



OPEN ACCESS

EDITED BY
Yuantao Xie,
University of International Business and
Economics, China

REVIEWED BY
Ghulam Raza Sargani,
Sichuan Agricultural University, China
Moslem Savari,
Khuzestan University of Agricultural
Sciences and Natural Resources, Iran

*CORRESPONDENCE
Jilin Wu,
✉ wjlin9911@163.com
Shuiliang Liu,
✉ lsliang2004@163.com

SPECIALTY SECTION
This article was submitted to
Environmental Economics and
Management,
a section of the journal
Frontiers in Environmental Science

RECEIVED 26 October 2022
ACCEPTED 22 December 2022
PUBLISHED 10 January 2023

CITATION
Wu J, Zuo J, Li L and Liu S (2023),
Evaluation and influencing factors of
farmers' sustainable livelihood response to
ecocultural tourism in minority areas
of China.
Front. Environ. Sci. 10:1080277.
doi: 10.3389/fenvs.2022.1080277

COPYRIGHT
© 2023 Wu, Zuo, Li and Liu. This is an
open-access article distributed under the
terms of the [Creative Commons
Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use,
distribution or reproduction in other
forums is permitted, provided the original
author(s) and the copyright owner(s) are
credited and that the original publication in
this journal is cited, in accordance with
accepted academic practice. No use,
distribution or reproduction is permitted
which does not comply with these terms.

Evaluation and influencing factors of farmers' sustainable livelihood response to ecocultural tourism in minority areas of China

Jilin Wu^{1*}, Jinyou Zuo¹, Li Li² and Shuiliang Liu^{3*}

¹School of Civil Engineering and Architecture, Jishou University, Zhangjiajie, China, ²School of Government, Beijing Normal University, Beijing, China, ³School of Tourism and Management Engineering, Jishou University, Zhangjiajie, China

Ecocultural tourism plays an crucial role in promoting poverty reduction and farmers' sustainable livelihood enhancement worldwide, which has attracted strong attention from scholars and society. However, the impact of ecological and cultural capital of farmers' sustainable livelihoods have not been yet fully investigated. This paper modifies the sustainable livelihoods framework (SLF) and emphasizes the effects of ecological and cultural capital on farmers' sustainable livelihoods. The modified SLF can be used as a possible theoretical model to comprehensively characterize farmers' sustainable livelihoods in tourism destinations with rich ecological and cultural resources. By constructing an evaluation index system, principle component analysis and multiple linear regression are used to analyze the types and response levels of farmers' sustainable livelihoods to ecocultural tourism and determine the factors influencing this response. The results show that farmers' sustainable livelihood responses to ecocultural tourism can be classified into six types. The overall response values are low, and the responses are ranked by the degree of response in descending order as complete response, balanced development, cultural network, ecology-dominant, developmental delay, and resource advantage response. Farmers' sustainable livelihoods respond strongly to cultural capital and ecological capital factors and relatively weakly to physical, natural, social, financial, and labor capital. Five main factors that influence farmers' sustainable livelihood responses are then identified. Finally, strategies and suggestions for livelihood transformation, strategy selection, and improvement are proposed. This study provides case study examples for promoting the sustainable development of ecocultural tourism sites and improving farmers' livelihoods in China and worldwide.

KEYWORDS

ecocultural tourism, farmers, sustainable livelihood, livelihood response, minority area

Introduction

Poverty is a global challenge that is particularly significant in developing countries (Liu et al., 2017; Rignall et al., 2017). Unlike the rapid expansion of urbanization, rural areas, where 79% of the world's poor live, are gradually declining. Thus, promoting the development of rural economies and improving the livelihood of farmers has become a common goal in global poverty reduction (Guo and Liu, 2021; Li et al., 2021). As a tool for economic growth and diversification, rural tourism can broaden the livelihood channels of families and enrich the livelihood assets of farmers and has become the driving force in local economic development (Mbaiwa, 2011; Zhao et al., 2021). Rural tourism can transform the traditional income sources

of farmers to that of tourism, promote new capital and livelihood strategy combinations, enrich farmers' livelihood diversity, and improve their livelihood resilience (Su et al., 2019; Bires and Raj, 2020). A large number of studies have found that tourism has improved the livelihoods of local people in rural areas and has played a significant role in poverty reduction around the world (Saarinen et al., 2011). For villages with rich natural and cultural resources, making full use of regional resource advantages to develop rural tourism and transform the livelihoods of farmers is a feasible way to promote rural economic development and improve farmers' livelihoods.

Ecocultural tourism has gradually emerged as the leading form of tourism as global concepts of development evolve, and living standards improve. Ecocultural tourism is based on natural ecological endowment and is centered on historical and cultural relics. As a new mode of tourism that promotes sustainability, stability, and harmony, it presents an effective method to achieve sustainable tourism (Guri et al., 2020). Ecocultural tourism is the result of the mutual response of the human economy, culture, and sustainable social development (Guillaume et al., 2017). It plays an important role in promoting environmental protection, cultural inheritance, and economic development by integrating ecological and cultural resources to maximize the economic, social, and ecological benefits of tourism destinations. Research on rural ecocultural tourism involves many diverse disciplines, research fields, and perspectives, which have extended its scope (Ross and Wall, 1999; Cater, 2000; Clifton and Benson, 2006). The research contents have mainly focused on theory and tourism management. Scholars have explained the concept of ecocultural tourism from different perspectives and discussed the feasibility and rationality of ecocultural tourism as a method to achieve sustainable development in culturally vulnerable and ecologically sensitive areas (Wallace and Russell, 2004). They have also combined ecocultural tourism with tourism development, decision-making, cultural heritage, and sustainable development (Guillaume, 2019; Sun, 2020). Additionally, scholars have carried out detailed research on the factors influencing ecocultural tourism and environmental protection, determining that the reasonable and effective development of ecocultural tourism can predominantly be obtained through resource integration (Jamal et al., 2010; Tiberghien et al., 2017). The research methods focused on case studies, combining qualitative description and quantitative evaluation methods to build an analysis framework and evaluation indicators. Case studies were conducted in tourism destinations in Europe, Asia, Africa, and other regions through induction and deduction, providing tourism practitioners with new concepts for development and management (Guillaume et al., 2020; Guri et al., 2020). The recent collaborative study of ecocultural tourism and poverty, sustainable livelihood, regional development, and other issues has facilitated a new era in ecocultural tourism, which is of great significance to the politics, economy, and individual livelihoods of countries around the world.

The World Commission on Environment and Development (WCED) first put forward the concept of sustainable livelihood in 1980, which comprehensively considered various factors affecting poverty and provided a new perspective for solving the world poverty problem (DFID, 2000). Chambers discussed the connotations of sustainable livelihood, considering a sustainable livelihood as one that could recover from pressure and influence, maintain or strengthen its capacity and assets over time, and not

damage the natural resource base (Chambers and Conway, 1992). Due to different academic backgrounds and research objects, there are many analytical frameworks for understanding and evaluating sustainable livelihoods, among which the sustainable livelihood approach (SLA) framework established by the British Agency for International Development (DFID) is widely used (Carney, 1998). The SLA framework takes the fragile environment and the process of policy institutions as the analysis background, regards poor families as the main earners in the fragile environment, and reveals the mechanism of sustainable livelihoods by linking livelihood assets, strategies, output, and other factors (Toner and Franks, 2006). It is a model for understanding poverty, which identifies the potential opportunities for poverty eradication, and reveals how people use a large number of properties, rights, and strategies to pursue a certain livelihood. Sustainable livelihood research focuses on how human beings survive and maintain their sources of income and is widely used to study the human dimension of development issues and global change (Savari and Moradi, 2022). Scholars have explored the risks of vulnerable environments to farmers' livelihoods (Thuy et al., 2022; Ye et al., 2022) and the adaptability of farmers to such risks (Chen et al., 2021; Tran et al., 2021). An evaluation system was constructed to carry out a quantitative analysis of farmers' livelihood assets (Wang et al., 2021), analyze the factors affecting farmers' these assets (D'Annolfo et al., 2021), and propose countermeasures to promote their optimization and transformation (Sivagnanam et al., 2019). The impact of policy and regulation implementation on the livelihoods of farmers was also analyzed as a basis to test the effect of past measures and guide the formulation of future decisions (Barati et al., 2021; Su et al., 2021). The causes, constraints, existing problems, and change prospects of farmers' livelihood strategies and sources and characteristic trends of livelihood diversification were explored (Mao et al., 2020) to guide farmers to flexibly switch among various livelihood strategies to maintain their livelihood security (Mao et al., 2020). Research on farmers' livelihood restoration (Li et al., 2019) and sustainable livelihood response has also gradually emerged in recent years (Savari and Zhooldideh, 2021). Villages have undergone adaptive adjustment and continuous evolution under the disturbance of internal and external factors, which has had an important impact on the sustainable livelihood of farmers. The mutual feedback between farmers and communities has also promoted the evolution of rural adaptation. Scholars explored the livelihood changes and responses of farmers in the context of policy change, social transformation, industrial poverty alleviation, rural evolution, etc. (Ding et al., 2020; Su et al., 2021; Bogale et al., 2022). They have also analyzed the livelihood responses of farmers with different livelihood modes to changes in the external environment (Ding et al., 2019; Su et al., 2019), which played an important role in the sustainable development of farmers' livelihoods.

As the participants and stakeholders of rural ecocultural tourism, the development of rural ecocultural tourism will disturb the types and strategies of farmers' livelihoods (Stastna et al., 2020; Sun et al., 2021). Researchers are beginning to address issues regarding the types of sustainable livelihood responses farmers have to rural ecocultural tourism, how and to what degree their response levels change, and the major factors influencing this. These problems have gradually formed new perspectives for studying sustainable rural development. China is the largest developing country in the world, with a high number of villages and rural populations. Poverty is a significant issue hindering China's sustainable development. As China is rich in natural



FIGURE 1
Location map of six villages.

and cultural resources, rural ecocultural tourism plays an important role in China's socioeconomic development and is an effective way to alleviate industrial poverty alleviation and revitalize rural areas. However, many problems exist in the process of rural tourism development in China, such as unbalanced regional development, low economic benefits, and low participation of farmers, which seriously hinder rural development. In addition, similarly to many tourism destinations, China's tourism development is largely promoted by external stakeholders, such as the government and tourism companies. As a result, residents are excluded from the decision-making process of rural tourism, posing a serious threat to farmers' livelihoods.

