains National Park. The survey and analysis found that the overall condition of the entrance community is the lowest value of natural capital, the highest value of human capital, followed by social capital, physical capital, and financial capital; usually, residents with more natural capital will choose the livelihood strategy of farming or grazing, and those with less natural capital will consider other livelihoods; human capital and social capital are the most important driving forces for the development of ecotourism in the rural community, which shows that the entrance community have great potential in developing ecotourism. Financial capital is an important factor that hinders the participation of entrance communities in ecotourism. Residents of rural communities usually do not know enough about the bank lending system, so they do not want to borrow or dare not borrow, and their access to household financial capital is limited. Therefore, on the way to developing ecotourism in the entrance communities of national parks, the government should give positive encouragement and support in terms of finance.

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