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Value Transformation and Ecological Practice: The Path to Realizing the Value of Ecotourism Products in Heritage Sites—A Case Study of the Qitai Dry Farming System in Xinjiang

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Abstract: The analysis of the realization path of the value of ecotourism products in agro-cultural heritage sites from the perspective of farmers' behaviors can not only provide decision-making references for improving the well-being of farmers and alleviating poverty but also help to provide a scientific basis for the sustainable development of ecosystems in agro-cultural heritage sites. Based on the field research data of the Qitai dry farming system in Xinjiang in 2023, this study establishes an evaluation index system for livelihood capital transformed by tourism value, and it analyzes whether there is a significant difference between the livelihood capital held by different types of farmers by using the entropy method and non-parametric tests. This study found that (1) farmers who participated in tourism in alpine grassland pastoral areas possessed advantageous financial, social and cultural capital; those who participated in tourism in rain-fed agricultural areas possessed advantageous human capital; and those who participated in tourism in irrigated agricultural areas possessed advantageous financial and human capital. (2) There are significant differences in the natural, physical and financial capital between farmers in alpine grassland pastoral, rain-fed and irrigated agricultural areas. (3) The different types of farm households are categorized into three representative livelihood types in dryland agricultural and cultural heritage sites: strong financial capital-strong, socio-cultural capital sites, strong human capital-weak natural capital sites, and strong human capital-weak physical capital sites. Depending on the composition of the livelihood capital, different types of farmers in heritage sites can realize the tourism value of ecological products, thus helping them to ameliorate their combined benefits.

Keywords: agricultural cultural heritage site; value of ecotourism products; livelihoods of farmers



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1. Introduction

Since the Food and Agriculture Organization (FAO) of the United Nations launched the “Globally Important Agricultural Heritage (GIAHS)” project in 2002, the protection and utilization of agricultural cultural heritage has attracted much attention [1]. As of 2023, China’s Ministry of Agriculture and Rural Development has released seven groups of 188 important agricultural and cultural heritage sites in China, 19 of which are included in the GIAHS list. China’s Central Document No. 1 from 2017 to 2024 emphasizes the need to strengthen the development and protection of “agricultural cultural heritage”. Agricultural cultural heritage is a typical social–ecological–economic composite system with significant ecological, economic and social benefits [2]. At the same time, as a special tourism resource, the rich connotation and unique value of agricultural cultural heritage are of great significance to livelihood security.

Ecological product value realization is achieved through market transactions or government management to make ecological advantages into industrial ones, the essence of which is ecological resource value appreciation [3]. The concept of ecosystem services

was first used to explore the value of ecological products [4–6]. Then, in 2001, the United Nations launched the Millennium Ecosystem Assessment (MEA) program, and ecosystem services have gradually attracted more attention from scholars, including from the perspectives of provisioning, cultural, and regulating services, and their relationship with human well-being has been explored [7,8]. From the start of the 21st century, domestic scholars have tried to commence research on and discussions of “ecological product value realization” based on the results of ecosystem services, and they have achieved fruitful results in defining the property rights of ecological products [9,10], their conceptual connotation and theoretical basis [11,12], value accounting [13,14] and methods of realization [15–17]. Reasonable tourism development can realize the multiple values of ecosystems in agro-cultural heritage sites, for it is important for the value of ecological products [18]. In the study of tourism in agricultural and cultural heritage sites, the international literature covers tourists’ preferences [19], tourism development paths [20], community participation [21] and other aspects. Meanwhile, in China, the focus is on the development of tourism resources in agro-cultural heritage sites at an early stage [22,23], and it is then gradually extended to the behavior of tourists [24], the participation of community residents [25,26] and the realization of the value of eco-products [18]. The realization of the value of ecotourism products in agricultural and cultural heritage sites is still lagging behind; it is not sufficient to support the needs of current practices.

As the main body of agricultural cultural heritage site protection and tourism development, the sustainability of farmers’ livelihood is closely related to the sustainable development of heritage sites. The Qitai dry farming system in Xinjiang was selected as the third batch of “China’s important Agricultural cultural heritage” in 2015, which is a typical agricultural production for “relying on the weather” in China’s arid areas. Therefore, this paper takes the Qitai dry farming system in Xinjiang as an example and tries to construct a measurement index system of livelihood capital for tourism value transformation based on the theory of farmers’ behavior and the theory of externality. Moreover, according to the characteristics of livelihood capital held by different types of farm households, it proposes specific paths to promote the realization of ecotourism product value in order to provide a reference for the coordinated development of ecological resources and farmers’ livelihoods in agro-cultural heritage sites.