While most of the current studies on farmers' sustainable livelihood are based on the SLA framework, this model is not suitable for direct application in ethnic areas (Quandt et al., 2018; Ma et al., 2021). Farmers' sustainable livelihoods present strong regional and subjective characteristics, and ecological capital, cultural capital, and subjective behavior also have important impacts (MacRae, 2017; Alipour et al., 2021). However, the SLA framework has been criticized for ignoring the power inequality among different stakeholders. Therefore, this paper modifies the

SLA framework used to study ecocultural tourism by emphasizing the role of ecological and cultural factors in influencing farmers' sustainable livelihoods in ethnic areas. The modified framework is used to analyze the types of livelihood responses and influencing factors of such livelihoods to ecocultural tourism in ethnic areas of China. This study provides case studies for the development of ecocultural tourism and improving farmers' sustainable livelihood worldwide. The problems and shortcomings of ecocultural tourism development in ethnic areas are also identified, and effective suggestions for the implementation of rural revitalization strategy in China and globally are presented.

Data and methodology

Study area

This paper takes the most representative ethnic regions in China as the research area. Xiangxi Prefecture is located in the northwest of Hunan Province, China. It is a national cultural and ecological protection and national tourism demonstration area, with rich

TABLE 1 Analysis of resources in the six villages.

| Village | Landscape and resources | Cultural resources | Feature industries | Honorary names |
|--------------------|--|--|--|---|
| Shuangfeng Village | Baishou Hall and ancient trees | Longfeng flag raising, ancestor worship, Tujia Daliuzi, wood leaf blowing, bride's weeping songs, Tujia Maogusi dance, and hand-waving dance | Tea growing and bee breeding | The first Tujia village in China |
| Lahao Village | Beacon towers, Southern Great Wall Lahao Yingpan section, and Shibao Village | Stonework, woodwork, and Miao medicine | Kiwi growing | A key cultural artifact protection unit of China and one of the first traditional ancient villages of China |
| Dehang Village | Stilt houses and canyon scenery | Miao songs, Miao dance, lion snatching, knife ladder climbing, bull racing, gate blocking and antiphonal singing challenge, and toasting | Tourism | Province-level scenic and historic area; national key scenic and historic area |
| Laoche Village | Tujia Chongtian buildings and Rejala Tujia pavilion bridge | Ceremonial weeping for marriage, hand-waving dance, Maogusi, Daliuzi, Dongdongkui, and dragon boat race | Ecotourism agriculture and goat and cattle farming | Chinese national culture and art, the hometown of Tujia brocade |
| Longbi Village | Morong Miao Village | Miao drum dance and Miao folksongs | Tourism and tea growing | Hometown of the Miao flower drum, hometown of Chinese folk culture and art, and Chinese traditional village |
| Shibadong Village | Miao Village scenery | Watermelon festival, dragon dance, knife ladder climbing, cattle slaughter, and Miao song singing | Tourism and plantation industry | Chinese traditional village |

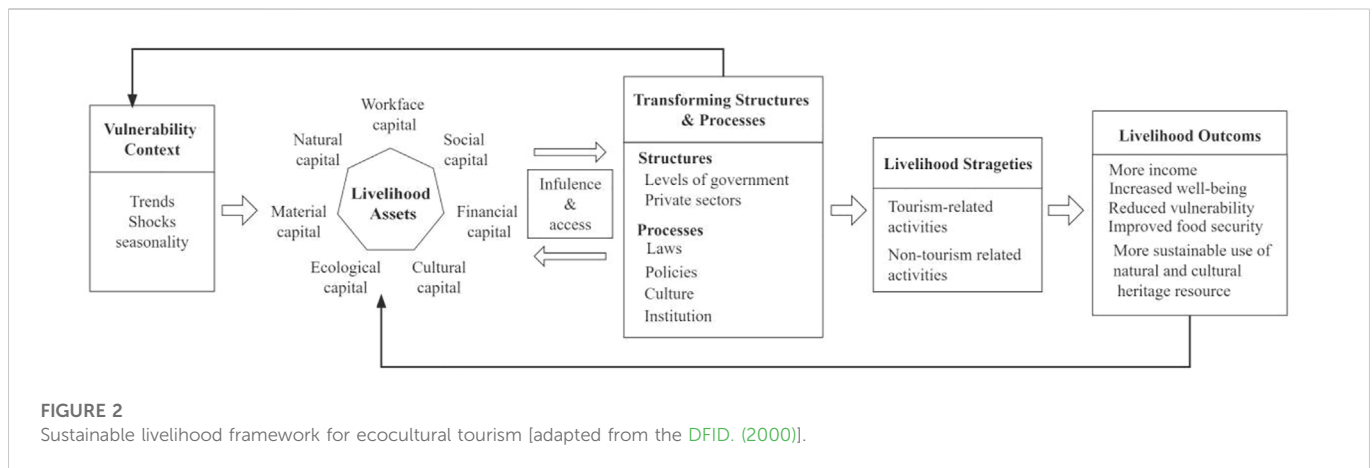
natural and cultural resources that provide the basis for ecocultural tourism development. Xiangxi Prefecture has a subtropical monsoon climate and abundant water resources. The major rivers are the Yuan, You, Wu, and Mengdong Rivers (Figure 1). Because Xiangxi Prefecture has abundant wood resources, wooden Tujia-style houses with Xiangxi characteristics are extremely common. Xiangxi Prefecture is one of the most famous ethnic regions in China. The population of ethnic minorities accounts for 77.21% of the total population of the prefecture. Xiangxi Prefecture has a World Heritage Site, 12 national key cultural artifact protection units, 12 Hunan Province cultural artifact protection units, and 11 A-class scenic spots. The area has rich natural landscape resources and cultural sites, which provide a basis for tourism development. In the past, Xiangxi Prefecture was economically backward and belonged to a poor area because of its remote location. However, with the support of the national tourism poverty alleviation policy, it has vigorously developed ecological cultural tourism to promote regional economic development. At present, 181 villages in Xiangxi Prefecture have carried out tourism development. Ecocultural tourism has become the pillar industry of Xiangxi Prefecture and the most effective way to promote farmers' sustainable livelihoods.

We conducted ecocultural tourism field research in Xiangxi Prefecture, considering village roads, traffic, village features, population, economic performance, and industry scale. Six ecocultural tourism villages were selected for the survey: Yongshun County's Shuangfeng Village, Fenghuang County's Lahao Village, Jishou City's Dehang Village, Longshan County's Laoche Village, Guzhang County's Longbi Village, and Huayuan County's Shibadong Village. A location map of these villages is provided in Figure 1 and Table 1 presents an analysis of their resources. These villages are selected as case studies as they are rich in natural and cultural resources and have the characteristics and manifestations of ecocultural tourism villages, such as traditional buildings, customs, and costumes, as well as natural scenery, which are suitable for the development of rural ecocultural tourism. Secondly, the development of ecocultural tourism in these villages has increased the annual *per*

capita income of farmers from less than 2000 yuan (300 US dollars) to 15,000 yuan (2500 US dollars), alleviating poverty in these areas. Thus, it can be observed that the ecocultural tourism industry has had a profound impact on farmers' sustainable livelihood, with high social awareness and economic benefits. Finally, these villages include different tourism development models (government-led development, tourism enterprise-led development, village-led development) and farmers of different livelihood types, which largely represent the livelihood characteristics of ecocultural tourism farmers in ethnic areas.

Data resources

A variety of data collection methods were adopted to ensure the richness of information, improve the credibility and preciseness of the research, and promote a triangular relationship between methods and research effectiveness (Baxter and Eyles, 1996). First, the basic information of the six villages was obtained through the official websites and policy documents of the local governments. Field research was then carried out in the six villages from July to September 2022. These included structured questionnaires and semi-structured interviews, as well as farmers' livelihood data, which was obtained in detail. The survey content mainly included the livelihood capital of farmers and their participation in and attitude toward ecocultural tourism. Farmers and families were considered as a unit, and the survey time for each household was 45–60 min. The interviewees were mainly the heads of households or the main labor force of families, and they could refuse to answer any questions that were uncomfortable for them (Liu et al., 2022). This part of the survey was mainly achieved through snowball sampling (Baxter and Eyles, 1996). First, we conducted a detailed interview with the main leaders of each village and asked for referrals after the interview. As the snowball sampling method may be affected by self-selection bias, we also conducted a random sampling survey of farmers to overcome these limitations and ensure data objectivity. In addition, researchers lived with villagers and learned about ecocultural tourism from their



perspective, including farmers' daily livelihood behavior and how they participate in rural tourism activities. A total of 350 questionnaires were issued, and 350 were returned. After removing the missing and abnormal values of key variables, 327 valid farmers' sample data were finally obtained, accounting for 93.4% of the sample. The number of questionnaires in each village was more than 50, meeting the requirements for reliability, validity, and representativeness of data.

Theoretical framework and evaluation index system

SLF is a practical tool that is widely used in the analysis of farmers' livelihood diversity and regional poverty reduction. The framework includes five concepts: fragile environment, livelihood assets, transformation structure and process, livelihood strategy, and livelihood results (Scoones, 1998; DFID, 2000). Among them, livelihood assets are the ability to build livelihoods and resist livelihood risks and the rights forming the basis of livelihood strategy selection. The background of vulnerability refers to the external environment composed of specific conditions, trends, shocks, *etc.*, which affects the availability and controllability of assets. Livelihood strategies are the activities and choices to achieve livelihood goals, while livelihood output is the yield and results of engaging in livelihood strategies. Policies, institutions, and processes refer to the systems, organizations, policies, and relevant legal norms that affect livelihoods, which will influence the exchange conditions between different types of capital and the choice of livelihood strategies.

While SLF provides standardized tools and systematic research concepts for the study of farmers' livelihoods, it still has some limitations in the context of ecocultural tourism (Liu et al., 2022). First, it ignores the important value of cultural factors on farmers' sustainable livelihoods. Especially in ethnic areas where tourism is developed, traditional culture is an important factor in increasing tourism attraction and promoting the sustainability of farmers' livelihoods (Daskon and Binns, 2010). As such, cultural factors should be included in SLF as important livelihood capital. Secondly, SLF does not fully consider farmers' community participation and sustainable livelihood responses. (Shen, et al., 2008). For ethnic villages, ecocultural tourism is not only responsible for economic development but also for cultural heritage

and ecological protection, in which farmers play a key role (Quandt, 2018). Tourism development has affected the livelihood assets of farmers and also led to changes in their livelihood behavior. These changes are mainly reflected in the ecological behavior of farmers. Therefore, it is also necessary to include the ecological capital of farmers in the analysis (Wang, et al., 2014). The modified SLF, with the additions of "cultural capital" and "ecological capital," is shown in Figure 2. On this basis, the sustainable livelihood response index system of farmers' ecocultural tourism is constructed to improve the reliability of the evaluation results.

Investigation of farmers' sustainable livelihood responses to ecocultural tourism in minority areas requires consideration of a clear subject, sustainable livelihood participants, and the means through which farmers can achieve such livelihoods. Farmers' sustainable livelihoods are a crucial issue for rural revitalization through the development of rural ecocultural tourism. Tourism disturbance affects the livelihood of farmers, prompting them to choose livelihood strategies or change their livelihood methods. The livelihood capital owned by farmers provides the basis for farmers to resist livelihood risks and formulate livelihood strategies. The types, levels, and factors of farmers' sustainable livelihood responses are analyzed based on the theory of sustainable livelihood and combined with the actual situation of the study area. These data are then employed to construct an evaluation index system of sustainable livelihood responses of farmers' ecological and cultural tourism in Xiangxi Prefecture from the perspective of farmers' livelihood capital response with seven primary indicators and 23 secondary indicators (shown in Table 2).

The seven criterion-level indicators are natural, material, financial, workforce, social, ecological, and cultural capital. Natural, material, social, workforce, and financial capital are the five basic livelihood capitals in the study of the sustainable livelihood of farmers, which are universal elements of farmers' livelihoods. Ecological capital is the ecological endowment that farmers can use to develop ecocultural tourism and is also the main basis forming the appeal of rural tourism. Cultural capital is the unique essence of ecocultural tourism development and the core of constructing ecocultural tourism characteristics. Together, they constitute the resource background for the rural development of ecocultural tourism. The "high-speed" development of industry, workforce, organization, ecology, and culture requires the support of the corresponding five major basic types of livelihood capital to

TABLE 2 Indicator system of farmers' sustainable livelihood responses to rural ecocultural tourism.

| Criterion level | Indicator level | Variable evaluation | Sub-weight | Total weight |
|--------------------------------------|--|---|------------|--------------|
| Natural capital B_1 (0.0833) | Agricultural land area (C_1) | 1 = less than 0.066 h m ² ; 2 = 0.067–0.133 h m ² ; 3 = 0.134–0.198 h m ² ; 4 = 0.199–0.264 h m ² ; 5 = more than 0.265 h m ² | 0.1667 | 0.0139 |
| | Homestead area (C_2) | 1 = less than 0.033 h m ² ; 3 = 0.034–0.066 h m ² ; 5 = more than 0.067 h m ² | 0.8333 | 0.0694 |
| Material capital B_2 (0.0916) | House area (C_3) | 1 = less than 100 m ² ; 2 = 100–200 m ² ; 3 = more than 200 m ² | 0.1048 | 0.0096 |
| | House type (C_4) | 1 = stone; 2 = wood; 3 = brick and wood; 4 = brick and concrete | 0.4991 | 0.0457 |
| | Major furniture items in the house (C_5) | 1 = less than 20,000 CNY; 2 = 20,001–30,000 CNY; 3 = 30,001–40,000 CNY; 4 = 40,001–50,000 CNY; 5 = more than 50,001 CNY | 0.3961 | 0.0363 |
| Financial capital B_3 (0.0953) | Part-time work income (C_6) | 1 = less than 10,000 CNY; 2 = 10,001–20,000 CNY; 3 = 20,001–40,000 CNY; 4 = 40,001–60,000 CNY; 5 = more than 60,001 CNY | 0.0821 | 0.0078 |
| | Tourism income (C_7) | 1 = less than 3000 CNY; 2 = 3,001–6000 CNY; 3 = 6,001–10,000 CNY; 4 = 10,001–15,000 CNY; 5 = more than 15,001 CNY | 0.5498 | 0.0524 |
| | Rural tourism investment fund (C_8) | 1 = under 5000 CNY; 2 = 5,001–10,000 CNY; 3 = 10,001–20,000 CNY; 4 = 20,001–30,000 CNY; 5 = more than 30,001 CNY | 0.3681 | 0.0351 |
| Workforce capital B_4 (0.0494) | Migrant labor or start-up experience (C_9) | 1 = none; 2 = 1 time; 3 = 2 or 3 times; 4 = 3–5 times; 5 = more than five times | 0.0852 | 0.0042 |
| | Number of family members participating in tourism (C_{10}) | 1 = 1; 2 = 2; 3 = 3; 4 = 4; 5 = 5 or more | 0.6442 | 0.0318 |
| | Number of relatives and friends (C_{11}) | 1 = fewer than 50; 2 = 51–100; 3 = 101–150; 4 = 151–200; 5 = more than 201 | 0.2706 | 0.0134 |
| Social capital B_5 (0.0338) | Residence location (C_{12}) | 1 = more than 201 m from the main road of the village; 2 = 101–200 m away; 3 = 51–100 m away; 4 = within 50 m; 5 = next to the main road | 0.0737 | 0.0025 |
| | Frequency of professional skill training (C_{13}) | 1 = none; 2 = 1 time; 3 = 2 or 3 times; 4 = 4 or 5 times; 5 = more than five times | 0.1873 | 0.0063 |
| | Family members participating in social affairs (C_{14}) | 1 = no participation; 2 = 1 time; 3 = 2 times; 4 = 3 times; 5 = more than three times | 0.2851 | 0.0096 |
| | Closeness to related organizations (C_{15}) | 1 = none; 2 = 1 time per month; 3 = 2 or 3 times per month; 4 = 4 or 5 times per month; 5 = more than five times per month | 0.4539 | 0.0153 |
| Ecological capital B_6 (0.2839) | Clean energy usage level (C_{16}) | 1 = firewood; 2 = coal or charcoal; 3 = electricity; 4 = liquefied gas or biogas; 5 = solar power | 0.1469 | 0.0417 |
| | Average expenditure and pesticide cost per mu of land (C_{17}) | 1 = more than 51 kg; 3 = 31–50 kg; 5 = less than 30 kg | 0.1469 | 0.0417 |
| | Domestic sewage processing method (C_{18}) | 1 = discharge at will; 2 = sewage is sometimes reused; 3 = sewage is often reused; 4 = sewage is collected without harmless treatment; 5 = sewage is collected with harmless treatment | 0.548 | 0.1556 |
| | Human and animal feces processing method (C_{19}) | 1 = discharge at will (without septic tank); 2 = some feces is used as fertilizer (without septic tank); 3 = all feces is used as fertilizer (without septic tank); 4 = individual treatment with septic tank; 5 = centralized treatment with septic tank | 0.1583 | 0.0449 |
| Cultural capital B_7 (0.3627) | Folk art and cultural performance participation level (C_{20}) | 1 = none; 2 = individual festivals; 3 = important festivals; 4 = most festivals; 5 = all festivals | 0.3153 | 0.1143 |
| | Traditional farming tool preservation level (C_{21}) | 1 = abandoned farming; 2 = no traditional farming tool; 3 = traditional farming tools (fewer); 4 = traditional farming tools (more); 5 = complete traditional farming tools | 0.0602 | 0.0218 |
| | Frequency of wearing ethnic clothing (C_{22}) | 1 = no ethnic clothing; 2 = wear rarely; 3 = wear to festival events (less); 4 = often wear (more); 5 = always wear | 0.0843 | 0.0306 |
| | Ethnic buildings (C_{23}) | 1 = building with ethnic elements (no conservation); 2 = renovation (keeping ethnic elements); 3 = ethnic building (poorer conservation); 4 = ethnic building (average conservation); 5 = ethnic building (superior conservation) | 0.5402 | 0.1959 |

achieve the “high-quality” development of ecocultural tourism. Research on farmers' sustainable livelihood response can guide farmers to make reasonable choices that are practical and incur lower risks when affected by ecocultural tourism or other

disturbances to livelihood. Thus, farmers can achieve the steady development of their sustainable livelihoods and promote the orderly implementation of rural revitalization strategies through their responses to ecocultural tourism.

TABLE 3 Total variance of interpretation.

| Component | Initial eigenvalue | | | Extraction load sum of squares | | |
|-----------|--------------------|------------------------|-----------------------|--------------------------------|------------------------|-----------------------|
| | Total | Percentage of variance | Cumulative percentage | Total | Percentage of variance | Cumulative percentage |
| 1 | 3.479 | 16.255 | 16.255 | 3.479 | 16.255 | 16.255 |
| 2 | 2.120 | 10.346 | 26.601 | 2.120 | 10.346 | 26.601 |
| 3 | 1.953 | 9.622 | 36.223 | 1.953 | 9.622 | 36.223 |
| 4 | 1.727 | 9.041 | 45.864 | 1.727 | 9.041 | 45.864 |
| 5 | 1.563 | 8.427 | 53.691 | 1.563 | 8.427 | 53.691 |
| 6 | 1.488 | 7.601 | 61.292 | 1.488 | 7.601 | 61.292 |
| 7 | 1.323 | 7.184 | 68.476 | 1.323 | 7.184 | 68.476 |
| 8 | 1.231 | 6.282 | 74.758 | 1.231 | 6.282 | 74.758 |
| 9 | 1.065 | 5.312 | 80.070 | 1.065 | 5.312 | 80.070 |
| 10 | 0.977 | 4.046 | 84.116 | — | — | — |
| 11 | 0.949 | 3.125 | 87.241 | — | — | — |
| 12 | 0.826 | 2.890 | 90.131 | — | — | — |

Methods

The participatory rural appraisal method was employed for field research on rural ecocultural tourism in Xiangxi Prefecture. The Delphi method, analytic hierarchy process, and expert grading method were used to determine the weights of 23 indicators, including agricultural land areas (Wang, et al., 2021). Principal component analysis was used for dimension reduction of the 23 indicators, which were transformed into nine comprehensive indicators, and the principal components were extracted for analysis (Wu, et al., 2018). To determine the types of response of farmers to ecocultural tourism in Xiangxi Prefecture, cluster analysis was used to analyze the nine comprehensive indicators, and six livelihood response types, such as the balanced development type, were identified. Stepwise analysis was then employed to analyze the elements (Wu, et al., 2020). Tourism income was used as the dependent variable, and other factors were used as the independent variables. Finally, the factors affecting farmers' response to sustainable livelihood were analyzed.

Results

Response types of farmers' sustainable livelihood

Main factor extraction

Statistical analysis was conducted using the interview data, and principal component analysis was carried out using SPSS 24.0 statistical software on the questionnaire survey data from the residents of the six case villages. The Kaiser-Meyer-Olkin test result was 0.676, indicating strong correlations between the variables. Bartlett's sphericity test result was close to that of the chi-square

test, at 1273.001. The number of degrees of freedom was 253, and the significance value was smaller than 0.05. This indicated that the variables were not independent and significant correlations existed between them. The data were thus suitable for factor analysis. The nine major factors extracted using principal component analysis were also independent, meaning the extracted factors had a favorable quality (Table 3). Through further analysis, the nine major factors were identified as economic development, infrastructure, social development, folk culture, economic ecology, social connection, natural resources, policy awareness, and ecological development factors.