2. Analytical Framework for Value Realization of Ecotourism Products

The Sustainable Livelihoods Framework (SLA) categorizes livelihood capital into five types: natural, physical, financial, human and social; it argues that farmers can adjust livelihood strategies based on their livelihood status to produce outcomes, which in turn influence the next round of statuses in a dynamic, cyclical process [27,28]. The sustainable livelihoods framework provides a more complete analytical system for analyzing the level of capital, livelihood choices and outcomes of farmers, and it is an important tool for studying the behavior and livelihood status of farmers. However, when the framework is specifically applied to a particular context, appropriate modifications or adjustments are required in order for it to be relevant to the real situation. For example, Su et al. [29] emphasized the importance of cultural capital in their study of farmers’ livelihood capital, arguing that traditional cultural resources are key core tourism attractions, which led to the proposal of a tourism-based livelihood approach. Sun et al. [30] focused on the impact of rural tourism on farmers’ livelihood capital and strategy selection. Other scholars’ studies have focused on the sustainability evaluation of farmers’ livelihoods [31], changes in their capital before and after tourism development [32], and their resilience [33]. The results of this research make the theoretical research on the impact of tourism development on the livelihood capital of farm households increasingly rich and comprehensive, and they are also an important theoretical and methodological basis for this paper.

In this paper, we construct a logical, analytical framework for realizing the value of ecotourism products based on the sustainable livelihood framework and the actual situation of agro-cultural heritage sites [34] (Figure 1). The value realization of ecotourism products

consists of three dimensions: First, at the level of supply services, it involves the production and value-added process of ecological material products, which is reflected in how crops and other materials are traded in the market as agricultural products. Secondly, at the level of cultural services, it involves the process of realizing and adding value to ecological cultural products, which is reflected in the sale of cultural products by the government and enterprises through the development of leisure, vacation and educational products. Thirdly, at the level of regulating services, it involves the process of the property rights trading of ecological service products, which is reflected in the ecological platform created by the local government for the purchase and transfer of property rights services. As the main operators and maintainers of ecosystems in agro-cultural heritage sites, farmers' choice of livelihood strategies is crucial to the realization of the value of ecotourism products in heritage sites. Through the consideration of positive ecological externalities, farmers need to rationally make economic decisions and allocate their livelihood capital based on their own livelihood status. Their economic activities will have a direct impact on the ecological products that can be transformed by tourism, and, to a certain extent, they will also influence the arrangement of macro-structures and institutional policies [35], which constitute the external support conditions of the livelihood system of farmers. Ultimately, the end product or service is formed through the market path, the government path and the mixed government and market path [18]. Additionally, the choice of livelihood strategies also makes it possible to transform the intrinsic value of ecological products into ecological, economic and social benefits, realizing the process of transforming the value of ecological resources.

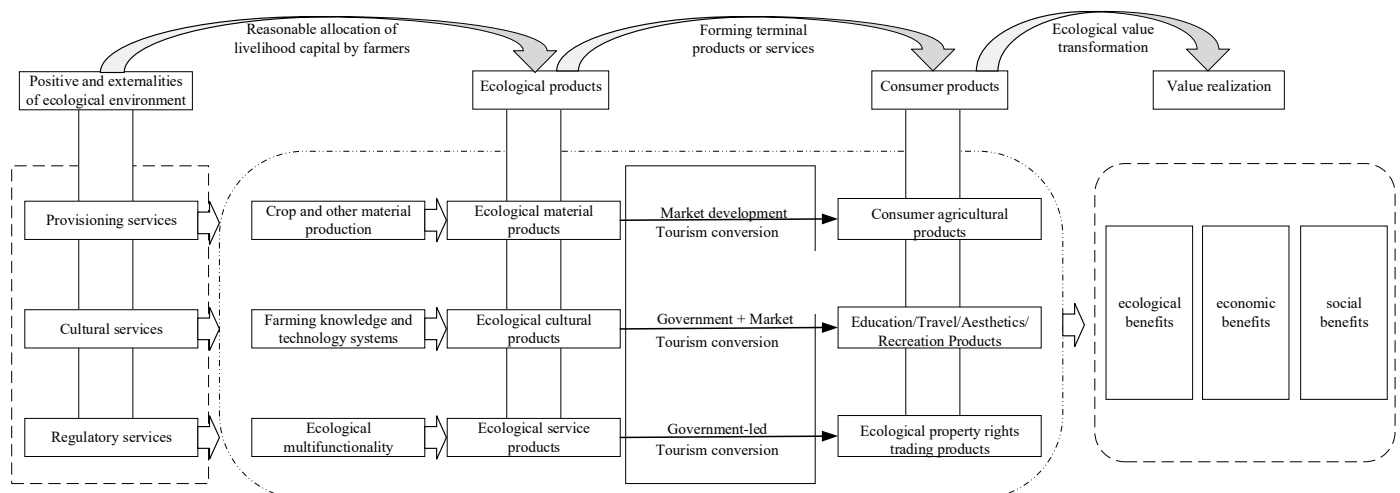


Figure 1. Logical framework for realizing the value of ecotourism products in agro-cultural heritage sites.