Classification of response types

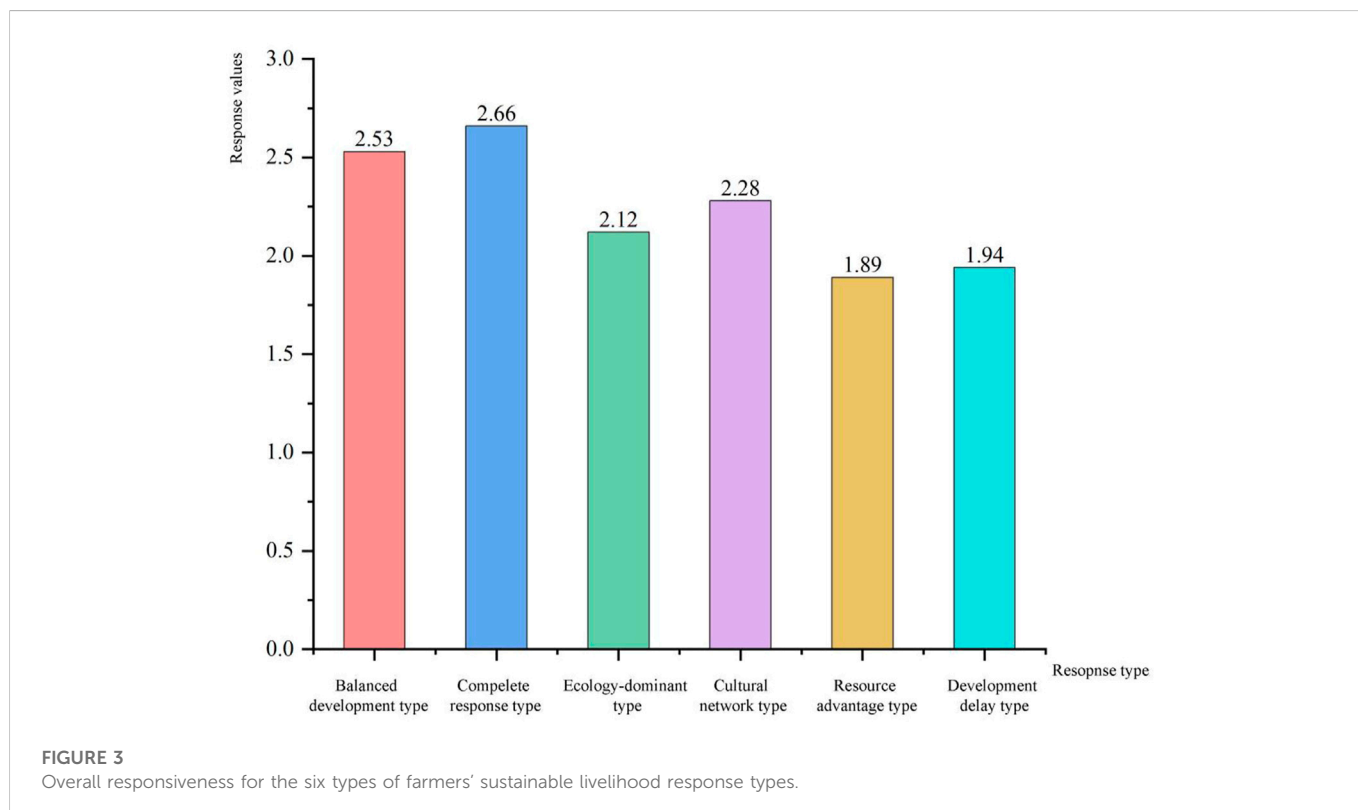
Classification of farmers' sustainable livelihood response types can aid in developing rural ecocultural tourism, implementing rural revitalization strategies, and the targeted formulation of agriculture policy by the government. It can also help to increase land use efficiency and improve ecological environment conservation. K-means cluster analysis was performed in this study for classification according to the sustainable livelihood data obtained from 327 farmer households. The final cluster center table (Table 4) shows that in cluster 1, the scores were highest for the infrastructure (0.92272) and social development (1.03942) factors. The average factor score was balanced among the six types, reflecting the "balanced development type." In cluster 2, the economic development factor had the highest score (2.03796). The remaining infrastructure (0.09503), economic ecology (0.31390), social connection (0.53024), policy awareness (0.39001), and ecological development (0.05978) factors also had high scores, which reflected the "complete response type." In cluster 3, the ecological development factor had the highest score (1.74162). In addition, the natural resource factor had a relatively high score (0.23359), so this type was considered the "ecology-dominant type." In cluster 4, the folk

TABLE 4 Final clustering center table.

| Variables | Clustering | | | | | |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Economic development factor | -.13080 (2) | 2.03796 (1) | -.25674 (4) | -.53618 (6) | -.37178 (5) | -.14663 (3) |
| Infrastructure factor | .92272 (1) | .09503 (2) | .02232 (3) | -.06678 (5) | -.47604 (4) | -.06863 (6) |
| Folk culture factor | .00687 (2) | -.00481 (3) | -.19959 (4) | 2.85872 (1) | -.20411 (5) | -.26392 (6) |
| Social development factor | 1.03942 (1) | .07022 (3) | -.10153 (4) | .28007 (2) | -.36355 (6) | -.21661 (5) |
| Economic ecology factor | -.12545 (5) | .31390 (2) | .04047 (4) | .10824 (3) | .65471 (1) | -.69482 (6) |
| Social connection factor | -.71710 (6) | .53024 (2) | -.32839 (5) | .67530 (1) | -.14690 (4) | .33708 (3) |
| Natural resource factor | .02393 (4) | -.09842 (5) | .23359 (2) | .11102 (3) | .25878 (1) | -.36067 (6) |
| Policy awareness factor | .06154 (3) | .39001 (2) | -.07073 (5) | -.03419 (4) | .46524 (1) | -.55644 (6) |
| Ecological development factor | -.32260 (4) | .05978 (2) | 1.74162 (1) | -.04338 (3) | -.50179 (6) | -.38530 (5) |

TABLE 5 Classification of farmers' livelihood responsiveness.

| Response value | ≤1.50 | 1.51–2.00 | 2.01–2.50 | 2.51–3.00 | 3.01–3.50 | ≥3.51 |
|----------------|------------------------|-------------|-----------------------|------------------|-----------------|-------------------|
| Response level | Absolutely no response | No response | Generally no response | General response | Strong response | Complete response |



culture (2.85872) and social connection (0.67530) factors had high scores and were deemed the “cultural network type.” In cluster 5, the economic ecology (0.65471) and natural resource (0.25878) factors had high scores, which reflected the “resource advantage type.” In

cluster 6, the infrastructure (–0.06863), folk culture (–0.26392), economic ecology (–0.69482), and policy awareness (–0.55644) factors had the lowest scores and were considered the “developmental delay type.”

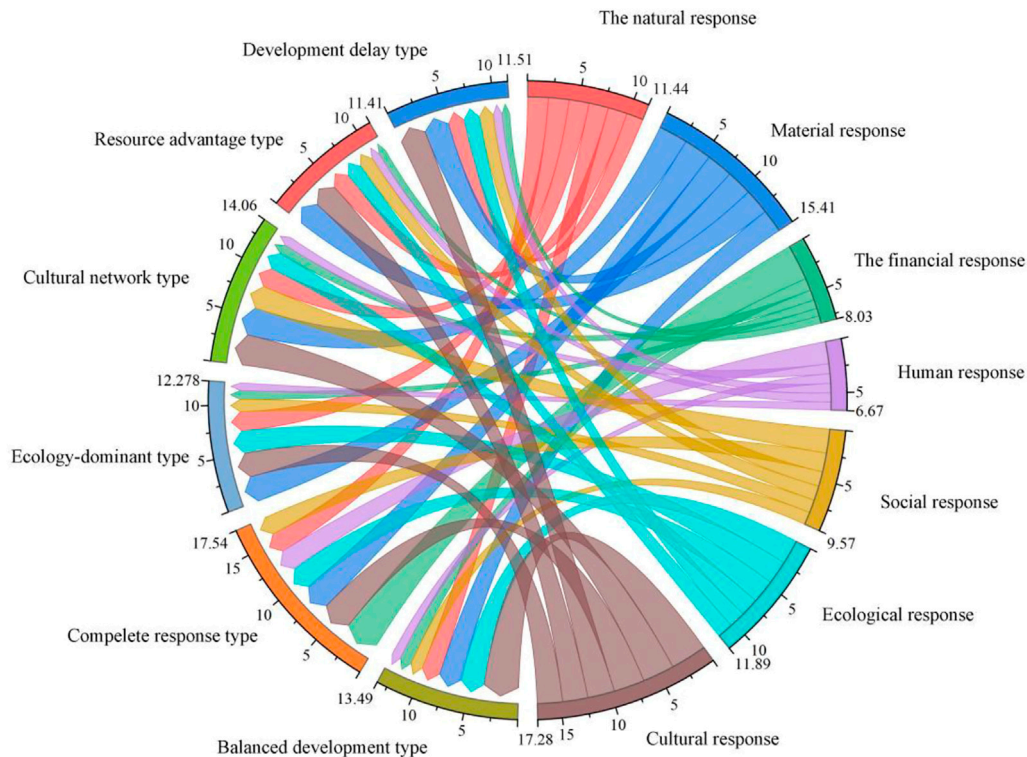


FIGURE 4
Degree of response of different response type factors.

Evaluation of farmers' responses to sustainable livelihood

Indicator weight calculation

The weight survey table was generated using the indicator evaluation system constructed in this study. The survey tables were rated by experts in ecocultural tourism, scholars with relevant backgrounds, and major planners at the planning bureau. The survey table was evaluated using the analytic hierarchy process and the Delphi method (expert grading method), and the weight ratios of the indicators were calculated (Table 2).

The response values were classified using the arithmetic classification method and the 5-point Likert scale. Farmers' sustainable livelihood values were classified into "absolutely no response," "no response," "generally no response," "general response," "strong response," and "complete response" (Table 5).

Overall response level analysis for different response types

The overall response values of the six response types were calculated according to the indicators, and the response levels were determined through evaluation (Figure 3). The order of the overall response values, from high to low, was as follows: complete response type, balanced development type, cultural network type, ecology-dominant type, developmental delay type, and resource advantage type. The overall response values of the six response types were between 2.01 and 2.50; thus, the response levels had generally no response. The response value of

the complete response type was higher than 2.51; therefore, the response level was general response. The response values of the balanced development, ecology-dominant, and cultural network types were between 2.01 and 2.50, indicating generally no response. The response values of the resource advantage and developmental delay types were between 1.51 and 2.00, indicating no response.

Response level analysis of different response type factors

Certain similarities and dissimilarities were found in the response levels of the six response type factors (Figure 4). Regarding the natural capital response, farmers with a balanced development response have superior cultural capital but lack human capital. Such farmers have superior cultural capital and ecological capital but lack financial capital and human capital. This is because such farmers lack sufficient funds to participate in ecocultural tourism activities, most of their family workforce choose to go out to work, and tourism participation is low. Although cultural resources are rich, they cannot be converted into economic benefits. Therefore, it is necessary to increase financial support for such farmers and attract more cultural inheritors to participate in ecocultural tourism. Farmers with a complete response type have rich financial capital and cultural capital, and other capital indexes are relatively high without obvious disadvantages. Only social capital and human capital are relatively lacking in this case. Such farmers have good livelihood foundations and diversified livelihood options. As ecocultural tourism is not an important type of livelihood for them, their tourism participation is not high. For such farmers, skills training should be enhanced to encourage participation in

ecocultural tourism. Farmers with an ecology-dominant response type are rich in material capital and ecological capital but are short of other livelihood capital. Such farmers mainly rely on the agriculture and planting industry for their livelihood. While their ecological awareness and behavior are good, the impact of tourism development is very low as they lack the appropriate skills to participate in tourism activities. Of course, such farmers still have certain advantages. In this case, the government and tourism decision-makers should consider them more attentively, provide some financial support, and expand the farmers' source of livelihood by purchasing agricultural products. Farmers with a cultural network response type have rich cultural and material capital, but other capital is relatively lacking. This is because material capital is the basis of their livelihood. Although they can use cultural capital to create income, the overall income level is low, which is an important reason why many young people are unwilling to learn traditional folk culture. Therefore, it is necessary to give more attention and formulate welfare policies for this type of farmer, as well as encourage more young people to learn cultural skills and participate in ecocultural tourism. Farmers with a resource advantage response type are relatively rich in material capital but lack other livelihood capital. Such farmers are typical "Chinese farmers," who are mainly engaged in traditional agricultural production activities and generally have low acceptance of emerging methods. They have a single source of livelihood, with high vulnerability. Thus, the government needs to give them support, and buying their agricultural products could effectively promote their livelihoods. Farmers with a developmental delay response type lack all kinds of livelihood capital. This type of farmer faces poor economic conditions and has an insufficient capacity to carry out livelihood transformation. They not only lack livelihood capital but also need to improve their livelihood awareness. Thus, the government should consider both their material concerns and lack of awareness, as well as establish long-term tracking and security mechanisms to improve their livelihood.

The above comparison indicates that different types of farmers have different responses to various livelihood capital. First, the livelihood assets owned by farmers determine their position in tourism activities (Huang, et al., 2021). Rural tourism requires a certain livelihood basis; Farmers with good family conditions can seize tourism development opportunities and become the main decision-makers or beneficiaries of tourism activities; Farmers with poor family conditions are disadvantaged or unable to participate in tourism activities, perpetuating conditions in which "the poor are poorer, and the rich are richer" (Gautam and Anderson, 2016). Secondly, the livelihood characteristics of farmers determine the way they participate in tourism. Therefore, it is imperative that farmers formulate appropriate livelihood strategies according to their own livelihood characteristics (Dai et al., 2020). For example, farmers with balanced and complete response types should give full play to their livelihood advantages, invest more capital and human resources, and improve their enthusiasm to participate in ecocultural tourism. Farmers with a cultural network response type should fully utilize their cultural advantages, actively innovate forms of cultural expression, and transform intangible cultural resources into tangible cultural capital. Farmers with ecology-dominant and resource-advantage response types should explore new agricultural development models and rely on characteristic agricultural products to improve their livelihood. Of course, the government's support cannot be ignored in this process. It is necessary to provide targeted help to different types of farmers according to local conditions (Liu et al., 2022), especially for farmers with a developmental delay response type. Such farmers should also actively engage in contact

with the outside world and transform their perspectives by learning advanced technologies and concepts to improve their livelihood.

Response level analysis of different response factor types

Certain differences were found in the response levels for the seven capital types (Figure 5). Regarding the natural capital response levels, farmers with balanced development, ecology-dominant, resource advantage, or developmental delay response types exhibited no response, and farmers with a complete response and cultural network response type exhibited generally no response. This is because farmers with complete response and balanced development response types have good livelihood bases. Agriculture is not the main source of livelihood, and they are not highly dependent on natural capital. The other four types of farmers have poor livelihood bases and limited natural capital. Therefore, although different farmers have different livelihood conditions, their overall response to natural capital is not high. It is necessary to encourage them to plan and use the homestead and cultivated land. Regarding material capital response levels, farmers with any of the six response types exhibit a general response. This indicates that, in rural ecocultural tourism, these farmers respond to material capital. Farmers' sustainable livelihoods can reach a steady state when disturbed by rural ecotourism. Regarding the financial capital response levels, only the farmers with a complete response type have a general response, and the other five types of farmers have absolutely no response. This result indicates that although ecocultural tourism has greatly improved the livelihood of farmers, the overall livelihood of farmers is still at a low level, and they cannot make large-scale investments in rural tourism. In addition, the low awareness of farmers' participation in tourism is another important reason for the low responsiveness of financial capital. Regarding the workforce capital response levels, only the farmers with a complete response type have generally no response, and the other five types of farmers exhibit absolutely no response. This is because the income most farmers can obtain from rural tourism is limited, and they cannot maintain the daily living expenses of their families. Thus, going out to work is their first choice of livelihood. Therefore, it is necessary to give more employment opportunities to farmers and improve their position in tourism development in order to encourage farmers to actively participate in ecocultural tourism. Regarding the social capital response levels, farmers with a cultural network type have generally no response, and farmers with a complete response type exhibit no response; the other four types of farmers have absolutely no response. The main reason is that farmers' enthusiasm to participate in rural tourism is lacking. Thus, it is necessary to increase the enthusiasm of farmers to participate in social management, strengthen the relationship between farmers and relevant organizations, and provide professional skills training for farmers to improve the sustainability of their livelihoods. Regarding the ecological capital response levels, farmers with a cultural network and resource advantage response type exhibit no response, and the other four types of farmers have generally no response. This result shows that farmers' ecological awareness is relatively weak on the whole, and they should strengthen their environmental awareness, improve their production, living, and tourism facilities, and promote tourism. Such actions can support the adoption of a more technically advanced and reasonable lifestyle to achieve the sustainable

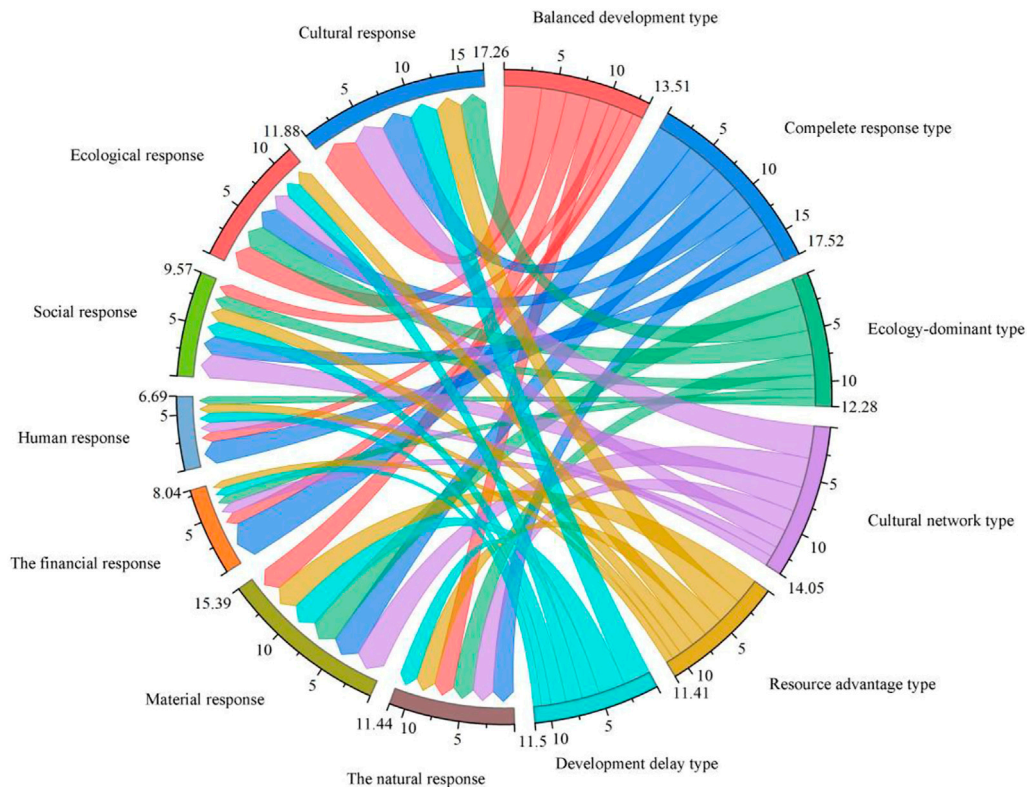


FIGURE 5
Degree of responsiveness of different response factors.

development of rural tourism. Regarding the cultural capital response levels, only the farmers with a resource advantage type response have generally no response, and the other five types of responses are relatively strong. Cultural capital is the unique livelihood foundation of farmers in ethnic areas and a critical resource advantage for developing ecocultural tourism in such areas. Most farmers have mastered these traditional skills. Determining how to make full use of this advantage and transform cultural resources into the source of farmers' livelihood is crucial.

It can be seen from the above comparison that different types of farmers may have the same response form to the same livelihood capital. First, except for cultural capital, farmers' response to the other six types of livelihood capital is relatively low. This is because Xiangxi Prefecture was formerly a poor area, and the overall livelihood level of farmers is not high, meaning the livelihood basis for participating in tourism is limited (Wu et al., 2018). Thus, it is necessary to give financial support to farmers and encourage them to participate in tourism. Secondly, the participation of six types of farmers in tourism is not high. The reason is that the government and tourism enterprises are the main organizers and activity subjects of ecocultural tourism, and farmers are in a disadvantaged position in the process of tourism development (Chen et al., 2020). As they can only obtain a small portion of the benefits, their enthusiasm is reduced. To address this, farmers should be given more rights so that they participate in rural tourism more, profit from it, and their enthusiasm is enhanced. Finally, the gap between the rich and poor is an important issue that cannot be ignored in the development of ecocultural tourism in

ethnic regions. While some farmers have better livelihood options and are unwilling to participate in tourism development, most farmers are still in an awkward situation where they want to participate in tourism but have no livelihood basis (Gautam and Anderson, 2016). How to balance the conflict of interest and contradiction between the two groups of farmers is an issue that managers need to pay close attention to.

Scale analysis of factors affecting farmers' responses to sustainable livelihood

Due to the continual development of ecocultural tourism, farmers' responses to sustainable livelihood are no longer influenced by only a single aspect. The tourism industry and other industries are integrated and mutually influencing, disturbing the steady state of farmers' sustainable livelihoods. Therefore, we conducted an analysis targeting the factors affecting the responses to sustainable livelihood of farmers facing ecocultural tourism in Xiangxi Prefecture.