3. Materials and Methods

3.1. Overview of the Study Area

The Xinjiang Qitai dry farming system, with a total area of 200,000 mu, is located in China's only Arctic water system at the northern foot of the Tianshan Mountains. Located in Qitai County, Changji Hui Autonomous Prefecture, Xinjiang, China, with a geographic range of 89°13'–91°22' E and 43°25'–49°29' N, it is characterized by the development of agriculture using natural precipitation and ice- and snow-melt water from the Tianshan Mountains, and it has formed a typical dry farming system in the arid northwestern region after a long period of development. The three-dimensional Qitai dry farming system of "alpine grassland pasture area—rain-fed agriculture area—irrigated agriculture area" has more than 2000 years of history. On 17 November 2015, it was formally included in the list of China's important agricultural cultural heritage; the value of this heritage's protection is self-evident.

The dry farming system in Qitai, Xinjiang, currently has three different livelihood patterns: alpine grassland pastoral, rain-fed agriculture, and irrigated agriculture farmers. ① Alpine grassland pastoral areas are located over 2000 m above sea level, with a thick grass layer and high-quality pasture resources, and the livelihood of herding households is dominated by traditional animal husbandry, accompanied by a small number of outbound workers. At the same time, a small number of herdsmen live in the Jiangbrak Scenic Spot, diversifying the types of livelihoods. ② The rain-fed agricultural areas are located in the low hills at an altitude of 1000 to 2000 m, with deep and fertile black and chestnut calcium soils and relatively gentle slopes. The long-term development of the agricultural cultivation system is based on a set of completely natural conditions that “rely on the sky to harvest”, also known as “ten thousand acres of dry land”. This system mainly comprises planting wheat, safflower, oilseed rape and other crops. In comparison with other types of farming households, the number of adult laborers lost in this district is higher, and the remaining laborers’ awareness of tourism participation is lower. ③ The irrigated agricultural areas are located below 1000 m above sea level and can be divided into two types: river-water-irrigated and groundwater-irrigated. Major crops such as spring wheat, oilseed rape and beans are mainly grown there. Farmers in this district have fully developed ecotourism based on the Jambulak scenic area. A small number of farmers run side businesses such as agro-parlors, lodgings and restaurants, increasing the diversity of their livelihoods.

Combining geographic location and economic development levels, this paper selects townships around the core conservation area of the heritage site—the national 5A scenic area of Jiangburak. Two alpine grassland pastoral areas (Dazhuangzi and Altenhuole villages in Banjiegou Town), two rain-fed agricultural areas (Xindoliang and Magouliang villages in Banjiegou Town) and two irrigated agricultural areas (Jiangblake and Washizangzi villages in Banjiegou Town) are the study areas. There are two reasons for selecting the Xinjiang Qitai dry farming system as the case study: First, Qitai County is a representative gathering area of ethnic minorities in the Northwest, and its dry farming agricultural system has been selected as part of the list of China’s important agricultural cultural heritage, which is important in promoting the sustainable development of oasis agro-ecosystems in arid zones. Secondly, Qitai County is a transportation hub on the northern route of China’s ancient Silk Road, with rich agricultural resources and a profound farming heritage. However, the comparative efficiency of agriculture is low, the loss of labor is more serious and the traditional farming culture and technology need to be protected. It faces the common problems of sustainable development experienced by many agricultural and cultural heritage sites at present.

3.2. Typology of Ecotourism Products in Heritage Sites

Ecological product value realization is the process of trading ecological products between the supply and the consumption sides [36]. In this paper, the value realization of ecotourism products in agricultural and cultural heritage sites needs to be combined with the theory of farmers’ behavior and the theory of externality, and it proposes paths to achieve this that can be taken by different types of farmers according to the differences in livelihood capital. Following the existing research, this paper divides the ecological products of agricultural and cultural heritage sites into supply, cultural and regulating services from the perspective of the manifestation and function of ecological products [37]. Moreover, by synthesizing the ecological characteristics of agricultural cultural heritage sites, ecological products for tourism value transformation are divided into ecological material, ecological cultural and ecological service products [11] (Table 1).

Table 1. Eco-products of heritage sites undergoing tourism value transformation.

Types of Ecological Products	Tourism Resources Included	Type of Value	Modes of Value Realization
Ecological product	Crops, agricultural products, water supply, etc.	Economic value	Market-driven
Ecological and cultural products	Agricultural landscape, traditional architecture, traditional agricultural tools, traditional farming experience and knowledge, folk songs and dances, traditional skills, etc.	Ecological + economic value	Government + market synergy
Ecological service products	Forest cover, climate regulation, air quality, soil stabilization and mitigation, nutrient cycling, etc.	Ecological value	Government-led

3.3. Data Sources

The research team traveled to the case study sites in September 2023 to conduct a pre-survey, with several rounds of revisions and refinements being made to the questionnaire. Formal research was conducted in October 2023, using the Participatory Rural Appraisal (PRA) method to conduct questionnaires and semi-structured in-depth interviews with farmers in the case study sites. The main content involves farmers' livelihood capital, willingness to participate in tourism and attitudes towards the conservation of heritage sites. It should be noted that the household survey covered the vast majority of households living in the case study villages during this period. A total of 151 questionnaires were distributed in this research, including 49 sample households in alpine grassland pastoral areas (31 households in Dazhuangzi Village and 18 households in Altenhuole Village), 52 sample households in the rain-fed agricultural areas (28 households in Xinquoliang Village and 24 households in Maigouliang Village) and 50 sample households in the irrigated agricultural areas (25 households in Jiangburak Village and 25 households in Yaozhanzi Village). The basic information of the questionnaire respondents is shown in Table 2.

Table 2. Basic information on the samples.

	Type	Sample Size/Copy	Percentage/%
Sex	Male	84	55.63
	Female	67	44.37
Ethnic group	Han nationality	95	62.92
	Hui nationality	2	1.32
	Kazak nationality	52	34.44
	Other	2	1.32
Age	19~35	35	23.18
	36~50	59	39.07
	51~65	45	29.80
	≥65	12	7.95
Educational level	Primary and below middle school	40	26.49
	High school or vocational school	55	36.42
	College degree or above	39	25.83
		17	11.26
Career	Farmer	89	58.94
	Village cadres	8	5.30
	Homestay	12	7.95
	Restaurant	8	5.30
	Supermarket	7	4.64
	other	27	17.87

Table 2. Cont.

	Type	Sample Size/Copy	Percentage/%
Family livelihood methods/types	1	113	74.83
	2	34	22.52
	3	4	2.65
Annual household income	<5	45	29.80
	5~10	66	43.71
	11~15	23	15.23
	16~20	10	6.62
	>20	7	4.64

3.4. Research Methods

3.4.1. Measurement Indicator System

The realization of the value of ecotourism products in agro-cultural heritage sites is influenced by a number of factors. On the one hand, the realization of the value of ecotourism products in agro-cultural heritage sites is closely related to the livelihood capital of farmers. In order to take into account the carrying capacity of the agro-cultural heritage sites, it is necessary to enhance the livelihood capital of farmers without jeopardizing them. On the other hand, the realization of ecotourism value in agro-cultural heritage sites involves the degree of farmers' awareness of tourism, including their tourism participation skills and willingness to participate in tourism. This is crucial for the sustainable conservation and utilization of agro-cultural heritage sites. Based on this, this paper constructs an indicator system for transforming tourism value into livelihood capital (Table 3) according to the sustainable livelihood analysis framework and related studies [16,38–42], combining the characteristics of the case study site and the actual needs of farmers.

Table 3. Indicator system and weights of indicators for transforming tourism value into livelihood capital.

Primary Indicators and Weights	Secondary Indicators and Weights	Indicator Interpretation
Natural capital (0.067)	Cultivated area (0.035)	Total household cultivated land area/mu
	Family orientation (0.042)	The distance between the house and the core area of the heritage site: less than 10 km = 5; 11~20 km = 4; 21~30 km = 3; 31~40 km = 2; over 40 km = 1
	Ecological environment conditions (0.012)	Very dissatisfied = 1; not satisfied = 2; generally = 3; satisfaction = 4; very satisfied = 5
	Development level of tourism resources (0.911)	Undeveloped = 1; exploration stage = 2; participation stage = 3; development stage = 4; consolidation stage = 5
Physical capital (0.388)	Number of livestock (0.200)	Number of livestock raised, such as chickens, ducks, geese, pigs, cows, sheep, etc./piece
	Family housing type (0.010)	Civil engineering room = 1; brick and wood house = 2; brick and tile house = 3; concrete room = 4; high-end villa = 5
	Family residential area (0.053)	Total housing area/unit of rural households
	Tourism-available housing area (0.395)	The area/space that rural households can use for tourism
	Fixed assets available for tourism (0.342)	Fixed assets such as transportation and household appliances that can be used for tourism by rural households/piece

Table 3. Cont.

Primary Indicators and Weights	Secondary Indicators and Weights	Indicator Interpretation
Financial capital (0.207)	Annual household income (0.227)	The total income of the family in the current year/CNY: less than 50,000 = 1; 5~10 = 2; 11~15 = 3; 16~20 = 4; over 200,000 = 5
	Whether to enjoy government subsidies or not (0.663)	Whether the family has received government funding subsidies: No = 1; Yes = 2
	Access to credit opportunities (0.043)	The difficulty level for farmers to obtain loans from banks or credit cooperatives: very easy = 5; easy = 4; generally = 3; not easy = 2; very difficult = 1
	Type of household network (0.067)	Unable to access the internet = 1, traffic = 2, broadband = 3, traffic+broadband = 4
Human capital (0.127)	Number of sound labor force (0.033)	Number of adult labor in the household per person
	The highest education level for adult labor force (0.019)	Primary school and below = 1; junior high school = 2; high school or vocational school = 3; university and associate degree = 4; graduate and above = 5
	Consciousness of protecting and inheriting traditional culture (0.061)	Very unwilling = 1; unwilling = 2; generally = 3; willing = 4; very willing = 5
	Disposable time for family tourism (0.321)	The total time spent by farmers participating in tourism-related work per month: less than 3 months = 1; 3~6 months = 2; 7~10 months = 3; over 10 months = 4
	Tourism-related strengths and skills (0.199)	Whether members of rural households possess tourism-related skills: No = 1; Yes = 2
	Tourism industry experience (0.211)	Never before = 1; have relevant experience = 2; engaged in = 3
	Tourism participation awareness (0.156)	The willingness of farmers to participate in accommodation or catering, tourism project design, scenic area service management and sales of tourism products: type 1 = 1; type 2 = 2; type 3 = 3; type 4 = 4
	Relation network (0.310)	Whether there are relatives who are public officials: No = 1; Yes = 2
Social and cultural capital (0.211)	Skill training opportunities (0.193)	Whether family members of farmers participated in relevant skill training: No = 1; Yes = 2
	Social interactions with friends or neighbors (0.029)	Very little interaction = 1; general communication = 2; frequent communication = 3
	Participation in family agricultural organizations (0.468)	Whether farmers participate in relevant cooperatives: No = 1; Yes = 2