Cluster-dependent variable selection

Tourism income was selected as the dependent variable, the stepwise analysis method was used, and five variables were identified (Table 6). The regression function of farmers' responses

TABLE 6 Statistics in each step of the regression process.

| | Model | Non-standardized coefficient | | Standardized coefficient | T | Sig |
|---|---|------------------------------|----------------|--------------------------|--------|-------|
| | | B | Standard error | | | |
| 1 | (constant) | 0.348 | 0.078 | | 4.476 | 0 |
| | Number of family members participating in tourism | 1.292 | 0.067 | 0.732 | 19.389 | 0 |
| 2 | (constant) | 0.345 | 0.074 | | 4.684 | 0 |
| | Number of family members participating in tourism | 1.016 | 0.078 | 0.576 | 13.107 | 0 |
| | Investment in rural tourism | 0.356 | 0.058 | 0.27 | 6.147 | 0 |
| 3 | (constant) | 0.162 | 0.116 | | 1.396 | 0.164 |
| | Number of family members participating in tourism | 1.017 | 0.077 | 0.577 | 13.187 | 0 |
| | Investment in rural tourism | 0.327 | 0.059 | 0.248 | 5.512 | 0 |
| | Number of relatives and friends | 0.145 | 0.071 | 0.076 | 2.044 | 0.042 |
| 4 | (constant) | 0.282 | 0.126 | | 2.246 | 0.025 |
| | Number of family members participating in tourism | 1.01 | 0.077 | 0.572 | 13.17 | 0 |
| | Investment in rural tourism | 0.335 | 0.059 | 0.254 | 5.669 | 0 |
| | Number of relatives and friends | 0.183 | 0.072 | 0.096 | 2.531 | 0.012 |
| | Family members participating in social affairs | -0.121 | 0.051 | -0.086 | -2.369 | 0.018 |
| 5 | (constant) | 0.027 | 0.178 | | 0.154 | 0.877 |
| | Number of family members participating in tourism | 1.015 | 0.076 | 0.575 | 13.298 | 0 |
| | Investment in rural tourism | 0.328 | 0.059 | 0.249 | 5.577 | 0 |
| | Number of relatives and friends | 0.178 | 0.072 | 0.093 | 2.478 | 0.014 |
| | Family members participating in social affairs | -0.128 | 0.051 | -0.091 | -2.513 | 0.012 |
| | Ethnic buildings | 0.078 | 0.039 | 0.071 | 2.013 | 0.045 |

*Dependent variable: tourism income (Wu, et al., 2020).

to sustainable livelihood based on rural ecocultural tourism is as follows:

$$Y = 1.015X_1 + 0.328X_2 + 0.178X_3 - 0.128X_4 + 0.078X_5 + 0.027 \quad (1)$$

Influence factor analysis

According to the results of Eq. 1, tourism income is influenced by five factors: the number of family members participating in tourism, investment in rural tourism, number of relatives and friends, family members participating in social affairs, and ethnic buildings. The influence on tourism income can be divided into that from strong-influence factors ($\beta \geq 0.3$), moderate-influence factors ($0.1 < \beta < 0.3$), and weak-influence factors ($\beta \leq 0.1$). The number of family members participating in tourism is a workforce capital factor and a strong-influence factor, with $\beta = 1.015$. This factor denotes the number of people in a farming family that work in tourism-related industries, including parents and children. Tourism income is based on the accumulation of funds. The larger the number of participating family members, the more favorable the fund accumulation and the higher the service quality for tourists.

Investment in rural tourism is a financial capital factor and strong-influence factor, with $\beta = 0.328$; it denotes the government's support for rural ecocultural tourism. The development of rural ecocultural tourism must be supported through funding, and a lack of financing limits the development of rural tourism. For rural areas, the larger the fund provided by the government for ecocultural tourism, the higher the rural infrastructure level and the attraction for tourists. The number of relatives and friends is a workforce capital factor and a moderate-influence factor, with $\beta = 0.178$. For tourist attractions, promotions and public reputation are crucial means of attracting tourists, in which word-of-mouth promotion from farmers' families and friends is an essential promotion method. The larger the number of a farmer's family and friends, the larger the range of promotion and the greater the customer flow to tourist attractions.

Family members participating in social affairs is a social capital factor and a weak-influence factor, with $\beta = -0.128$. Ideally, family members work in government institutions, villages, or other social organizations. Thus, the state of tourism and tourist needs can be understood in time through family members' participation in social affairs. Such participation also helps farmers improve their service and management abilities. Ethnic building conservation level is a cultural capital factor and a weak-influence factor, with $\beta = 0.078$. For tourists, the more complete the conservation of ethnic buildings, the more attractive the destination, and the stronger the cultural adaptability of

the tourist attraction. This creates a climate of high cultural conservation awareness and supports rural cultural revitalization. Above all, the workforce, financial, social, and cultural capital factors have the strongest influences on farmers' responses to sustainable livelihood based on rural ecocultural tourism.

Discussion

Formulating methods to simultaneously achieve poverty alleviation and promote the sustainable development of farmers' livelihoods is increasingly crucial as global poverty reduction advances. Since the SLA framework was put forward, the research on the sustainable livelihoods of later-generation farmers has largely considered five aspects of natural, material, workforce, social, and financial capital. However, our field survey illustrates that the traditional five aspects cannot fully summarize the capabilities and assets of farmers. Factors such as ecological resources (Zhao et al., 2021), cultural assets (Ma et al., 2021), religious beliefs (Liu et al., 2014), etc., also have an important impact. The SLA framework should provide an analytical approach to the study of sustainable livelihoods rather than seeking a universal solution. As such, it needs to be revised and adjusted according to the actual situation of the study area and the study object (Zhang and Zhao, 2015). As far as China is concerned, farmers' sustainable livelihood is the result of the joint participation of the government, enterprises, farmers, and multiple other subjects. It involves labor, land, capital, and other key livelihood capital, as well as resource background, policy background, industrial support, and other development conditions. Subjective factors, including farmers' psychology and behavior, also have an important impact (Deng et al., 2020). The main contribution of this paper is to expand ecological and cultural capital on the basis of the five major livelihood capital factors according to the characteristics of minority area ecological and cultural tourism development, as well as the characteristics of farmers' behavior, psychology, and other elements. This provides a more accurate assessment of the livelihood capacity of Xiangxi's farmers and expands sustainable livelihood research. Establishing more comprehensive evaluation indicators and extensively evaluating the farmers' sustainable livelihood response and influencing factors of ecocultural tourism farmers provides theoretical guidance for the implementation of China's rural revitalization strategy and case references for the improvement of farmers' sustainable livelihood in the world's minority areas.

According to our findings, different types of farmers have the same and different responses to livelihood capital in the process of ecotourism development in ethnic areas. On the one hand, ecocultural tourism improves the livelihood capital of farmers (whether farmers demonstrate tourism behavior or not), especially in social capital and financial capital fields (Shui et al., 2022). On the other hand, farmers do not show a strong enthusiasm for ecocultural tourism, which is the result of numerous factors (He et al., 2022). First, due to the limitations of their livelihood foundation, farmers are unable to participate in large-scale tourism investment and lack a sufficient capacity to resist and even adapt to the risks and opportunities brought by tourism interference (Gautam and Anderson, 2016). Second, due to the long-standing inability of farmers to participate in tourism activities, they are at a disadvantage in the competition process with other stakeholders and lack the power and resources to obtain satisfactory returns

from tourism activities (Chen et al., 2020). Therefore, how to improve the economic benefits of ecocultural tourism, expand the tourism industry chain, and give farmers more jobs and higher tourism income are issues that deserve special attention.

With the implementation of China's rural revitalization strategy, many non-agricultural businesses have become tourist villages, enriching the diversity of rural farmers' sustainable livelihoods. However, this diversification does not ensure the successful transformation of farmers' livelihood methods. First, as Chinese farmers have been engaged in simple production activities for generations, their livelihood foundation is relatively weak, and their livelihood stability is insufficient. Therefore, they lack adequate funds and the ability to adapt to the livelihood risks caused by tourism interference. Farmers often have low enthusiasm for participating in the process of rural tourism (Chen et al., 2017). It is necessary to guide farmers to actively participate in rural ecocultural tourism, consider expanding the employment channels of rural ecocultural tourism and encourage and guide farmers to start businesses and obtain employment by formulating preferential policies. Farmers' enthusiasm to participate in rural ecocultural tourism should be encouraged to realize the transformation of farmers' sustainable livelihood from labor-oriented to intelligent or service-oriented strategies and inject impetus into the development of rural ecocultural tourism. Secondly, rural revitalization is a major measure involving the participation of all sectors of society, and it is also a significant strategy that best conforms to China's national conditions. While the government has issued many policies to promote rural development, there are still some problems, such as small coverage and insufficient continuity. China has the national condition of a "strong government," in which farmers' sustainable livelihoods are closely related to the government's guidance. As such, the government should establish a long-term security mechanism, increase investment in rural ecocultural tourism infrastructure and service facilities, guide farmers to actively participate in rural ecocultural tourism, and create a good livelihood environment for farmers' sustainable livelihoods. The improvement of education, experience, and skills and the promotion of the overall quality of farmers are equally important aspects of optimizing farmers' livelihood and promoting sustainable development and require long-term attention through national policies. Finally, the purpose of rural revitalization is to enhance the endogenous development capacity of farmers and encourage them to improve their livelihoods through various methods to give full play to the characteristics of regional resources. The landscape environment and cultural resources owned by minority areas are the core elements of the development of ecocultural tourism. As such, they should be vigorously protected, and farmers are the carriers of these "elements" as rural areas belong to farmers. Competitive ecocultural tourism to ensure sustainable development can only be obtained by fully harnessing the enthusiasm of farmers to participate in ecocultural tourism and transforming farmers from tourism participants to inheritors of regional culture (Wu et al., 2017; Deng et al., 2020). Therefore, it is necessary to highlight the dominant position of farmers and utilize ecological cultural tourism as the carrier of inheriting and developing distinctive rural culture. Developing characteristic tourism, promoting employment of rural farmers, attracting lost populations back to rural areas, introducing new talent, and realizing rural urbanization, agricultural modernization, and farmers' employment in minority areas must also be accomplished.

Conclusion and recommendations

In this study, the types, levels, and factors influencing the responses to ecocultural tourism of 327 farming households in six ecocultural tourism villages of Xiangxi Prefecture were analyzed by constructing an indicator evaluation system. The major conclusions were as follows:

Ecocultural tourism disturbs farmers' sustainable livelihoods. As changes in farmers' sustainable livelihoods affect the development process of ecocultural tourism, the mutual feedback between tourism and farmers promotes the evolution of rural adaptation. Nine major factors that influence the sustainable livelihood response of farmers in Xiangxi Prefecture were obtained. These were economic development, infrastructure, social development, folk culture, economic ecology, social connection, natural resource, policy awareness, and ecological development factors. These factors respond to industrial, talent, organizational, ecological, and cultural revitalization in China's rural revitalization strategy.

While the development of ecocultural tourism has enriched the diversity of farmers' sustainable livelihoods, significant differences between different livelihood response types remain. Six types of responses to sustainable livelihood were identified among farmers in Xiangxi Prefecture. In descending order, they were a developmental delay, resource advantage, ecology-dominant, balanced development, complete response, and cultural network types. The overall level of response of the farmers was generally no response. The reason for this was that the development of ecocultural tourism in Xiangxi Prefecture was not spatially balanced. Factors such as natural resources, social development, and the local economy have affected farmers' sustainable livelihood response.

Under the disturbance of ecocultural tourism, farmers' sustainable livelihoods have undergone a dynamic transformation in the form of a "steady state–unbalanced–steady state," thus promoting the sustainable development of their livelihoods. The order of different types of response levels, from high to low, was: complete response, balanced development, cultural network, ecology-dominant, developmental delay, and resource advantage. Farmers with a complete response type had the strongest response in the financial capital category, whereas farmers with an ecology-dominant response type responded most strongly in the material capital category. For other types, the strongest response was in cultural capital. The weakest response of farmers with a balanced development, ecology-dominant, or cultural network response type was in the workforce capital category, whereas that of farmers with a resource advantage or developmental delay response type was financial capital. For the complete response type, the weakest response was in social capital. These results demonstrated that farmers with a balanced development, complete response, or cultural network response type could respond more suitably to rural ecocultural tourism.

The backflow and incorporation of talent in farmers' ecocultural tourism in Xiangxi Prefecture ensured the implementation of the rural revitalization strategy. Five factors influencing farmers' sustainable livelihood response was identified. In order of degree of response, from high to low, these factors were the number of family members participating in tourism, investment in rural tourism, number of relatives and friends, family members participating in social affairs, and ethnic buildings. The willingness and behavior of farmers to participate in rural ecocultural tourism have an important impact on

tourism development, and the revitalization of talents in rural revitalization is particularly urgent.

Based on the research results of the article, the paper put forward suggestions to promote the livelihood improvement of ecotourism farmers in ethnic areas, with the aim of providing effective guidance for poverty reduction and sustainable rural development in China and worldwide. Rural tourism involves multiple stakeholders and requires the concerted efforts of the government, tourism enterprises, and farmers. First, the government is the most solid backing mechanism for the people. As such, it should fully recognize the significance of ecocultural tourism for sustainable development and provide maximum rural policy support (such as land policy, talent policy, rent reduction, skills training, *etc.*) and financial support (including infrastructure construction, tourism facilities construction, *etc.*). The government should also strengthen the environmental and cultural awareness of farmers and promote ecological protection and cultural heritage. Secondly, tourism companies should consider long-term interests, give full play to the human resource advantages of farmers, and provide more jobs for farmers. They should also improve the interest relationship between farmers and tourism through capital investment, ticket dividends, and other methods to attract the active participation of farmers in rural tourism. Finally, farmers must fully seize the opportunity of tourism development, actively accept novel ideas, and improve their comprehensive ability to transform their livelihoods. As cultural skills are the most attractive resources that farmers have, they should actively innovate cultural forms, further enhance the core competitiveness of national culture, and turn intangible cultural resources into tangible cultural capital to achieve livelihood improvement.

We acknowledge that our study has several limitations. Since farmers' sustainable livelihood are a dynamic process, with the implementation of policies and changes in the social environment, farmers' sustainable livelihood adaptation and livelihood transition will face new challenges that will have increasingly complex effects on farmers' sustainable livelihood responses. This paper evaluates and analyzes farmers' sustainable livelihood responses by selecting cross-sectional data, which is not sufficient to comprehensively describe the characteristics and mechanisms of farmers' sustainable livelihood responses in ethnic tourism in a dynamic time series. In subsequent research, scholars should conduct long-term follow-ups and further explore the dynamic evolution process and mechanisms of farmers' sustainable livelihood responses through comparative analysis in different periods.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

Conceptualization, JW; Methodology, JW; Software, LL; Validation, JZ; Formal analysis, JW; Investigation, JZ; Resources, SL; Data curation, JZ; Writing—original draft preparation, JW; Writing—review and editing, JW; Visualization, WX; Supervision, SL. All authors have read and agreed to the published version of the manuscript.

Funding

This work was supported by the National Natural Science Foundation of China (42061036, 41861031), Research Foundation of Education Bureau of Hunan Province (18A283, 19C1509).

Acknowledgments

The authors appreciate the insightful and constructive comments and suggestions of the editor and two reviewers. We would also like express gratitude for the technical and financial support of our school and the support of our colleagues.

References

- Alipour, H., Rezapouraghdam, H., and Akhshik, A. (2021). Heritage redemption and the curse of tourism: The case of world's last inhabited Troglodyte village. *Tour. Plan. Deve* 18 (1), 68–85. doi:10.1080/21568316.2020.1775114
- Barati, A. A., Zhoohideh, M., and Moradi, M. (2021). Multidimensional poverty and livelihood strategies in rural Iran. *Envir Dev. Sustain* 24, 1–31. doi:10.1007/s10668-021-01977-x
- Baxter, J., and Eyles, J. (1996). Evaluating qualitative research in social geography: Establishing "rigour" in interview analysis. *Inst Br. Geogra* 22 (4), 505–525. doi:10.1111/j.0020-2754.1997.00505.x
- Bires, Z., and Raj, S. (2020). Tourism as a pathway to livelihood diversification: Evidence from biosphere reserves, Ethiopia. *Tour. Manag.* 81, 104159–159. doi:10.1016/j.tourman.2020.104159
- Bogale, F. M., Ben, D., Sewnet, A., Van Passel, S., Adgo, E., and Nyssen, J. (2022). Analyzing the impact of land expropriation program on farmers' livelihood in urban fringes of Bahir Dar, Ethiopia. *Habitat Inter* 129, 102674. doi:10.1016/j.habitatint.2022.102674
- Carney, D. (1998). *Implementing the sustainable livelihoods approach in sustainable rural livelihoods: What contribution can we make?* London: Department for International Development, 3–26.
- Cater, E. (2000). Ecotourism: An introduction by david A. Fennell. *Area* 32 (2), 245–246. doi:10.1177/146879760100100207
- Chambers, R., and Conway, G. R. (1992). Sustainable rural livelihoods: Practical concepts for the 21st century. IDS Discussion Paper No. 296. Brighton, Institute of Development Studies.
- Chen, F., Xu, H., and Lew, A. A. (2020). Livelihood resilience in tourism communities: The role of human agency. *Jour Sustain Tour.* 28 (4), 606–624. doi:10.1080/09669582.2019.1694029
- Chen, J., Zhang, L. Q., and Yang, X. J. (2017). The impact of tourism development on changes of households' livelihood and community tourism effect: A case study based on the perspective of tourism development mode. *Geogra Res.* 36 (09), 1709–1724. doi:10.11821/dlxy201709009
- Chen, Q., Hu, Q. G., and Shen, W. T. (2021). Coastal fishermen's livelihood vulnerability changes and its influence Factors under the vessel buyback and fishermen transfer programs: Based on the investigation of converted fishermen in Zhoushan City, Zhejiang Province. *Sci. Geogr. Sin.* 41 (08), 1487–1495. doi:10.13249/j.cnki.sgs.2021.08.020
- Clifton, J., and Benson, A. (2006). Planning for sustainable ecotourism: The case for research ecotourism in developing country destinations. *Jour Sustain Tour.* 14 (3), 238–254. doi:10.1080/09669580608669057
- Dai, X. H., Wu, Z. L., Fan, Y., Li, B., Yang, Z., Nan, B., et al. (2020). Characteristics and determinants of livelihood diversification of different household types in Far Northwestern China. *Sustain* 12 (1), 64. doi:10.3390/su12010064
- D'Annolfo, R., Gemmill-Herren, B., Amudavi, D., Shiraku, H. W., Piva, M., and Garibaldi, L. A. (2021). The effects of agroecological farming systems on smallholder livelihoods: A case study on push–pull system from western Kenya. *Int. J. Agric. Sustain* 19 (1), 56–70. doi:10.1080/14735903.2020.1822639
- Daskon, C., and Binns, T. (2010). Culture, tradition and sustainable rural livelihoods: Exploring the culture-development interface in Kandy, Sri Lanka. *Community Dev.* 45, 494–517. doi:10.1093/cdj/bsp019
- Deng, Q. Q., Li, E. L., and Zhang, P. (2020). Livelihood sustainability and dynamic mechanisms of rural households out of poverty: An empirical analysis of Hua County, Henan Province, China. *Habitat Int.* 99, 102160. doi:10.1016/j.habitatint.2020.102160
- DFID (2000). *Sustainable livelihoods guidance sheets.* London: Department for International Development, 68–125.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