3.4.2. Weight Determination

Studies on livelihoods often use the entropy value method as a comprehensive indicator evaluation method, an objective assignment method that can avoid the arbitrariness of active assignment to a certain extent. The specific formula is as follows:

- (1) Calculate the proportion of each indicator, p_{ij} :

$$p_{ij} = \frac{s_{ij}}{\sum_{i=1}^n s_{ij}}$$

- (2) Calculate the entropy value of each individual indicator, e_j :

$$e_j = -\frac{1}{\ln n} \sum_{i=1}^n (p_{ij} \cdot \ln p_{ij})$$

- (3) Calculate the information entropy redundancy for each indicator, d_j :

$$d_j = 1 - e_j$$

- (4) Calculate the weights of the indicators, w_j :

$$w_j = \frac{d_j}{\sum_{i=1}^m d_j}$$

Multiply the value of the second-level indicator of each capital type in the sample by the corresponding weight, w_i , to obtain the evaluation score of the second-level indicator in each capital type. Then, sum up to obtain the comprehensive evaluation score of each first-level indicator, which can be calculated according to the abovementioned steps in turn. Finally, acquire the comprehensive evaluation score and weight of the rest of the first-level indicators [18,39].

In order to clarify the degree of influence of the secondary indicators in each type of capital, we selected five livelihood capital indicator layers to calculate the weight of each indicator hierarchically: the higher the weight, the greater the influence of the indicator in the level of the livelihood of the farmers. The weight value of each indicator is shown in Table 3. The largest weight was that of physical capital; the reason for this is that the three indicators of “tourism available housing area” and “tourism available fixed assets” in the secondary indicators have a larger weight, which can directly affect the comprehensive score of physical capital. The weights of the secondary indicators of natural capital differ the most, and the weight of “degree of exploitation of tourism resources” reaches 0.911, indicating that the utilization rate of tourism resources within the Qitai dry farming system is high. This ensures, to a certain extent, the livelihood capital of farming households.

4. Results and Analysis

4.1. Analysis of Differences in the Transformation of Tourism Value into Livelihood Capital Held by Different Types of Farm Households

As shown in Table 4, the combined average score of tourism value transforming the livelihood capital of farmers in the heritage site is 1.038, and the scores of each capital are relatively unbalanced. Among them, financial capital and socio-cultural capital have the highest overall average scores. This indicates that heritage sites have strong external support and lending systems, which can cope with livelihood risks to a certain extent and can enhance livelihood risk coping capacity. Natural capital has the smallest weight and the lowest score, indicating the instability of farmers’ dependence on traditional agriculture for their livelihoods, while the development of tourism resources can, to a certain extent, reduce farmers’ dependence on traditional agriculture and enhance the stability of their livelihoods.

Table 4. Evaluation scores (average) of tourism value transformation livelihood capital held by different types of farmers.

Type	Natural Capital	Physical Capital	Financial Capital	Human Capital	Social and Cultural Capital	Comprehensive Score
Alpine grassland pastoral areas	0.101	0.079	0.509	0.358	0.331	1.378
Rain-fed agricultural areas	0.106	0.153	0.152	0.320	0.239	0.970
Irrigated agricultural areas	0.090	0.107	0.307	0.301	0.289	1.094
Overall	0.041	0.083	0.305	0.319	0.290	1.038

Independent sample non-parametric tests were conducted to understand the differences in livelihood capital held by different types of farm households in the heritage site. As can be seen from Table 5, there are statistically significant differences in natural, physical and financial capital among different types of farm households ($p < 0.05$). However,

there is no statistically significant difference in human capital and social and cultural capital ($p > 0.05$). Also, by performing multiple comparisons of independent samples, the following points can be found:

- (1) The level of natural capital was higher for farmers in irrigated agricultural areas than for those in rain-fed agricultural areas and alpine grassland pastoral areas as a whole. The reason for this is that there is a positive correlation between a farmer's household orientation and the choice of livelihood strategy. The closer farmers are to the core area of the heritage site or to townships and highways, the higher the likelihood that farmers will choose a tourism livelihood strategy. The results of the field visits show that the irrigated agricultural areas are strategically located along the main highway. Enhancing livelihood diversity through the development of lodges and restaurants is a natural choice.
- (2) The level of physical capital was higher for farmers in alpine grassland pastoral areas than for those in irrigated and rain-fed agricultural areas. From the average rank, there is a significant difference in the scores of farmers in alpine grassland pastoral areas compared to those of other types of farmers. The advantage held by farmers engaged in livestock farming comes from the heritage land having large areas of grassland available for grazing and the income from livestock farming being very substantial. At the same time, some farmers operate side businesses, such as catering and horse rentals, in scenic spots during the peak tourist season, which, to a certain extent, also enhances their livelihood capital level.
- (3) The level of financial capital was higher for farmers in alpine grassland pastoral areas than for those in rain-fed and irrigated agricultural areas. In addition to grazing, tourism services and labor, the sources of finance for farm households in the district include lending opportunities from financial institutions and government subsidies. Analyzing Table 5, it is not difficult to see that the financial capital of the remaining types of farmers is slightly low compared with that of those in alpine grassland pastoral areas. This reflects the strong support of the government and relevant departments provided to the farmers in the district.

Table 5. Non-parametric tests and multiple comparisons of farm household type and capital type.

	Farmer Type	N	Rank Average	H	<i>p</i>	Multiple Comparisons
Natural capital	Alpine grassland pastoral area	49	36.43	59.469	0.001	Irrigation agriculture areas > rain-fed agriculture areas > high-mountain grassland pastoral areas
	Rain-fed agricultural area	52	93.95			
	Irrigated agricultural areas	50	96.11			
Physical capital	Alpine grassland pastoral area	49	90.83	8.693	0.013	Alpine grassland pastoral areas > irrigated agricultural areas > rain-fed agricultural areas
	Rain-fed agricultural area	52	66.35			
	Irrigated agricultural areas	50	71.51			
Financial capital	Alpine grassland pastoral area	49	93.79	12.142	0.002	Alpine grassland pastoral areas > rain-fed agricultural areas > irrigation agricultural areas
	Rain-fed agricultural area	52	68.56			
	Irrigated agricultural areas	50	66.31			
Human capital	Alpine grassland pastoral area	49	84.27	2.822	0.244	—
	Rain-fed agricultural area	52	74.07			
	Irrigated agricultural areas	50	69.91			
Social and cultural capital	Alpine grassland pastoral area	49	81.45	1.294	0.524	—
	Rain-fed agricultural area	52	72.01			
	Irrigated agricultural areas	50	74.81			

4.2. Composition of Tourism-Value-Transformed Livelihood Capital Held by Different Types of Farm Households

By analyzing Table 5, it is clear that there is a significant difference in the livelihood capital held by different types of farmers. The composition of livelihood capital for tourism value transformation held by different types of farm households is analyzed further in

Figure 2. Indeed, there are different degrees of scarcity of livelihood capital among all types of farm households in the heritage site. Therefore, we categorized the farming households in alpine grassland pastoral areas, rain-fed agricultural areas and irrigated agricultural areas into three specific, typical, representative types of farming households in the dry farming cultural heritage site: strong financial capital-strong, socio-cultural capital (alpine grassland pastoral farmers), strong human capital-weak, natural capital (rain-fed agriculture farmers), and strong human capital-weak, physical capital type (irrigated agriculture farmers). The compositional structure of livelihood capital is consistent with the basic situation of farm households in the heritage area and is representative.

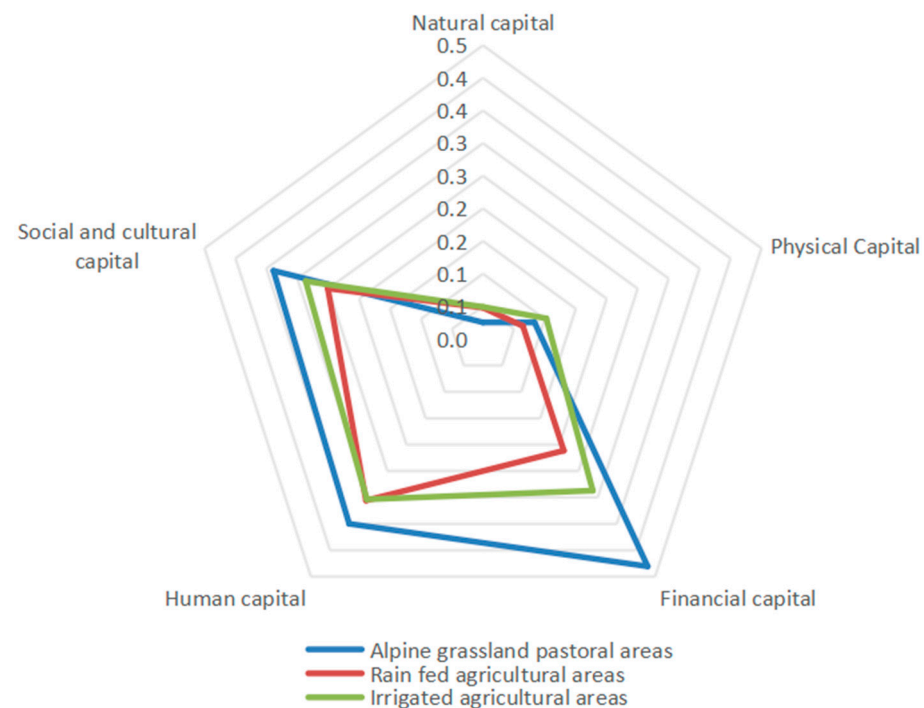


Figure 2. Distribution of tourism-value-transformed livelihood capital scores held by different types of farmers.