- Ding, J. J., Jin, N. B., and Jia, W. (2019). The livelihood response of rural households to urbanization and its influencing factors in Wuling Mountain area: With the survey data of 355 households in three typical towns. *Geogr. Res.* 38 (08), 2027–2043. doi:10.11821/dlyj020180441
- Ding, J. J., Wang, Z., Liu, Y., and Yu, F. (2020). Rural households' livelihood responses to industry-based poverty alleviation as a sustainable route out of poverty. *Reg. Sustain* 1 (1), 68–81. doi:10.1016/j.regus.2020.07.002
- Gautam, Y., and Andersen, P. (2016). Rural livelihood diversification and household well-being: Insights from Humla, Nepal. *Jour Rural. Stud.* 44, 239–249. doi:10.1016/j.jrurstud.2016.02.001
- Guillaume, T., Hamish, B., and Simon, M. (2020). Authenticity and disorientation in the tourism experience. *J. Ecotourism* 30 (C), 100283. doi:10.1016/j.jort.2020.100283
- Guillaume, T., Hamish, B., and Simon, M. (2017). Performance and visitors' perception of authenticity in eco-cultural tourism. *Tour. Geogra* 19 (2), 287–300. doi:10.1080/14616688.2017.1285958
- Guillaume, T. (2019). Managing the planning and development of authentic eco-cultural tourism in Kazakhstan. *Tour. Plan. Dev.* 16 (5), 494–513. doi:10.1080/21568316.2018.1501733
- Guo, Y. Z., and Liu, Y. S. (2021). The process of rural development and paths for rural revitalization in China. *Acta Geogr. Sin.* 76 (06), 1408–1421. doi:10.11821/dlxb202106007
- Guri, A. I., Osumanu, I. K., and Bonye, S. Z. (2020). Eco-cultural tourism development in Ghana: Potentials and expected benefits in the lawra municipality. *J. Tour. Cult. Change* 19 (4), 458–476. doi:10.1080/14766825.2020.1737095
- He, H., Wang, S. X., Tuo, S., and Du, J. (2022). Analysis of the effect of rural tourism in promoting farmers' income and its influencing factors-based on survey data from Hanzhong in Southern Shaanxi. *Sustain* 14 (3), 1289. doi:10.3390/su14031289
- Huang, L., Yang, L. Y., Tuyen, N. T., Colmekcioglu, N., and Liu, J. (2021). Factors influencing the livelihood strategy choices of rural households in tourist destinations. *Jour Sustain Tour.* 30 (4), 875–896. doi:10.1080/09669582.2021.1903015
- Jamal, T., Camargo, B., Sandlin, J., and Segrado, R. (2010). Tourism and cultural sustainability: Towards an ecocultural justice for place and people. *Tour. Recreat. Res.* 35 (3), 269–279. doi:10.1080/02508281.2010.11081643
- Li, S. P., Dong, Y. Q., Zhang, L. X., Liu, C. F., Dong, Y. Q., and Zhang, L. X. (2021). Off-farm employment and poverty alleviation in rural China. *Jour Integr. Agr.* 20 (4), 943–952. doi:10.1016/s2095-3119(21)63616-x
- Li, Y. H., Song, C. Y., and Yan, J. Y. (2019). The spatial-temporal difference of peasants' livelihood response and enlightenments to rural revitalization strategy. *Geogr. Res.* 38 (01), 2595–2605. doi:10.15970/j.cnki.1005-8575.2014.05.032
- Liu, H., Ma, B., and Wang, R. Q. (2014). A study of Alxa ecological migration in the perspective of sustainable livelihoods. *Jour Mingzu Univ (Phi Soc Sci Ed).* 41 (05), 31–40.
- Liu, Y. L., Ying, W., Dupre, K., and McIlwaine, C. (2022a). The impacts of world cultural heritage site designation and heritage tourism on community livelihoods: A Chinese case study. *Tour. Manag. Perspect.* 43, 100994. doi:10.1016/j.tmp.2022.100994
- Liu, Y., Shi, H., Su, Z., and Kumail, T. (2022b). Sustainability and risks of rural household livelihoods in ethnic tourist villages: Evidence from China. *Sustain* 14, 5409. doi:10.3390/su14095409
- Liu, Y. S., Liu, J., Zhou, Y., Liu, J. L., and Zhou, Y. (2017). Spatio-temporal patterns of rural poverty in China and targeted poverty alleviation strategies. *J. Rural Stud.* 52, 66–75. doi:10.1016/j.jrurstud.2017.04.002
- Ma, X. L., Wang, R., Dai, M. L., and Ou, Y. (2021). The influence of culture on the sustainable livelihoods of households in rural tourism destinations. *Jour Sustain Tour.* 29 (8), 1235–1252. doi:10.1080/09669582.2020.1826497

- MacRae, G. (2017). Universal heritage meets local livelihoods: “awkward engagements” at the world cultural heritage listing in Bali. *Inter Jour Herit. Stud.* 23 (9), 846–859. doi:10.1080/13527258.2017.1339107
- Mao, S. X., Qiu, S., Li, T., and Tang, M. (2020). Rural households’ livelihood strategy choice and livelihood diversity of main ethnic minorities in Chongqing, China. *Sustain* 12 (19), 8166. doi:10.3390/su12198166
- Mbaiwa, J. E. (2011). Changes on traditional livelihood activities and lifestyles caused by tourism development in the Okavango Delta, Botswana. *Manag* 32 (5), 1050–1060. doi:10.1016/j.tourman.2010.09.002
- Quandt, A. (2018). Measuring livelihood resilience: The household livelihood resilience approach (HLRA). *World Dev.* 107, 253–263. doi:10.1016/j.worlddev.2018.02.024
- Rignall, K., Atia, M., and Atia, M. (2017). The global rural: Relational geographies of poverty and uneven development. *Geogr. Compass* 11, 12322. doi:10.1111/gec3.12322
- Ross, S., and Wall, G. (1999). Evaluating ecotourism: The case of north Sulawesi, Indonesia. *Tour. Manag.* 20 (6), 673–682. doi:10.1016/s0261-5177(99)00040-0
- Saarinén, J., Rogerson, C., and Manwa, H. (2011). Tourism and Millennium development goals: Tourism for global development? *Curr. Issue Tour.* 14 (3), 201–203. doi:10.1080/13683500.2011.555180
- Savari, M., and Moradi, M. (2022). The effectiveness of drought adaptation strategies in explaining the livability of Iranian rural households. *Habit Inter* 124, 102560. doi:10.1016/j.habitatint.2022.102560
- Savari, M., and Zhooldideh, M. (2021). The role of climate change adaptation of small-scale farmers on the households food security level in the west of Iran. *Deve Pract.* 31 (5), 650–664. doi:10.1080/09614524.2021.1911943
- Scoones, I. (1998). *Sustainable Rural Livelihoods. A Framework for Analysis*. Brighton, UK: IDS Working Paper 72. IDS.
- Shen, F., Hughey, K. F., and Simmons, D. G. (2008). Connecting the sustainable livelihoods approach and tourism: A review of the literature. *Hosp. Tour. Manag.* 15, 19–31. doi:10.1375/jht.15.19
- Shui, W., Zhang, Y. Y., Wang, X. G., Liu, Y., Wang, Q., Duan, F., et al. (2022). Does Tibetan household livelihood capital enhance tourism participation sustainability? Evidence from China’s Jiayu Tibetan village. *Inter Jour Enviro Res. Public Health* 19 (15), 9183. doi:10.3390/ijerph19159183
- Sivagnanam, K. J., Murugan, K., and Thenkovan, M. (2019). Impact of national food security mission on farmers livelihood in Tamil Nadu. *Econ. Aff.* 64 (1), 131–144. doi:10.30954/0424-2513.1.2019.18
- Stastna, M., Vaishar, A., Brychta, J., Tuzova, K., Zloch, J., and Stodolova, V. (2020). Cultural tourism as a driver of rural development. Case study: Southern Moravia. *Sustain* 12 (21), 9064. doi:10.3390/su12219064
- Su, F., Song, N. N., Ma, N. N., Sultanaliyev, A., Ma, J., Xue, B., et al. (2021). An assessment of poverty alleviation measures and sustainable livelihood capability of farm households in rural China: A sustainable livelihood approach. *Agri* 11 (12), 1230. doi:10.3390/agriculture11121230
- Su, M. M., Wall, G., and Wang, Y. N. (2019). Integrating tea and tourism: A sustainable livelihoods approach. *Jour Sustain Tour.* 27 (10), 1591–1608. doi:10.1080/09669582.2019.1648482
- Sun, K. K., Xing, Z., Cao, X., and Li, W. (2021). The regime of rural ecotourism stakeholders in poverty-stricken areas of China: Implications for rural revitalization. *Int. J. Environ. Res. Public Health* 18, 9690. doi:10.3390/ijerph18189690
- Sun, Y. (2020). Eco-agricultural economic development strategy based on improving the eco-cultural tourism environment in rural areas along the Coast. *J. Coast. Res.* 104 (1), 648–651. doi:10.2112/jcr-si104-111.1
- Thuy, N., Christopher, G., and Hu, B. D. (2022). Livelihood vulnerability to climate change: A case of farm households in northeast Vietnam. *Enviro Dev. Sustain* 24, 12059–12078. doi:10.1007/s10668-022-02201-0
- Tiberghien, G., Bremner, H., and Milne, S. (2017). Performance and visitors’ perception of authenticity in ecocultural tourism. *Tour. Geogr.* 19 (2), 287–300. doi:10.1080/14616688.2017.1285958
- Toner, A., and Franks, T. (2006). Putting livelihoods thinking into practice: Implications for development management. *Public Admn Dev* 26 (1), 81–92. doi:10.1002/pad.395
- Tran, D. D., Dang, M. M., Duong, B. D., Sea, W., and Vo, T. T. (2021). Livelihood vulnerability and adaptability of coastal communities to extreme drought and salinity intrusion in the Vietnamese Mekong Delta. *Int. J. DRR* 57 (1), 102183. doi:10.1016/j.ijdr.2021.102183
- Wallace, G., and Russell, A. (2004). Ecocultural tourism as a means for the sustainable development of culturally marginal and environmentally sensitive regions. *Tour. Stud.* 4 (3), 235–254. doi:10.1177/1468797604057326
- Wang, J., Zhang, Y. J., and Shi, L. (2014). Evaluation index system of sustainable livelihoods ecotourism strategy: a case study of Wangjiazhai community in Baiyangdian wetland nature reserve Hebei. *Acta Eco Sin.* 34 (09), 2388–2400. doi:10.5846/stxb201210271490
- Wang, R., Dai, M. L., and Ou, Y. H. (2021). Measurement of rural households’ livelihood assets with cultural capital intervention: A case study of Likeng village in Wuyuan. *Tour. Trib.* 36, 56–66. doi:10.19765/j.cnki.1002-5006.2021.07.009
- Wu, J. L., Liu, S. L., and Liu, S. (2020). Vulnerability assessment and influencing factors of farmers towards rural tourism in Zhangjiajie. *Sci. Geogra Sin.* 40 (08), 1336–1344. doi:10.13249/j.cnki.sgs.2020.08.013
- Wu, J. L., Liu, S. L., and Zhou, C. S. (2017). Peasant households adaptability under the background of rural tourism development in traditional villages—a case study of 4 traditional villages in Zhangjiajie. *Econ. Geogr.* 37 (12), 232–240. doi:10.15957/j.cnki.jjdl.2017.12.030
- Wu, J. L., Zhou, C. S., and Xie, W. H. (2018). The influencing factors and evaluation of farmer’s adaptability towards rural tourism in traditional village: Based on the survey of 6 villages in Xiangxi prefecture, Hunan. *Sci. Geogra Sin.* 38 (05), 755–763. doi:10.13249/j.cnki.sgs.2018.05.013
- Ye, W. L., Wang, Y., Yang, X. J., and Wu, K. (2022). Understanding sustainable livelihoods with a framework linking livelihood vulnerability and resilience in the semiarid loess plateau of China. *Land* 11 (9), 1500. doi:10.3390/land11091500
- Zhang, F. F., and Zhao, X. Y. (2015). A review of ecological effect of peasant’s livelihood transformation in China. *Acta Ecol. Sin.* 36 (10), 3157–3164.
- Zhao, X. Y., Chen, H. H., and Zhao, H. H. (2021). Farmer households’ livelihood resilience in ecological-function areas: Case of the yellow river water source area of China. *Enviro Dev. Sustain* 24, 1–22. doi:10.1007/s10668-021-01827-w