5. Path to Realize the Value of Ecotourism Products in Heritage Sites

Based on the results of the previous evaluation of the transformation of tourism value into livelihood capital of farmers in the Qitai dry farming system combined with the results of previous research [18], this paper tentatively proposes a value realization path of ecotourism products suitable for farmers in the arid zone agro-cultural heritage sites.

(1) Path of the strong financial capital-strong, socio-cultural capital type

This path is used to expand the supply of ecological products and vigorously develop the ecotourism industry under the premise of strong economic and socio-cultural capital. The aim of this is to reduce farmers' dependence on livestock income and enhance their part-time industrialization capacity. The government should guide farmers to actively participate in grassland tourism and enrich new forms of grassland tourism. At the same time, farmers should be encouraged to participate in various associations, such as cattle and sheep breeding associations, horse rental associations, etc., in order to solve the problem of the sustainable livelihood of farmers. In addition, the government and relevant departments may offer activities such as training in animal husbandry to cope with possible natural disasters.

(2) Path of the strong human capital-weak natural capital type

This path is used to make full use of the advantages of human capital to realize the transformation of the tourism value of ecological products. The aim of this is to establish

the tourism-led mechanism of “government + enterprise + farmers” and improve the supporting infrastructure for tourism. Foreign investors should be given policy incentives to drive farmers to take the initiative in employment and entrepreneurship. The protection, inheritance and development of agricultural and cultural heritage sites cannot be separated from human resource reserves, and the “tourism dividend” should be used to attract young people back to the area while, at the same time, strengthening the professional skill training of local talents. At the same time, the professional skill training of local talent should be strengthened, such as through training in tourism service skills and training in employment and entrepreneurship, so as to enhance the livelihood skills of farmers.

(3) Path of the strong human capital-weak physical capital type

This pathway is used to add value to ecological products by balancing the strengths of human capital with the weaknesses of the physical base. The aim of this is to strengthen the infrastructure within the boundaries of heritage sites, improve the housing conditions of farmers and upgrade the material capital of farmers to participate in tourism. The primary processing of ecological agricultural products may be carried out through limited human capital and converted into primary tourism commodities; moreover, the government may guide incipient tourism operators to participate in the construction of multifunctional ecotourism demonstration zones. The creation of tourism industry clusters will enhance the overall risk-resistant capacity of farmers in heritage areas and compensate for the shortage of the material capital of farmers up to a certain point.

As ecological products are partly public products and partly public resources, they are characterized by non-exclusivity and, to a certain extent, may give rise to externality problems such as “free-riding”, the over-utilization of public resources and ecological degradation [43]. Therefore, on the basis of the abovementioned path and to overcome the problems caused by externalities, the state should strategically position the realization of the value of ecotourism products in agro-cultural heritage sites at the macro level, design them in a holistic manner and carry out special programs. For example, this may be accomplished through improving the ecological compensation system and policies for heritage sites, adjusting government subsidies and improving the financial organization system; therefore, the livelihood capital of farmers will be strengthened for tourism operation or development. Moreover, to optimize the structure of the livelihood capital of farm households in heritage sites at the micro level, the state should guide the establishment of different types of cooperatives or associations and regulate their conduct, encourage farmers to actively participate in community organizations and enhance the exchange of information among different groups. These suggestions can raise the awareness of communities and farmers of the protection of ecological resources and strengthen farmers’ recognition of the importance of the value of agro-cultural heritage sites.

6. Discussion and Conclusions

6.1. Discussion

As an important place for ecotourism, agricultural cultural heritage sites not only play a role in maintaining the dynamic balance between ecosystem and biodiversity but also affect the lifestyle of farmers around the heritage site [44]. Farmers’ participation in tourism has also become an important driver of the diversification of traditional agricultural livelihoods [45]. At present, farmers in the face of complex production and living environment for the purpose of effectively improving their own living conditions, adjust their own assets and business activities to achieve the transformation of living strategy [46], and improving the family livelihood level through this transformation has become an important topic. Some scholars’ explorations from a tourism perspective have shown that factors such as farmers’ awareness of tourism participation, the level of development of the tourism industry, and differences in livelihood assets have a significant impact on the choice of livelihood strategies for farmers [31,35]. Of course, the diversification of livelihoods through the combination of traditional agriculture and tourism should not take the form of a “hard landing” but rather a gradual progress. On the one hand, it continues to raise the

level of awareness of the value of ecotourism products among farm households in heritage sites. It promotes both ecological conservation in the choice of livelihood strategies and the likelihood of successful livelihood transformation for farmers. On the other hand, it is important to increase the capital stock of farmers' livelihoods. On the other hand, increases the livelihood capital stock of farmers. This requires farmers to cultivate their own internal forces and strengthen the combination of external government policies. In fact, our study found that few farmers in the case sites can recognize the impact of heritage conservation, tourism development and livelihood improvement. The positive effects of tourism have not yet been effectively demonstrated, and there is an urgent need to establish the correlation of benefits between tourism development and the development of farmers' livelihoods in a variety of ways.

Some of the findings of this paper are consistent with those of the existing literature [18,40,42,45,47,48] in that tourism has a positive impact on farmers' livelihood choices, livelihood outputs, etc., but there are also the same realities of low awareness of participation, fragile livelihood capital and the weak self-development capacity of farmers. Of course, there are differences in the natural environment and the level of economic development of the study regions, and to some extent, there are localized differences in the findings. For example, this paper finds that natural capital and physical capital are Type 2 capital most scarce for farmers in the agricultural and cultural heritage sites in Qitai County, Xinjiang, which is different from the agricultural and cultural heritage sites in Chifeng City, Inner Mongolia, and Kuancheng County, Hebei, where the two most scarce types of capital are physical capital and financial capital. The biggest difference from the existing studies is that this paper links the ecosystems of agro-cultural heritage sites with livelihood capital, constructs a livelihood capital evaluation index system from the perspective of tourism, measures whether there is significant variability in the livelihood capital held by different types of farmers in a certain region or heritage site and identifies the key driving or hindering factors, which will help to "prescribe the right medicine" and discover targeted intervention programs. In addition, evaluating the transformation of tourism value into the livelihood capital of farmers in a certain region's agro-cultural heritage site helps us to think about the inner causes of the hollowing out and decline of villages in this region's heritage site. Moreover, it provides a reference value for farmers in the same type of agro-cultural heritage site to rationally and efficiently utilize ecological resources and achieve the coordinated development of ecosystems and family livelihoods.

Tourism, as an important way to realize the value of ecological products in agro-cultural heritage sites, plays a significant role in the protection, utilization and inheritance of heritage. The research in this paper can help farmers better realize the social, cultural and economic values of ecological products and also enhance farmers' awareness of heritage and ecological protection. This can help further promote the adaptive management of agricultural and cultural heritage sites. However, this paper also suffers from the following research limitations: (1) The indicator system constructed in this paper for the transformation of tourism value into livelihood capital in agricultural and cultural heritage sites is the result of comprehensive consideration based on the existing literature and research. However, there are many shortcomings in this study, such as how the interpretation of the connotation of the indicators has a certain degree of subjectivity and the selection of the indicators is not comprehensive enough and needs to be further improved and supplemented in the future with the sustainable development of the heritage site and the changes in the livelihood environment of the farmers. (2) The research found that there are different degrees of hollowing out in the villages in the heritage site, the resident population of the community is small, and there are seasonal differences; therefore, the overall sample size is small, and the conclusions obtained inevitably have a certain one-sidedness. In the future, the evaluation framework of transforming tourism value into livelihood capital can be further tested in agro-cultural heritage sites with different levels of economic development. (3) As tourism participation varies across villages, there is a difference in the proportion of participating and non-participating farm households in the sample. It is worth noting that

the government, tourism enterprises and tourists are also stakeholders in the realization of the value of ecotourism products, and their participation in tourism also has a great degree of influence on the composition of the livelihood capital of farm households, which needs to be further explored in the future.

6.2. Conclusions

This study is based on the theory of farmers' behavior and the theory of externalities, combined with the special attributes of agricultural and cultural heritage sites as living heritage. Taking the Qitai dry farming system in Xinjiang as an example, the entropy method and non-parametric tests are applied to evaluate the differences in the transformed livelihood capital of the tourism value held by different types of farmers and the composition of capital. The following conclusions are drawn:

- (1) Financial and socio-cultural capital are advantageous for farmers' participation in tourism in alpine grassland pastoral areas; human capital is advantageous in rain-fed agricultural areas; and financial and human capital are advantageous in irrigated agricultural areas.
- (2) There are significant differences in the natural, physical and financial capital between farmers in alpine grassland pastoral, rain-fed and irrigated agricultural areas. The overall level of natural capital is higher in irrigated agriculture than in rain-fed agriculture and alpine grassland pastoralism; that of physical capital is higher in alpine grassland pastoral areas than in irrigated and rain-fed agricultural areas; and that of financial capital is significantly higher in alpine grassland pastoral areas than in rain-fed and irrigated agricultural areas.
- (3) The different types of farmers can be categorized into three representative types of livelihood strategies for farmers in dry farming cultural heritage sites: the strong financial capital-strong, socio-cultural capital type, the strong human capital-weak, natural capital type, and the strong, human, capital-weak, physical capital type.

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